Ecology Action Centre

Municipalities Idleless: Idling Reduction Options

One of the easiest actions that Canadians can take – with a simple turn of a key – is to avoid unnecessary idling. Idling is not only a waste of energy and money – after all, we're burning fuel but going nowhere – it is also a needless source of greenhouse gas emissions. While reducing vehicle idling alone won't solve the climate change problem, it's a step in the right direction and it's easy to do![1]

-Natural Resources Canada

Submitted by: TRAX, the Ecology Action Centre
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Executive Summary

When the province of Nova Scotia adopted the *Environmental Goals and Sustainable Prosperity Act* in 2007, it made a commitment to reduce the province's greenhouse gas emissions 10 per cent below 1990 levels by the year 2020.[2] It is only with the help of municipalities that this goal will be reached. As 28.1 per cent of the province's greenhouse gas emissions can be attributed to the transportation sector, reducing emissions from this area must be a key component of any action plan.[3] By eliminating needless idling, the government can reduce emissions, reduce energy use and reduce costs.

The Natural Resources Canada website states, "Motorists should keep in mind that idling for over 10 seconds still uses more fuel and produces more CO2 than restarting your engine".[4] The public seems to understand that idling is bad for the environment and bad for people, but fails to take strides towards changing this behaviour. A study by Lura Consulting highlights how, though 87 per cent of survey respondents believe that "…not idling their engine is the 'right thing to do,' most of them still participate in that behaviour."[5] There is a disconnect between knowledge and action.

This report outlines various options that municipalities and businesses can take to help reduce carbon emissions in the transportation sector. Before undergoing any project, the capacity and resources of the unit who will be responsible for the activity must be realistically evaluated. Resource limitations must be accounted for. These will help determine which idling reduction options are feasible to undertake.

The report divides possible actions into five categories:

1. Education and Incentives which focus on changing knowledge. Understanding why idling times should be reduced is foundational. All campaign efforts should include at least an element of education.
2. Policy which focuses on internal government or business practices ranging from vehicle purchasing policies to idling control policy.
3. Regulations which focus on how government can adopt legislation to change

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1 Natural Resources Canada. (2009). "Links between fuel consumption, climate change, our environment and health". Retrieved from http://oee.nrcan-rncan.gc.ca/transportation/idling/health.cfm?attr=8 on August 1, 2009.

2 Province of Nova Scotia. (2007) Environmental Goals and Prosperity Act. Retrieved from http://www.gov.ns.ca/legislature/legc/bills/60th_1st/3rd_read/b146.htm on April 21, 2010.

3 Nova Scotia Department of Energy. (2009) Toward a Greener Future: Nova Scotia's Climate Change Action Plan. Retrieved from http://www.gov.ns.ca/energy/resources/spps/energy-strategy/Climate-Change-Action-Plan-2009.pdf on April 21, 2010.

4 Natural Resources Canada. (2009). "Idling- Frequently Asked Questions". Retrieved from http://oee.nrcan-rncan.gc.ca/transportation/idling/faqs.cfm?attr=8 on August 3, 2009.

5 Lura Consulting (2003) Towards an Idle-Free Zone in the City of Mississauga. Retrieved from http://www.tc.gc.ca/eng/programs/environment-utsp-towardsanidlefreezone-1076.htmon April 3, 2010.

behaviour through regulation.

4. Managing Traffic Flow which focuses on changes to the layout and design of intersections that will reap benefits in the long term.

These options should be used in tandem for maximum energy and emissions savings.

To measure program success, it is imperative to take pre-and-post-action measurements.

Table of Contents

0.0 Executive Summary 2
1.0 Introduction
- 1.1 Transportation and Environment 5
- 1.2 Why Idling is a Problem 5
- 1.3 Context 6
- 1.4 Commitments 7
  - 1.4.1 National 7
  - 1.4.2 Provincial 8
  - 1.4.3 Municipal 9

2.0 Education and Incentives
- 2.1 Introduction 13
- 2.2 Incentives to Act 14
- 2.3 Fleet Driver Re-education 16
- 2.4 Fleet Challenges 17
- 2.5 Commitments and Pledges 19

3.0 Policy
- 3.1 Introduction 23
- 3.2 Idling Control Policy 23
- 3.3 Right-sizing Fleets 25
- 3.4 Alternative Fuels 26
- 3.5 Setting a Target 28
- 3.6 Fleet Management and Vehicle Maintenance 30

4.0 Regulation
- 4.1 Introduction 34
- 4.2 Idling Restriction By-laws 35
- 4.3 Land-use Restrictions 37

5.0 Managing Traffic Flow
- 5.1 Introduction 41
- 5.2 Roundabouts 43
- 5.3 Traffic Signal Synchronization 49
- 5.4 Creating Caution: Naked Streets, Removal of Lights, Use of Yield Signs 53

6.0 Evaluating Idling Reduction Opportunities
- 6.1 Reaching the Target 60

Appendix A: Appropriate and Inappropriate Uses of Roundabouts 62
Appendix B: Drafting Idling Restriction By-laws 65
Appendix C: HRM's Right-sizing Policy 68
Appendix D: Chart Evaluating Idling Reduction Opportunities 69

1.0 Introduction

1.1 Transportation and the Environment

In Nova Scotia, the transportation sector contributes 28.1 per cent of the province's emissions.[6] Of this amount, half can be attributed to the movement of goods and half to the movement of people. Across the world, emissions attributable to the transportation sector are generally increasing. This is despite the use of less carbon intensive fuel sources. As a society we are simply driving more.

1.2 Why Idling is a Problem

Communities in Canada are becoming increasingly aware of the effects of vehicular idling, both on the health of their citizens and on the health of the environment. There is a general desire to reduce emissions - the public recognizes the negative effects of exhaust. Reducing idling by itself will not reduce emissions enough to "save the planet" but bringing idling to the fore does encourage residents to consider the impacts of their actions. Idling reduction campaigns, policies and regulations act as signposts of what behaviours are and are not acceptable within the community.

Three primary reasons for idling reductions exist: saving energy, saving the environment and saving the health of individuals. Natural Resources Canada promotes idling restriction on the basis of saving energy and energy-related expenses. The International Panel on Climate Change (IPCC) has linked carbon dioxide emissions with increased temperature rises.[7] It states, "Physical and biological systems on all continents and in most oceans are already being affected by recent climate changes, particularly regional temperature increases."[8] Needless idling adds carbon emissions to the air which contributes to the greenhouse effect which in turn affects the climate. Health Canada promotes idling restriction based on decreasing emission levels and thereby decreasing particulate matter and other toxins. A staff report written by Toronto Public Health that reviews the idling control by-law in Toronto highlights the negative health-related aspects of idling.[9] This corresponds with the stance of

6 Bernstein, Jonah for Climate Change Directorate, NS Environment (2009) Climate Change Action Plan. Retrieved from http://www.gov.ns.ca/constructionportal/docs/ClimateChange.pdf on April 19, 2010

7 Parry, Martin L., Canziani, Osvaldo F., Palutikof, Jean P., van der Linden, Paul J., and Hanson, Clair E, International Panel on Climate Change (2007) Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. "Assessment of observed changes and responses in natural and managed systems". Cambridge University Press, Cambridge, United Kingdom, 1000 pp. Retrieved from http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter1.pdf on February 21, 2010

8 Parry, Martin L., Canziani, Osvaldo F., Palutikof, Jean P., van der Linden, Paul J., and Hanson, Clair E, International Panel on Climate Change (2007) Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. "Assessment of observed changes and responses in natural and managed systems". Cambridge University Press, Cambridge, United Kingdom, 1000 pp. Retrieved from http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter1.pdf on February 21, 2010

9 Medical Officer of Health. (December 19, 2008). Reviewing the Idling Control By-law. Retrieved from www.toronto.ca/legdocs/mmis/2009/gm/bgrd/backgroundfile-18167.pdf on July 15, 2009.

the Capital Regional District in Victoria, British Colombia that promotes the idling restriction *By-law 3533* and gives the reason for the by-law as "…to promote Clean Air by Regulating Motor Vehicle Idling."[10] Whether you side with Natural Resources Canada, IPCC or Health Canada about the reason for decreasing idling, the need itself is agreed upon.

Idling is customary. Documentation from County Grey, Ontario states that "… most fuel-injected engines today require only 30 seconds to one minute of running time to circulate fluids to get ready to drive even in winter conditions."[11] The Natural Resources Canada website states, "Motorists should keep in mind that idling for over 10 seconds still uses more fuel and produces more CO2 than restarting your engine".[12] Natural Resources Canada recommends idling for no more than one minute in order to decrease emissions. Some car mechanics msy argue that the "puff" of emissions when a vehicle starts counteracts some of the savings of turning your vehicle off. This is documented only for older, non fuel-injected vehicles.

1.3 Context

According to a health index report developed by Human Resources and Skills Development Canada, the activities of Canadians generated 22.96 tonnes of carbon dioxide per capita in 2002. [13] The exact figure is hard to quantify - different reports use different numbers:

- Natural Resources Canada gave per capita carbon emissions as 22.84 tonnes in 1998.[14]
- The Netherlands Environmental Assessment Agency measured Canadian carbon emissions at 17 tonnes per capita in 2008. [15]
- The Union of Concerned Scientists stated Canada's per capita emissions were 19.11 tonnes per person (18 Tons) in 2006.[16]

Whatever the exact figure, the fact remains that Canadians are using petroleum products at a

10 Capital Regional District. (April 8, 2009). Staff Report to the Capital Regional District Board. Pg. 1. Retrieved from http://www.crd.bc.ca/agendas/capitalregionaldistr_/2009_/apr8/Apr8.pdf on July 15, 2009.

11 Transportation and Public Safety Department. (May 5, 2009). Idling Policy. Pg.2. Retrieved from http://www.greycounty.ca/files/pagecontent/policy-roads-02-07-amended-idl.pdf on July 15, 2009.

12 Natural Resources Canada. (2009). "Idling- Frequently Asked Questions". Retrieved from http://oee.nrcan-rncan.gc.ca/transportation/idling/faqs.cfm?attr=8 on August 3, 2009.

13 Human Resources and Skills Development Canada. (August 20, 2009). Greenhouse Gas Emissions Per Person. Indicators of Well-being in Canada. Retrieved from http://www4.hrsdc.gc.ca/.3ndic.1t.4r@-eng.jsp?iid=64#M_2 on August 20, 2009.

14 Natural Resources Canada. (November 5, 2003). The Atlas of Canada. Greenhouse Gas Emissions by Gas 1998. Retrieved from http://atlas.nrcan.gc.ca/site/english/maps/climatechange/atmospherestress/greenhousegasemissionbygas on August 20, 2009.

15 Netherlands Environmental Assessment Agency. (June 25, 2009). Global CO2 emissions: annual increase halves in 2008. Retrieved from http://www.pbl.nl/en/publications/2009/Global-CO2-emissions-annual-increase-halves-in-2008.html on August 20, 2009.

16 Union of Concerned Scientists: Citizens and Scientists for Environmental Solutions. (2009). Each Country's Share of CO2 Emissions. Global Warming. Retrieved from http://www.ucsusa.org/global_warming/science_and_impacts/science/each-countrys-share-of-co2.html on August 20, 2009.

rate that is unsustainable.

1.4 Commitments

When the *British North America Act* was drafted in 1867, the environment was not listed within either the jurisdictional powers of provinces or the federal government. In plain language, neither Nova Scotia nor Canada has exclusive jurisdiction over air quality. This means that both are responsible for ensuring that the population has clean air to breathe.

1.4.1 National

The federal government has been involved in a series of commitments to international treaties. It has also been involved in a series of gaffes. On April 29, 1998, Canada ratified the Kyoto Agreement and made a further commitment to reducing greenhouse gas emissions six per cent below 1990 levels rather than the requisite five per cent. That was under a Liberal government; governments change and so too did the commitment to climate change strategies.

A timeline produced by CBC recounts:

> On March 31, 2006, environment minister Rona Ambrose told a Vancouver audience that since ratifying Kyoto, Canada's "greenhouse gas emissions are up by 24 per cent" – a far cry from the previous government's commitment to meet a target six per cent below the 1990 levels.[17]

As a nation Canada's greenhouse gas emissions are rising rather than decreasing. The Kyoto targets are outside of Canada's reach. The current federal government has proposed a *Clean Air Act* that would go into effect January 2010. **Unfortunately, the bill didn't make it past second reading.** CBC states that as of February 8, 2007:

> Environment Minister John Baird announced plans to introduce legislation that would regulate industrial pollutants. Baird also said Canada will not attempt to meet Kyoto's greenhouse gas targets.[18]

The Conservative Government has not proposed any legislation to replace the *Clean Air Act*.

The federal government says it has a plan to reduce greenhouse gas emissions. Environment Canada writes:

> The Government is committed to drastically reducing Canada's greenhouse gas emissions and air pollution as set out in its *Turning the Corner Plan*. With the *Turning the Corner Plan* the Government of Canada is putting into place one of the toughest regulatory

17 CBC. Kyoto and Beyond: Canada-Kyoto timeline. Retrieved from http://www.cbc.ca/news/background/kyoto/timeline.html on August 19, 2009

18 CBC. Kyoto and Beyond: Canada-Kyoto timeline. Retrieved from http://www.cbc.ca/news/background/kyoto/timeline.html on August 19, 2009

> regimes in the world to meet its target of reducing greenhouse gases an absolute 20 per cent from 2006 [levels] by 2020.[19]

The Pembina Institute questions the federal government's commitment to adopting strict regulations. A number of loopholes exist within the *Turning the Corner Plan* that mean that industry doesn't need to act until 2018. Pembina writes:

> The decision to "backload" the bulk of emission reductions to 2018 and later is highly questionable for a government that says it's on track to meet a national GHG target in 2020 - albeit one that falls far short of what the science calls for from a developed country.[20]

As was demonstrated during Copenhagen 2009, whether a plan is stringent enough is usually dependent on who is answering the question.

1.4.2 Provincial

In 2007, the Province of Nova Scotia committed to fostering ecological well-being with the passing of the *Environmental Goals and Sustainable Prosperity Act.* Nova Scotia has committed to becoming a recognized leader in balancing the needs of its citizens in both the environmental and economic realm. Nova Scotia recognizes that economic and social prosperity comes through environmental health. In section 4 of the Act, clause 2 e) outlines one of the primary goals of the Act, "…greenhouse gas emissions will be at least 10 per cent below the levels that were emitted in the year 1990 by the year 2020…"[21] Guidance for achieving these goals is provided through the shorter-term objectives outlined in the *Climate Change Action Plan*.[22] It is critical that any government elected works to achieve these goals.

Despite its laudable intentions, the Province struggles to implement the policies and procedures it has committed to. The struggle is chiefly due to financial and other resource constraints. However, measures the province has undertaken include:

- Environmental purchasing policies
- Green Fleet policies
- Employee trip reduction programs
- Improvements to public transit
- Land-use planning regulations to reduce sprawl and support transit, walking and cycling
- Energy-efficiency and energy conservation strategies
- Green power programs
- Activities to reduce the urban heat island effect including green

19 Environment Canada. Turning the Corner: Canada's plan to reduce greenhouse gas emissions and air pollution. Retrieved from http://www.ec.gc.ca/cc/default.asp?lang=En&n=A3CB096D-1 on August 19, 2009

20 Demerse, Clare Pembina Institute (March 26, 2008) Canada's Industry Regulations: Not "Turning the Corner" Anytime Soon. Retrieved from http://www.pembina.org/op-ed/1617 on February 21, 2010.

21 Government of Nova Scotia. Environmental Goals and Sustainable Prosperity Act (2007) retrieved from http://www.gov.ns.ca/legislature/legc/bills/60th_1st/1st_read/b146.htm on August 19, 2009

22 Province of Nova Scotia. (January 2009). Toward a Greener Future: Nova Scotia's Climate Change Action Plan. Retrieved from http://climatechange.gov.ns.ca/doc/ccap.pdf on August 20, 2009.

space enhancement. [23]

These measures will not be discussed within this document, but will be included in future work.

1.4.3 Municipal

Municipalities play a role in ensuring the well-being of citizens. As creatures of the province, municipalities have been given the power to regulate for the health of their citizens. The *Municipal Government Act* outlines the purpose of municipalities in Section 2. In this section, clause C states:

> (c)… that the functions of the municipality are to
> (i) provide good government,
> (ii) provide services, facilities and other things that, in the opinion of the council, are necessary or desirable for all or part of the municipality, and
> (iii) develop and maintain safe and viable communities.[24]

It would be difficult to argue that protecting air quality is not a measure that falls under working to benefit the health of the population. Section 2 seems to give broad authority to Council to act in a manner that is consistent with ecologically sound principles.

A municipality has the authority to adopt a by-law, policy or other regulation to ensure the well-being of its citizens. The City of Toronto has set a CO_2 reduction target of 20 per cent based on an emissions baseline of approximately 27,000,000 tonnes in 1990 as calculated by the Air Quality Improvement Branch of Works and Emergency Services. The 20 per cent target was originally set by the former City of Toronto and was then re-adopted by the amalgamated City of Toronto in December 1998. [25]A community must be prepared for any new by-law, change in enforcement patterns, or any policy changes. People tend to resist change, but if they understand why a change is necessary, they are much more likely to accept it.

Despite the fact that HRM does not have a delegated mandate to manage air quality, which is the responsibility of the federal and provincial governments, it has a responsibility to its residents to ensure that the environment in which they live is clean and does not pose a threat to their well-being.[26] An example of how HRM is achieving good air quality is the establishment of an integrated airshed management program. As an integrated program, the province is also involved. The Nova Scotia Department of Environment and Labour

23 Penney, J. (2005). "Situational Analysis: The Status of Anti-idling By-laws in Canada" Clean Air Partnership. Retrieved from http://www.cleanairpartnership.org/pdf/situational_analysis_0405.pdf on August 3, 2009.

24 Province of Nova Scotia. (1998). Municipal Government Act. Section 2. Retrieved from http://www.gov.ns.ca/legislature/legc/statutes/muncpgov.htm on August 16, 2009.

25 City of Toronto . Green Fleet Transition Plan 2004-2007. P. 9 Retrieved on August 18, 2009 from

26 Whitford, Jacques (April 2006). Clean Air Strategy Framework Document: Executive Summary. P. 1. Retrieved from http://www.halifax.ca/environment/documents/CleanAirStrategy-ExecutiveSummary.pdf on August 20, 2009.

has proposed leading an airshed management initiative that will bring parties together in a collaborative forum in order to better manage the airshed of which HRM is a part. [27]

27 Whitford, Jacques (April 2006). Clean Air Strategy Framework Document: Executive Summary. P. 2. Retrieved from http://www.halifax.ca/environment/documents/CleanAirStrategy-ExecutiveSummary.pdf on August 20, 2009.

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City of Toronto. Green Fleet Transition Plan 2004-2007. Retrieved on August 18, 2009 from www.toronto.ca/fleet/pdf/gftp_apr04.pdf

Demerse, Clare Pembina Institute (March 26, 2008) Canada's Industry Regulations: Not "Turning the Corner" Anytime Soon. Retrieved from http://www.pembina.org/op-ed/1617 on February 21, 2010.

Environment Canada. Turning the Corner: Canada's Plan to Reduce Greenhouse Gas Emissions and Air Pollution. Retrieved from http://www.ec.gc.ca/cc/default.asp?lang=En&n=A3CB096D-1 on August 19, 2009

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Human Resources and Skills Development Canada. (August 20, 2009). Greenhouse Gas Emissions Per Person. Indicators of Well-being in Canada. Retrieved from http://www4.hrsdc.gc.ca/.3ndic.1t.4r@-eng.jsp?iid=64#M_2 on August 20, 2009.

Medical Officer of Health. (December 19, 2008). Reviewing the Idling Control By-law. Retrieved from www.toronto.ca/legdocs/mmis/2009/gm/bgrd/backgroundfile-18167.pdf on July 15, 2009.

Natural Resources Canada. (2009). "Idling- Frequently Asked Questions". Retrieved from http://oee.nrcan-rncan.gc.ca/transportation/idling/faqs.cfm?attr=8 on August 3, 2009.

Natural Resources Canada. (November 5, 2003). The Atlas of Canada. Greenhouse Gas Emissions by Gas 1998. Retrieved from http://atlas.nrcan.gc.ca/site/english/maps/climatechange/atmospherestress/greenhousegasemissionbygas on August 20, 2009.

Netherlands Environmental Assessment Agency. (June 25, 2009). Global CO2 Emissions: Annual Increase Halves in 2008. Retrieved from http://www.pbl.nl/en/publications/2009/Global-CO2-emissions-annual-increase-halves-in-2008.html on August 20, 2009.

Parry, Martin L., Canziani, Osvaldo F., Palutikof, Jean P., van der Linden, Paul J., and Hanson, Clair E, International Panel on Climate Change (2007) Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. "Assessment of observed changes and responses in natural and managed systems". Cambridge University Press, Cambridge, United Kingdom, Retrieved from http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter1.pdf on February 21, 2010

Penney, J. (2005). "Situational Analysis: The Status of Anti-idling By-laws in Canada" Clean Air Partnership. Retrieved from http://www.cleanairpartnership.org/pdf/situational_analysis_0405.pdf on August 3, 2009.

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Transportation and Public Safety Department. (May 5, 2009). Idling Policy. Retrieved from http://www.greycounty.ca/files/pagecontent/policy-roads-02-07-amended-idl.pdf on July 15, 2009.

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Whitford, Jacques (April 2006). Clean Air Strategy Framework Document: Executive Summary. Retrieved from http://www.halifax.ca/environment/documents/CleanAirStrategy-ExecutiveSummary.pdf on August 20, 2009.

2.0 Education and Incentives

2.1 Introduction

Education campaigns often focus on delivering "the truth". There is a general belief, even if it is somewhat mistaken, that if people know what their behaviour is really doing they will be motivated enough to change that behaviour. Unfortunately, this does not seem to be the case, at least not in the case of idling. An article from Canwest News Service published on June 25, 2008 reminds the reader that, "…drivers' behaviours often seem to contradict their attitudes with respect to vehicle idling."[28] A 2003 study by Lura Consulting supports this. The study highlights how, though 87 per cent of respondents believed that "…not idling their engine is the 'right thing to do,' most of them still participate in that behaviour.[29] Although drivers are cognizant of the fact that driving is harmful, they still continue with the practice. At first the inconsistency may seem odd but if one is to reflect on his or her own behaviour it is actually quite common. Though an individual knows that smoking is bad for her health, she still does it. Although an individual knows that it would be healthier to walk to work, he still drives. Change is often difficult and without the proper incentives, education campaigns are likely to be ineffective.

An article looking at why individuals use alternative fuels explains how knowledge of the fact that alternative fuels are better for the environment is not enough of an incentive to change behaviour. In the article "Fleet conversion in local government: Determinants of driver fuel choice for bi-fuel vehicles", it states:

> Findings show that environmental attitudes do not have a significant effect on actual or perceived use; however, external variables such as fuelling convenience, vehicle performance, and the extent of informal communication significantly affect the driver's likelihood of using alternative fuel.[30]

Though education campaigns are necessary, they often must be accompanied by an incentive to act.

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28 Canwest News Services (June 25, 2008) Most drivers think idling uses less gas: survey. Retrieved from http://www.driving.ca/news/story.html?id=5b1372b7-668b-4317-b7cd-0f12f0993339 on April 3, 2010.

29 Lura Consulting (2003) Towards an Idle-Free Zone in the City of Mississauga. Retrieved from http://www.tc.gc.ca/eng/programs/environment-utsp-towardsanidlefreezone-1076.htmon April 3, 2010.

30 Johns, K., Khovanova, K., and Welch, E. (2009). Fleet conversion in local government: Determinants of driver fuel choice for bi-fuel vehicles. Environment and Behavior, 41(3), 402-426.

2.2 Incentives to Act

Explanation

As mentioned in the introduction, numerous behaviour change theories focus on the effect that information has on an individual's actions. Recognizing the effect that what they do or fail to do has on themselves, other people and the environment will motivate people to act differently. In this way, information campaigns can initiate positive behaviours among the target audience. Catherine Ray, a senior bureaucrat with Natural Resources Canada, who has researched idling for over 10 years, thinks a shift in behaviour will occur, "…once people understand the impact of their driving habits and the importance of shutting off an engine on a car that is parked for more than 60 seconds." [31] The exact time for acceptable idling is debatable, but the message that Ray adheres to is that information will induce a shift in behaviour.

This logic is supported by the work of Carric *et al*., that states, "Based on earlier research to the effect of information on idling behaviour, we have reason to believe that misinformation is a primary cause of unnecessary idling." [32] Providing individuals in the community with correct information will allow them to make the "right" decisions about when to turn off their vehicles.

However, Gardner and Stern point out that information alone is an insufficient reason for changing a behaviour. In their article *The Short List,* they state:

> But information alone…is not enough to induce behaviour change, especially for many efficiency increases that involve significant initial monetary costs. There are major barriers to change, in addition to knowledge, which must be overcome, even among people who know which actions to take and would like to take them.[33]

Following this thinking, education is only one step in shifting behaviour.

Theorists on human behaviour, such as Doug Mckenzie-Mohr, hold firm to a belief that information itself is insufficient motivation for change. He suggests a Community-Based Social Marketing (CBSM) approach that in addition to information, offers incentives for behaviour change and focuses on eliminating barriers that could stand in the way of change. The Natural Resources Canada website discusses CBSM, stating:

> This kind of marketing emphasizes direct, personal contact among community members and the removal of barriers (i.e., "roadblocks"

31 Canwest News Services (2008) Most drivers think idling uses less gas: survey. Retrieved from http://www.driving.ca/news/story.html?id=5b1372b7-668b-4317-b7cd-0f12f0993339 on April 3, 2010.

32 Carrico, Amanda R.. Paul Padgett, Michael P. Vandenbergh, Jonathan Gilligan, Kenneth A. Wallston. (2009) Costly myths: An analysis of idling beliefs and behaviour in personal motor vehicles. Energy Policy 37: 2881-2888.

33 Gardner, G.T., Stern, P.C., The Short List: The Most Effective Actions U.S. Households Can Take to Curb Climate Change, p. 22

to more sustainable actions and behaviours) since research suggests that such approaches are often most likely to bring about behavioural change.[34]

According to this theory, though information is essential, it must be combined with other elements in order to initiate change.

Benefits

Documented evidence suggests the benefits of information campaigns include:

- Creating a more informed public
- Constructing a comprehensive, easy to manage, campaign
- Maintaining a low-cost campaign

Challenges

No drawbacks to an information campaign could be identified though the effectiveness of such a campaign in and of itself may be limited.

Example

Numerous information-centred campaigns have been successfully carried out across the country. Looking to these campaigns for guidance can help prevent costly mistakes or oversights. One example is:

Eco-Kings, Nova Scotia

In order to have success at a higher level such as in implementing an idling restriction by-law, it is necessary to lay a strong foundation. Before the Town of Kentville, Nova Scotia enacted its idling restriction by-law, a two-year public relations campaign was undertaken. The Eco-Kings committee worked to inform the citizens of Kentville as to why idling is a problem before a by-law was ever mentioned.

34 Natural Resources Canada (2009) An Overview of Community-Based Social Marketing Retrieved from http://oee.nrcan.gc.ca/communities-government/transportation/municipal-communities/what_you_can_do/socialMarketing.cfm?attr=28 on April 4, 2010

2.3 Fleet Driver Re-education

Explanation

Professional drivers already know how to drive but may not be aware of the tactics they need to employ in order to drive in the most fuel-efficient way possible. Programs such as Natural Resources Canada's *Fleet Smart* program work to give professional drivers the information needed to make more fuel-efficient driving choices.

Benefits

Evidence suggests the benefits of targeted driver re-education and performance programs are many. They include:

> "…multiple benefits that range from reduced engine wear to lower fuel consumption to healthier drivers and a healthier community, all while reducing GHG emissions. They are an ideal way to start because of their ease of implementation and ability to demonstrate the numerous benefits of taking action on fleet operations."[35]

Challenges

Fleet managers and drivers may need to overcome a number of roadblocks before willingly participating in a driver re-education and monitoring. Some of these barriers may include:

- Resisting re-education on the basis that they "already know how to drive"
- Opposing courses from the union who disagree with increased monitoring practices
- Monitoring fuel use can be costly and time-consuming

Example

Re-educating drivers can occur in isolation or can be part of a bigger program such as that of the Fleet Challenge:

Repair Our Air Fleet Challenge, Ontario
Fleet Challenges give municipal vehicle operations as well as private citizens an opportunity to learn more about idling in a fun competitive manner.[36] The City of Toronto's *Green Fleet Transition Plan* lauds the *Fleet Challenge* for its ability to challenge municipalities so that they, "…work co-operatively on operational issues that impact the environment."[37].

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35 BC Climate Action Toolkit. 2009. Retrieved from http://www.toolkit.bc.ca/quick-starts-small-communities#localgovfleets on September 19, 2009.

36 City of Toronto. Green Fleet Transition Plan 2004-2007. P. 15 Retrieved from http://www.toronto.ca/fleet/green_fleet_transition.htm on August 18, 2009

37 City of Toronto . Green Fleet Transition Plan 2004-2007. P. 15 Retrieved from http://www.toronto.ca/fleet/green_fleet_transition.htm on August 18, 2009

2.4 Fleet Challenges

Explanation

When a municipality's pride is on the line or when an individual has an incentive to drive in a more fuel-efficient way, the possibilities for change are multiplied. In a Fleet Challenge, the element of personal honour promotes awareness and growth. A challenge pits one community or business group against another. It also pits an individual's "new awareness" against the old.

A Challenge needs to incorporate driver education with driver monitoring and a reward system. Having one group of drivers within a fleet decrease their fuel use can motivate another group within the company or within an organized competition to meet, and even surpass, the first group's achievement. This same sort of "call to arms" has successfully been used at a community-wide level.

Benefits

Evidence suggests the benefits of targeted driver re-education and performance programs are:

- Increasing efficiency with driving
- Decreasing idling
- Building camaraderie among team members

Challenges

Fleet managers and drivers may need to overcome a number of roadblocks before willingly participating in a driver re-education and monitoring. Some of these barriers may include:

- Dissenting opinions among drivers who feel that they already have learned to drive and are not interested in changing their habits
- Waning support from union leadership
- Union officials may feel "their drivers" are being threatened
- Management many oppose activities that are part of the Challenge because they feel that the activities do not contribute to the operational efficiency of the unit.

Example

Developing a Fleet Challenge program can aid in driver re-education without intimidation:

Repair Our Air (Fleet Challenge Ontario)
The Repair Our Air-Fleet Challenge (www.repairourair.org) provides a good blueprint of how to create behaviour change by actively engaging drivers in a competition to reduce idling

incidents. Features of the Challenge include[38]:

- Designing the Challenge in partnership with department supervisors
- Registering of departments on a voluntary basis
- Selecting vehicles to participate in the Challenge
- Installing telematics on all participating vehicles
- Launching the campaign with an information session on idling and on the Challenge
- Broadcasting weekly reports on idling incidents
- Celebrating successes at an awards ceremony
- Preparing a report that identifies how improved performance will be sustained

Following these points should help secure a successful Challenge.

The website repairourair.org is no longer functioning but information from the program is available through Fleet Challenge Ontario.

38 Fleet Challenge Ontario. (2008). Best Practices Manual 2008: Reducing the Use of Gasoline and Diesel: People Involvement. p. 48. Retrieved from http://www.fleetbusiness.com/pdf/FCOntario.pdf on April 5, 2010

2.5 Commitments and Pledges

Explanation

Making a commitment to reduce idling, either publicly or privately, can help a campaign achieve success. A report published by the Australian Public Service Commission states that individuals try to achieve consistency between their actions and beliefs. A commitment to idling reduction uses this desire for consistency. If individuals believe that idling is a negative behaviour for environmental health, then their actions should reflect this. The Australian report states:

> The cognitive consistency theory proposes that people are motivated to seek consistency between their beliefs, values and attitudes and their behaviours. This can be a powerful tool in certain circumstances where a commitment can be extracted from the individual to behave in a way that is consistent with their existing beliefs and attitudes. [39]

An idling-reduction campaign can use this desire to its advantage. For the greatest impact, pledges should be made in a public form and pledgers should be reminded of their commitment.

Benefits

The benefits of employing commitments to reduce idling are:

- Using an existing human proclivity towards consistency
- Using a variety of commitment levels can appeal to every audience but even if individuals commit to a lower-than-ideal level, they are still making a commitment.
- Working on collecting commitments can integrate into larger campaigns and thus can increase both the breadth and intensity of the public outreach

Challenges

Approaching individuals can be difficult and there is the possibility of negative reactions. Some challenges with approaching individuals for commitments include:

- Finding a time with individuals where they actually have time to sit down and discuss the issues
- Though most individuals desire congruency between belief and behaviour, in certain situations behaviour does not match stated beliefs. This is especially true in the case of environmental issues. [40]
- Searching for convenience may replace operator concern and caution.

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39 Australian Public Service Commission. (2007). Changing Behaviour: A public policy perspective. Retrieved from: www.apsc.gov.au/publications07/changingbehaviour4.htm on April 25, 2010.

40 Australian Public Service Commission. (2007). Changing Behaviour: A public policy perspective. Retrieved from: www.apsc.gov.au/publications07/changingbehaviour4.htm on April 25, 2010.

Example

Vancouver Ambassadors, British Columbia
Any idling reduction campaign will need to include as many partner organizations as possible in order to increase the reach of program activities. Along with that, as many methods as possible to induce change within the community should be employed. As such, idling reduction commitments are only one part of a larger effort. They can be a very important part but must occur alongside other education campaign. In British Columbia, the two Vancouver Ambassadors worked to promote idling reduction through a variety of means. The ambassadors, "successfully influenced community members by collecting idle-free photo and web pledges; by partnering with car mechanics and other key message deliverers; and by getting the commitment of councils and fleets to adopt policies and install idle-free signs"[41]. The pledges were one form of advocacy but only one among many.

41 Freedman, Rebecca. (March 2009). Idle-Free Ambassador Program Evaluation B.C. Air Action Plan Provincial Idle-Reduction Initiative

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Canwest News Services (2008) Most drivers think idling uses less gas: survey. Retrieved from http://www.driving.ca/news/story.html?id=5b1372b7-668b-4317-b7cd-0f12f0993339 on April 3, 2010.

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on April 3, 2010.

Lura Consulting (2003) Towards an Idle-Free Zone in the City of Mississauga. Retrieved from http://www.tc.gc.ca/eng/programs/environment-utsp-towardsanidlefreezone-1076.htm
on April 3, 2010.

Lura Consulting (2002) Anti-Idling campaign, final report. Retrieved from http://oee.nrcan.gc.ca/transportation/idling/material/reports-research/nov-CPPI-final-report.cfm?attr=16 on

April 3, 2010.

Motoda, Yoshitaka and Taniguchi, Masaaki (2003) A Study on Saving Fuel by Idling Stops While Driving Vehicles. Eastern Asia Society for Transportation Studies.

National Resources Canada. Residential Idling Survey Report. Retrieved from http://oee.nrcan.gc.ca/transportation/idling/material/reports-research/sudbury-survey-report.cfm?attr=28 on April 2, 2010

PRR, Inc. (2003) DOE Idling survey summary report. Retrieved from http://74.125.93.132/search?q=cache%3AzZpe8uiLgbYJ%3Awww.airwatchnorthwest.org%2Fwa%2FNO_IDLE%2FPDFs%2FIdling_Survey_Results.pdf+DOE+Idling+survey+summary+report&hl=en&gl=ca on April 3, 2010.

Repair Our Air Fleet Challenge (2009) Retrieved on August 17, 2009 from
Van den Hoed, Robert, Kirjam Harmelink and Suzanne Joosen for Intelligent Energy Europe (2006). Evaluation of the Dutch Ecodrive Program.

3.0 Policy

3.1 Introduction

Any company or government agency that has its own fleet of vehicles, or employees that use their own vehicles on company business, can demand that idling reduction policies be adhered to. These agencies also have the opportunity to reduce emissions by controlling the type of vehicles used in addition to controlling the duration of these vehicles' use. Together these two components form the foundation for vigorous idling restriction policy.[42]

3.2 Idling Control Policy

Explanation

As previously mentioned, by adopting a policy that makes a clear statement about how idling a vehicle is unacceptable to a corporation, that corporation sends a message to both employees and to consumers. The *Repair Our Air* website states that 35 per cent of running time for corporate vehicles is spent idling. [43] Part of this time is when a vehicle idles in traffic, but a larger part of this time is simply when a driver fails to "turn the key" thereby leaving the engine running. The repercussions of the needless idling are huge with air pollution being the biggest drawback.

Before a company engages in an idling reduction campaign, it should familiarize itself with where current practices stand. This may involve measuring exactly where and how idling is presently occurring. It is only with sufficient pre-test information that post-test measures are helpful.

Benefits

The benefits of a fleet-wide idling control policy are many. They include:

- Reducing fuel expenses for the company or government body
- Demonstrating to drivers what the actual cost savings are of turning off the engine
- Encountering better reception from the public than would an idling-control by-law- the policy may be a first step towards a by-law but the public will see that government is willing to "clean up" its own house before making demands of other
- Giving drivers positive reinforcement with public acknowledgement of their efforts
- Providing an opportunity for business/government to advertise their environmental prowess

These benefits should make the choice of when to "go idle-free" simple. The answer is, "As

42 Fleet Challenge Ontario. (2008). Best Practices Manual 2008: Reducing the Use of Gasoline and Diesel: Considerations in Fuel Procurement p. 61. Retrieved from http://www.fleetbusiness.com/pdf/FCOntario.pdf on April 5, 2010

43 Repair Our Air Fleet Challenge Retrieved from www.repairourair.org/the_challenge.html on August 17, 2009

soon as possible".

Challenges

The employees of a corporate or government entity may feel that an idling restriction policy means that central office is meddling in their private affairs. While a policy does put additional pressure on drivers, the scrutiny is warranted. The costs of idling are high financially, socially and environmentally.

Example

Numerous corporate entities and governments recognize that, in the absence of an idling control by-law, a policy to restrict idling can be nearly as effective. Here is an example of this type of policy:

County Grey, Ontario
County Grey, Ontario implemented a policy for its municipality in 2009. The policy will impact internal drivers but the County hopes that the fuel-saving message will be disseminated to the entire public. The purpose of the policy is to: "…allow the Corporation of the County of Grey [to] be a leader by remembering and instituting this policy both at work and within the community."[44] The cost savings outweigh any potential administrative detail.

44 Grey County. (2009). "Purpose" Idling Policy, Policy and Procedures. Retrieved from https://greydocs.greycounty.ca/ucm/groups/public/documents/greypolicies/gc_015672.pdf on October 11, 2009.

3.3 Right-Sizing Fleets

Explanation

"Right-sizing" a fleet means that fuel efficiency and job requirements are both considered when purchasing a vehicle. It means that choosing a vehicle considers:

- The function that a specific vehicle is used for 90 per cent of the time
- Fuel efficiency as measured against other vehicles in a certain class

With these two considerations, the most appropriate vehicle is chosen without sacrificing environmental standards. The use of a "90 per cent" factor recognizes that there will be exceptional circumstances where a vehicle will not be able to perform a certain task. In these instances, it is usually economically advantageous to rent or borrow a vehicle that is more appropriate for the given task.

Formulas are used to factor lifetime expenses and initial purchasing price into making decisions about which vehicles to acquire. See Appendix C for additional details.

Benefits

The benefits of fleet right-sizing are many. They include:

- Matching carbon emission levels to the task at hand. Fuel isn't wasted running engines that are bigger than necessary
- Saving fuel over the life of a vehicle
- Analyzing lifetime costs in determining which vehicle to purchase
- Using an appropriate policy tool removes guess work from purchasing decisions

Challenges

Fleet right-sizing policies have few identifiable drawbacks. One exception to this may be that a fleet manager does not get to purchase a vehicle that has performed well in the past if the quantifiable evidence does not substantiate this decision. Qualitative perspectives are not granted much weight with purchasing formulas.

Example

Different levels of government as well as business enterprises recognize the fuel efficiency savings that result from using a vehicle that is properly sized for the task it will be completing. An example of a right-sizing policy follows:

Halifax Regional Municipality, Nova Scotia
On July 7, 2009, HRM Regional Council both made and carried a motion to adopt a green "filter" for the purchasing of new fleet vehicles. The filter includes a right-sizing component as well as a life cycle cost analysis. [45] See Appendix C for details.

45 Halifax Regional Municipality (July,7 2009)Meeting Minutes. Halifax Regional Council. Retrieved from

3.4 Alternative Fuels

Explanation

Petroleum is the most common fuel for vehicles in North America. However, an increasing mix of alternative fuels is being used both for their cost advantage and for their greenhouse gas emission advantage. Vehicles are no longer exclusively designed to run on standard petroleum - flex fuel vehicles, natural gas engines, propane conversions, and electric vehicles are all becoming increasingly common. The engineering of these alternative-fuelled vehicles is safe and no more complex than for regular gasoline. What is an issue is alternative fuel availability.

While switching to alternative fuels is not an idling reduction measure *per se*, because alternative fuels often are less carbon intensive than is gasoline, fewer greenhouse gas emissions occur when these types of vehicles are in use. This means that while idling at traffic lights or while idling for "other acceptable reasons" the environmental damage is reduced.

Benefits

Alternative fuel technology is often more expensive than straight gasoline because many vehicles need to be converted after factory production. Even if this is the case, lifetime fuel savings can reduce or eliminate additional expenses. Other benefits include:

- Saving greenhouse gas emissions. Before this claim can be made of all alternative fuels careful research may need to be completed. Ethanol, for example, looks like a great renewable alternative, but because of the conversion process for cellulosic ethanol the carbon footprint of the fuel may actually be greater than that of petroleum. The same holds true for biodiesel. If the fuel is made from waste products it certainly is less carbon intensive than regular diesel, but if food crops are being used to produce the fuel other social and environmental issues arise.
- Possibly reducing fuel expense. As prices vary with market conditions, it is difficult to assert a definite financial benefit

Challenges

Depending on your location the widespread use of alternative fuels will differ. This may be the biggest factor in determining how feasible alternative fuels are for a municipality or business. Some considerations when looking at alternative fuels include:

- Converting engine to running on alternative fuel and purchasing fuel tanks
- Finding alternative fuels locally

Example

http://www.halifax.ca/council/documents/c090707.pdf on April 19, 2010

Individual enterprises have converted to various fuels. An example follows:
Blue Line Transportation Ltd., Hamilton, Ontario
Individual businesses can recognize the cost savings and energy reduction of switching to alternative fuels. In the 1980s, Hamilton's Blue Line Transportation Ltd. began converting its vehicles from standard gasoline to propane. At present, natural gas is the fuel of choice. The conversion has resulted in significant economic and environmental savings for the company.[46]

46 Natural Resources Canada. FleetSmart Profiles: Municipalities and Utilities
Blue Line Transportation Ltd. – Hamilton, Ontario Taxi Fleet Achieves Fuel-Cost Savings With Alternative Fuels. Retrieved from http://fleetsmart.nrcan.gc.ca/index.cfm?fuseaction=docs.view&id=municipal-blueline on January 18, 2010

3.5 Setting a Target

Explanation

Without a target, a campaign to reduce idling is like a ship without a rudder - it has no direction. In its plan to reduce greenhouse gas emissions from the transportation sector, the City of Vancouver states, "This recognized the importance of setting a target that would challenge the entire community to make real emission reductions. At the same time, the target had to be one that could be achieved through concerted and coordinated efforts."[47] The City recognizes the importance of setting a target, but it also recognizes that this target must be feasible. For the community to accept the target, the possibility of reaching that target must exist.

Fleet Challenge Ontario recognizes a need for goal setting. It states, "Management commitment is essential to the success of a reduced idling campaign. Developing the necessary commitment is best done in stages…"[48] Breaking the overall goal into reasonably achievable targets helps the larger task appear possible. Fleet Challenge Ontario recognizes that commitments are often solidified by a corporation or an individual's willingness to commit money to support a pledge, stating:

> The level of management commitment will become evident when a budget is requested for the purchase or lease of telematics to measure idling incidence, and when direct participation in the idling campaign is requested. While reduced idling can provide a "quick win" for any Green Fleet program, note that the measurement and control of idling will require an initial capital outlay...[49]

A lack of financial commitment often demonstrates that a promise to an ideal is vacuous.

Benefits

Setting a target allows an entity to measure progress towards its goal. Without knowing where you want to be, it is impossible to measure how far you've come.

Challenges

Having set a target the main challenge is measurement. A corporation or community first

47 City of Vancouver Engineering Services and Sustainability Office (2007) Achieving Greenhouse Gas Reductions from Passenger Vehicles. Retrieved from http://www.tac-atc.ca/english/resourcecentre/readingroom/conference/conf2005/docs/s17/klimchuk.pdf on April 12, 2010

48 Fleet Challenge Ontario. (2008). Best Practices Manual 2008: Reducing the Use of Gasoline and Diesel: Management Commitment. p. 47-48. Retrieved from http://www.fleetbusiness.com/pdf/FCOntario.pdf on April 5, 2010

49 Fleet Challenge Ontario. (2008). Best Practices Manual 2008: Reducing the Use of Gasoline and Diesel: Management Commitment. p. 47-48. Retrieved from http://www.fleetbusiness.com/pdf/FCOntario.pdf on April 5, 2010

needs to identify where it is and then needs to commit to evaluating progress towards the goal at regular intervals. If these measurements show that progress is not occurring then that entity needs to be willing to change its approach to reducing emissions. The willingness to take a new course of action means that the entity needs to be flexible and adaptable.

Additional challenges may include:

- Getting all stakeholders playing from the same handbook
- Accounting for results. One individual should have the ultimate responsibility of collecting and reporting idling data. [50]
- Supporting unions and other workers organizations. Monitoring idling often involves monitoring the entirety of an individual's actions and behaviours. Union officials may worry that this amounts to "police state" thinking. [51]

Example

Stratford, a town on Prince Edward Island, demonstrates its commitment to sustainability in a variety of ways:

Town of Stratford, Prince Edward Island
In 2009, the Town of Stratford adopted a *Sustainability Decision Making Framework*. The Framework outlines a series of questions that aid in evaluating municipal decisions and projects. The framework ensures that the Town's actions reflect its commitment to the four pillars of sustainability: social, cultural, economic and environmental.

Doug Deacon, Sustainable Economic Development Coordinator, says that using the framework was slow at first, but with time it became second nature. He continues, stating that "the decision making framework is really a more powerful tool than the vision statement and community sustainability framework, I personally think it is the strongest tool in our arsenal." (Personal Communication, December 15, 2009)

One of the questions included in the Framework is "Does this proposal contribute to reducing greenhouse gas emissions? (energy consumption)"[52] Having each move that Council considers taking evaluated by contribution to greenhouse gas emissions will likely result in more environmentally sustainable decision making.

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50 Fleet Challenge Ontario. (2008). Best Practices Manual 2008: Reducing the Use of Gasoline and Diesel: Supporting Structures and Processes p. 47-48. Retrieved from http://www.fleetbusiness.com/pdf/FCOntario.pdf on April 5, 2010

51 Fleet Challenge Ontario. (2008). Best Practices Manual 2008: Reducing the Use of Gasoline and Diesel: Supporting Structures and Processes p. 47-48. Retrieved from http://www.fleetbusiness.com/pdf/FCOntario.pdf on April 5, 2010

52 Town of Stratford (PEI) Sustainability Decision Making Framework p.4 Retrieved from http://www.townofstratford.ca/sites/default/files/site_files/files/Decision_Making_Framework.April08.pdf on Feb. 20, 2010

3.6 Fleet Management and Vehicle Maintenance

Explanation

Proper fleet management does not directly impact idling. Fleet management involves vehicle monitoring, driver education and vehicle maintenance. However, all three components affect the amount and type of emissions released while a vehicle is engaged in limited but necessary idling.

According to *Fleet Challenge Ontario*: "Few fleet managers or drivers understand the extent of waste associated with unnecessary idling."[53] Relying on data collected through *Repair Our Air*, an anti-idling campaign, *Fleet Challenge Ontario* states that the percentage of time during normal operations that the following types of vehicles spend idling are[54]:

- Municipal service fleets, 30 - 50 per cent
- Transit, 35 - 40 per cent
- Enforcement, 65 - 85 per cent
- Utilities, 30 - 75 per cent

Figures like this are appalling because of the amount of fuel used without purpose. Such fuel use, or misuse, is both an extraneous expense and a huge burden on the atmosphere.

Benefits

Proper fleet management and maintenance allows for:

- Monitoring of fleet vehicles and driving staff
- Knowing which vehicles and which drivers have a tendency to idle more than others can identify potential trouble spots
- Maintaining proper vehicle maintenance can aid in dealing with routine situations before they become problems
- Measuring idling situations
- Reducing overall costs which can in time be returned to the program.[55]
- Achieving sustainable behavioral change and lower fuel costs through a change-management approach
- Reducing vehicle wear. Fleet Challenge Ontario writes:

> Idling has several undesirable attributes, which include but are not limited to: impact on engine operating life, as one hour of engine idle is equivalent to two hours of driving and results in the more frequent servicing and replacement of spark plugs, fuel injectors, valve seats, and piston crowns; higher cost, through incurring an

53 Fleet Challenge Ontario. (2008). Best Practices Manual 2008: Reducing the Use of Gasoline and Diesel: Idling Reduction. p. 46. Retrieved from http://www.fleetbusiness.com/pdf/FCOntario.pdf on April 5, 2010

54 Fleet Challenge Ontario. (2008). Best Practices Manual 2008: Reducing the Use of Gasoline and Diesel: Idling Reduction. p. 46. Retrieved from http://www.fleetbusiness.com/pdf/FCOntario.pdf on April 5, 2010

55 Fleet Challenge Ontario. (2008). Best Practices Manual 2008: Reducing the Use of Gasoline and Diesel: Idling Reduction. p. 46-47. Retrieved from http://www.fleetbusiness.com/pdf/FCOntario.pdf on April 5, 2010

> additional $1.25 in vehicle maintenance for every $1.00 of fuel consumed; and, reducing engine oil life by 75 per cent, from 600 engine hours to 150 engine hours.[56]

Challenges

Adopting best practices for fleet vehicles may have a short term economic impact on maintenance costs but any additional expenses should be recouped in fuel savings.

Example

Fleet Challenge Ontario has an excellent section on how to manage fleets for energy efficiency:

Fleet Challenge Ontario
Fleet Challenge Ontario wants to safely challenge Ontarians to take measures to reduce fuel use. It writes:

> The single first best thing a fleet manager can do for the environment and to cut costs is to burn less fuel (i.e., encourage use of transportation alternatives, stop idling, perform regular preventative maintenance, among other options). The more a fleet can perform using less energy, the better off a fleet will be regardless of the type of fuel.[57]

Following the lead of Fleet Challenge Ontario, Nova Scotian municipalities could realize significant fuel savings.

56 Fleet Challenge Ontario. (2008). Best Practices Manual 2008: Reducing the Use of Gasoline and Diesel: Idling Reduction. p. 46. Retrieved from http://www.fleetbusiness.com/pdf/FCOntario.pdf on April 5, 2010

57 Fleet Challenge Ontario. (2008). Best Practices Manual 2008: Reducing the Use of Gasoline and Diesel: Consideration for Fuel Procurement. p. 60. Retrieved from http://www.fleetbusiness.com/pdf/FCOntario.pdf on April 5, 2010

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City of Vancouver Engineering Services and Sustainability Office (2007) Achieving Greenhouse Gas Reductions from Passenger Vehicles. Retrieved from http://www.tac-atc.ca/english/resourcecentre/readingroom/conference/conf2005/docs/s17/klimchuk.pdf on April 12, 2010

Fleet Challenge Ontario. (2008). Best Practices Manual 2008: Reducing the Use of Gasoline and Diesel: Considerations in Fuel Procurement p. 61. Retrieved from http://www.fleetbusiness.com/pdf/FCOntario.pdf on April 5, 2010

Fleets and Facilities Department Officer of Sustainability and Environment. (2007). A Clean and Green Fleet: An Updated Action Plan for the City of Seattle. "Implementation of the Original Plan". Retrieved from https://www.seattle.gov/environment/Documents/CleanGreenFleetAP.pdf on November 14, 2009.

Government of Nova Scotia (2010) Registry of Motor Vehicles - Improved Motor Vehicle (Safety) Inspection Procedures. Retrieved from http://www.gov.ns.ca/snsmr/rmv/inspection/new_mvi.asp on April 17, 2010

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Natural Resources Canada. FleetSmart Profiles: Municipalities and Utilities
Blue Line Transportation Ltd. – Hamilton, Ontario
Taxi Fleet Achieves Fuel-Cost Savings With Alternative Fuels

Province of Nova Scotia. Common Services Manual (August 26. 2007). Section 7.2 Vehicle Policy. Retrieved from http://www.gov.ns.ca/treasuryboard/manuals/PDF/300/30702-03.pdf on April 2, 2010

Repair Our Air Fleet Challenge Retrieved from www.repairourair.org/the_challenge.html on August 17, 2009

4.0 Regulation

4.1 Introduction

Regulation is the strongest means available to government to reduce idling. Whether at the provincial or municipal level, when legislation is enacted to reduce idling, it signals to the community that the behaviour being regulated is only acceptable within certain limits. By legislating idling restrictions, government emphasizes the importance of reducing energy consumption, the seriousness of climate change, and the desire to have healthy constituents. Idling restriction by-laws may encounter community opposition so it is important to first educate the public about why that specific behaviour is worthy of restriction.

It is also important that there are alternatives to the behaviour being regulated, in this case idling. People use drive-throughs for their comfort and convenience. Certain municipalities across Canada have chosen to limit the number of new drive-through facilities that can be built. If we make entering the restaurant just as quick and comfortable as snaking along the line in a running vehicle, then people will choose to go into the restaurant.

4.2 Idling Restriction By-laws

Explanation

In 2005, more than 20 communities in Ontario had adopted idling restriction by-laws.[58] By 2009, the number had increased to over 28.[59] More exciting than the increase in absolute numbers, is that a number of communities are revisiting their efforts and tightening the provisions of the by-laws themselves. These communities include Burlington and London. Ontario is not the only province whose towns and cities are adopting anti-idling by-laws. British Columbia, Alberta, and Nova Scotia have communities leading the charge for idling reduction. See Appendix C for a draft idling restriction by-law.

Benefits

The benefits of a community or municipality-wide idling restriction by-law are many. They include:

- Reinforcing and strengthening public education campaigns working to restrict idling[60]
- Legitimizing idling as a problem for both environmental and health reasons
- Attracting media attention
- Reducing community-wide energy use
- Reducing wear and tear on individual vehicle engines

Challenges

Some challenges about enacting idling-reduction by-laws include:

- Enforcing specific allowable idling times. An enforcement officer would need to time a possible offender. However, if an idling restriction by-law is enacted that does not permit any idling, this challenge is removed. Any vehicle that is idling is automatically in contravention of the by-law.

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58 Clean Air Partnership (2005) Situational Analysis: The Status of Anti-idling By-laws in Canada P1 http://74.125.93.132/search?q=cache%3Arzcae9Fif3EJ%3Awww.cleanairpartnership.org%2Fsituational_analysis_0405.pdf+Situational+Analysis%3A+The+Status+of+Anti-idling+By-laws+in+Canada&hl=en&gl=ca on August 19, 2009

59 City of Burlington (2009) An Update of the City's Idling Initiatives including a Review of the Idling Control By-law and a Strategy to Increase Levels of Enforcement, P 3. Retrieved from http://cms.burlington.ca/Page2893.aspx on November 3, 2009

60 Carrico, Amanda R. and Paul Padgett, Michael P. Vandenbergh, Jonathan Gilligan, Kenneth A. Wallston. (2009) Costly myths: An analysis of idling beliefs and behaviour in personal motor vehicles. Energy Policy 37: 2881-2888

Example

In Nova Scotia a number of municipalities are looking at implementing idling restriction by-laws. Only one community in Nova Scotia has enacted one:

Town of Kentville, Nova Scotia
Kentville Town Councillor Eric Bolland explains (Personal communication, August 6, 2009) that the by-law came after at least two years of hard work. That effort was led by the Eco-Kings Action Team. The team is a collaboration between "the Municipality of the County of Kings, the Towns of Berwick, Kentville, and Wolfville with the Kings Community Economic Development Agency, Valley Waste Resource Management, Eastern Kings Chamber of Commerce, and Eastern Habitat Joint Ventures."[61] Bolland recounts how the by-law could only have occurred after the Action Team prepared the community through an education and awareness campaign.

A year and a half after the Town of Kentville adopted its *Idling Control By-law* on Sept. 23, 2008, the communities of Annapolis Royal and Antigonish are exploring the possibility of adopting idling restriction legislation.

61 Eco-Kings: About Us. Retrieved from http://www.ecokings.ca/about.html on April 16, 2010

4.3 Land-use Restrictions

Explanation

Through zoning and its regulations, municipalities have the ability to determine what type of business, residential or industrial use is allowed on parcels of land within the community. This power can be used simply to segregate "incompatible" uses or a municipality can use it to direct and mould the type of development allowed within its boundaries. By restricting the number of drive-throughs allowed, the municipality can take a stance against vehicle idling.

Benefits

The "benefits" and "challenges" of a restriction on the number and location of new drive-throughs often depend on which stakeholder group is asked. Community health advocates are likely to support restrictions to drive-throughs while drive-through owners are likely to see such restrictions as an infringement on their right to the free market. Thus said, some of the benefits to regulating drive-throughs include:

- Prioritizing pedestrians over vehicles. City of Calgary Alderman Brian Pincott voted in favour of restricting the number of drive-throughs in a Calgary subdivision stating that, "In a city trying to put pedestrians first and cars last, blocking new drive-throughs from being built makes sense."[62] He continues, stating "We've got to start designing and building our city for people and drive-throughs are not about people, they're about cars."
- Achieving significant greenhouse gas emission reductions. The average drive-through transaction takes approximately three minutes to complete. If every person driving a light duty vehicle were to pick up just one order at Tim Hortons every day for a year it would result in 31,468 tonnes of GHG emissions.[63] If a prohibition on new drive-throughs were to be enacted that number could be reduced, contributing to a better quality of life in the community.
- Reducing fuel use for individual customers.

Challenges

The elimination of drive-throughs would require individuals to think differently about the ease and conveniences they have become accustomed to. This is not necessarily a bad move, it is simply a different way of understanding our place in society. Some challenges that would need to be taken into account include:

- Adopting a lifestyle more cognizant of realistic time constraints. Drive-through services are the epitome of convenience; not having drive-throughs doesn't make life inconvenient,

62 The Calgary Herald (June 26 2008) City urged to ban takeout windows. Retrieved from http://www.canada.com/calgaryherald/news/story.html?id=47638478-6afc-4e00-b494-8587a35f4e73 on April 11, 2010

63 Natural Resources Canada (2008) The Idling Impact Calculator. Retrieved from http://oee.nrcan-rncan.gc.ca/transportation/tools/calculators/Idling/idlingimpact-general.cfm on April 11, 2010

but it does require additional planning.[64] [65]

- Countering the idea that the key to reducing greenhouse gas emissions is simply reducing the number of vehicles on the road. In reality, reducing GHGs can be achieved in part with a more effective use of the automobile. Rather than getting a coffee by way of the drive-through, having a driver actually get out of the car should provide quicker, more personable service.
- Challenging the notion that restricting drive-throughs necessarily results in an increase in the size of parking lots. This is a belief held by many, including John McInnes, owner of a McDonalds restaurant in Comox. In a presentation to Comox Town Council he stated, "... that what banning drive-throughs does do is create the need for larger parking lots, which leads to less green space."[66] Given the amount of space that is required for drive-through lanes, this argument is baseless.

Example

Communities across Canada are already reviewing their land-use by-laws to see whether a drive-through restriction legislation can feasibly be implemented. North Vancouver and Calgary have implemented partial restrictions. Comox has gone even further:

Comox, British Columbia.
On July 15, 2009 the Town of Comox, a community with a population of just over 12,000, adopted a by-law limiting the establishment of new drive-through restaurants. A motion that would allow for existing drive-throughs but would prevent the establishment of new drive-throughs was passed.[67] A planner with the Town of Comox could not verify whether the by-law encouraged businesses to establish in one of the neighbouring communities rather than in Comox itself (Personal communication, April 12, 2010)

64 The Calgary Herald (June 26 2008) City urged to ban takeout windows. Retrieved from http://www.canada.com/calgaryherald/news/story.html?id=47638478-6afc-4e00-b494-8587a35f4e73 on April 11, 2010

65 Canadian Restaurant and Foodservices Association (2009) Drive-Thrus. Retrieved from http://www.crfa.ca/news/bytopic/drivethroughs.asp on April 11, 2010

66 Town of Comox (2009) Minutes of the Regular Council Meeting: Drive Thrus. Retrieved from http://comox.ca/town-hall/meetings/minutes/2009-minutes/07-15%20RCM%20Minutes.pdf/ on April 11, 2010

67 Town of Comox (2009) Minutes of the Regular Council Meeting: Drive Thrus. Retrieved from http://comox.ca/town-hall/meetings/minutes/2009-minutes/07-15%20RCM%20Minutes.pdf/ on April 11, 2010

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Clean Air Partnership (2005) Situational Analysis: The Status of Anti-idling By-laws in Canada P1 http://74.125.93.132/search?q=cache%3Arzcae9Fif3EJ%3Awww.cleanairpartnership.org%2Fsituational_analysis_0405.pdf+Situational+Analysis%3A+The+Status+of+Anti-idling+By-laws+in+Canada&hl=en&gl=ca on August 19, 2009

City of Burlington (2009) An Update of the City's Idling Initiatives including a Review of the Idling Control By-law and a Strategy to Increase Levels of Enforcement, P 3. Retrieved from http://cms.burlington.ca/Page2893.aspx on November 3, 2009

Eco-Kings: About Us. Retrieved from http://www.ecokings.ca/about.html on April 16, 2010

Municipality of Jasper (2007) By-law #095, Anti-Idling By-law. Retrieved from http://74.125.93.132/search?q=cache%3AOUExWrYBk1IJ%3Ajasper-alberta.com%2Fuserfiles%2Fdocuments%2FF14+All+bylaws%2F095_Idling_Bylaw.pdf+Bylaw+%2523095%2C+Anti-Idling+Bylaw&hl=en&gl=ca on December 14, 2009

Lu, Vanessa and Dana Flavelle (February, 15 2008) Drive-thru ban eyed for city vehicles Retrieved from http://www.thestar.com/news/gta/article/303944 on April 11, 2010

Natural Resources Canada (2008) The Idling Impact Calculator. Retrieved from http://oee.nrcan-rncan.gc.ca/transportation/tools/calculators/Idling/idlingimpact-general.cfm on April 11, 2010

The Calgary Herald (June 26 2008) City urged to ban takeout windows. Retrieved from http://www.canada.com/calgaryherald/news/story.html?id=47638478-6afc-4e00-b494-8587a35f4e73 on April 11, 2010

Tim Hortons (2009) Five Year Performance Consolidated. Retrieved form http://www.timhortons.com/ca/en/about/5-year.html on April 11, 2010

Town of Comox (2009) Minutes of the Regular Council Meeting: Drive Thrus. Retrieved from http://comox.ca/town-hall/meetings/minutes/2009-minutes/07-15%20RCM%20Minutes.pdf/

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Tim Hortons (2009) Tim Hortons Inc. Announces 2009 Fourth Quarter and Year-End Results. Retrieved from http://www.newswire.ca/en/releases/archive/February2010/25/c4440.html on April 11, 2010

5.0 Managing Traffic Flow

5.1 Introduction

Reducing greenhouse gas emissions through traffic management is convenient because it does not require private vehicle users to shift their habits or alter their modes of transport. This is especially helpful when sustainable transportation options such as transit, cycle paths or carpooling are not readily available. Rural areas in Nova Scotia face particular problems with distance and weather conditions. This section explores three alternative intersection improvements that have been used to combat idling.

The three options discussed are applicable for Nova Scotia, with its traffic volumes and rural urban composition. They are:

- Roundabouts
- Traffic signal synchronization
- Creating Caution

Before investing in any project, all alternatives must be explored. The U.S. National Transportation Operations Coalition writes, "In this time of competing investments and with the recognition that we cannot build our way out of congestion, it is more important than ever to make performance-based decisions on resource allocation."[68]

Certain advocates of sustainable transportation argue that improved traffic flow is tantamount to inviting more traffic onto the roads. That is, improving traffic flow actually produces additional traffic. Because the amount of time it takes to reach a destination may be lowered by traffic management and because per trip gasoline costs are lowered as a function of reduced time spent idling, the net result of the effort is a reduction in cost and also a decrease in the amount of time a driver spends in the vehicle. Because of these reasons, managing traffic can actually encourage vehicle use by a larger segment of the population. Todd Litman of the Victoria Transport Policy Institute writes:

> Roadway improvements that alleviate congestion reduce the generalized cost of driving (i.e., the price), which encourages more vehicle use…In the short-run generated traffic represents a shift along the demand curve; reduced congestion makes driving cheaper per mile or kilometre in terms of travel time and vehicle operating costs.[69]

Following Litman's logic, reducing idling will actually encourage more drivers to be on the road.

68 National Transportation Operations Coalition (2007) National Traffic Signal Report Card: Technical Report. p20 "Where Do We Go From Here?—Improving the Score" Retrieved from http://www.ite.org/REPORT-CARD/technical_report%20final.pdf on February 21, 2010

69 Litman, Todd for Victoria Transport Policy Institute (2009)Generated Traffic and Induced Travel:Implications for Transport Planning. "Introduction" p2. Retrieved from http://www.vtpi.org/gentraf.pdf on March 4, 2010

Joseph E. Hummer writes:

> Many urban and suburban arterials are congested with little immediate hope of relief. Access management and better coordination between land use and transportation offer long-term hope for developing areas but little short-term promise for developed areas…public transportation will require shifts in land use before it provides major relief.[70]

Hummer points to land-use planning as a key reason for traffic inefficiency.

Just because it is "easier" for traffic engineers to do what was done before, such as build a four-way stop and a traffic light where yield signs and a traffic circle would save both time and fuel, doesn't mean this is the "best" thing to do. Hummer continues, explaining that the negative consequences of exploring a new alternative are few but that the negative consequences of not acting to improve traffic flow are many. [71]

Michael J. Wallwork, a professional engineer who wrote the article entitled *A New Perspective on Road Design* highlights the fact that traffic engineers generally refer to standard documents rather than initiate change. Wallwork points to *Geometric Design of Streets and Highways*, the manual of the American Association of State Highway Officials and the *Manual of Uniform Traffic Control Devices* as the "bibles" of roadway design, the two main standards that North American engineers use when designing roads. [72] Wallwork states that, "These documents are very much vehicle-orientated manuals with limited consideration given to the needs of other roadway users."[73] Because these manuals have definite parameters for roadway building they can be used as justifications for not thinking creatively about other, more efficient, solutions to traffic management.

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70 Hummer, Joseph E. and Jonathon D. Reid (1998) Unconventional Left-Turn Alternatives for Urban and Suburban Arterials. Retrieved from http://findarticles.com/p/articles/mi_qa3734/is_199809/ai_n8824901/ on February 20, 2010.

71 Hummer, Joseph E. and Jonathon D. Reid (1998) Unconventional Left-Turn Alternatives for Urban and Suburban Arterials. Retrieved from http://findarticles.com/p/articles/mi_qa3734/is_199809/ai_n8824901/ on February 20, 2010.

72 Wallwork, Michael J. P.E (2000) A New Perspective on Road Design. Retrieved from http://www.round-abouts.net/roaddesign.html on February 13, 2010

73 Wallwork, Michael J. P.E (2000) A New Perspective on Road Design. Retrieved from http://www.round-abouts.net/roaddesign.html on February 13, 2010

5.2 Roundabouts

Explanation

Modern roundabouts are not rotaries, nor are they traffic circles. In an article entitled *A New Perspective on Road Design*, author Michael J. Wallwork states, "The modern roundabout is smaller, safer, slower, and has a much higher vehicle capacity than rotaries or traffic circles."[74] Though both modern roundabouts and rotaries/traffic circles are circular intersections with traffic flowing in a single direction with a circular median at the centre, the way in which the two are designed and driven are different. Until the summer of 2009, the Armdale rotary existed at the convergence of Chebucto Road, Quinpool Road, St. Margaret's Bay Road, Herring Cove Road and Joseph Howe Drive in HRM. Many motorists avoided the rotary, as the one-and-one rule seemed to confound drivers. When converted to a modern roundabout, residents of the municipality had to relearn to drive the interchange, but the change meant a more efficient traffic system.

Table 1: Characteristics of circular intersections

Characteristic	Roundabout	Rotary/Traffic circle
Right of way	Vehicles inside the circle have right of way	Vehicle entering the circle have right of way
Deflection	Used as a tool to slow vehicles	Minimal deflection
Speed	No more than 30 kilometres per hour	50 kilometres per hour
Crashes	Minimal and at low speeds	Higher speed and angle of deflection mean more severe accidents[1]
Example	Typical intersection in the United Kingdom	Surrounding the Arc de Triumph in Paris, France

74 Wallwork, Michael J. P.E (2000) A New Perspective on Road Design. Retrieved from http://www.roundabouts.net/roaddesign.html on February 13, 2010

In an article detailing the evaluation and design for roundabouts, principal investigators state that roundabouts should "be considered as an alternative intersection during all intersection improvements"[75]

Benefits

Documented evidence suggests the benefits of roundabouts are many. They include:

- Appropriate for a variety of traffic volumes
- Reducing idling. Wallwork reports, "They have much less delay and pollution than other forms of traffic control." [76] Isaacs *et al.* write, "The requirement for vehicles to yield on roundabout approaches, rather than stop, leads to a reduction in idling time. This reduces vehicle emissions, creating less air pollution, and lowers fuel consumption."[77] A report for Kansas State University says:

  > Vehicles stopping at traffic signals and stop signs emit more carbon dioxide (CO2) when compared to roundabouts, as the delay and queuing are greater. Even if the delays are similar to that of roundabout, traffic signals always queue traffic at a red light and hence emissions are usually greater. The average delays at roundabouts have to be significantly larger than at traffic signals for the emissions to be equal. When traffic volumes are low, traffic rarely stops at a roundabout and the emissions are very small.[78]

- Reducing noise pollution. Slower moving vehicles are quieter.[79]
- Reducing serious vehicle incidents. An article published through the U.S. National Cooperative Highway Research Program found in an investigation of 11 roundabouts that accidents fell by 37 per cent over the number of incidents with the previous intersection type.[80] Other studies have put the number of crashes at 50 to 90 per cent

75 Benekohal, Rahim F. and Varun Atluri for Illinois Centre for Transportation (2009) Evaluation and Design: A Site Selection Procedure. "Conclusions" p30. Civil Engineering Studies, Illinois Center for Transportation Series No. 09-051

76 Wallwork, Michael J. P.E (2000) A New Perspective on Road Design. Retrieved from http://www.roundabouts.net/roaddesign.html on February 13, 2010

77 Isaacs, Beatrice and Jill P. Barrett (2003)Use Of Roundabouts In An Urban Setting. p5 "Roundabouts vs Signalized Intersections: Environmental Considerations"
Retrieved from http://www.urbanstreet.info/2nd_sym_proceedings/Volume%202/Isaacs.pdf on February 21, 2010

78 Mandavilli, Srinivas, Eugene R. Russell and Margaret J. Rys (2003) Impact of Modern Roundabouts on Vehicular Emissions p3. Retrieved from on February 20, 2010

79 Isaacs, Beatrice and Jill P. Barrett (2003)Use Of Roundabouts In An Urban Setting. p5 "Roundabouts vs Signalized Intersections: Environmental Considerations"
Retrieved from http://www.urbanstreet.info/2nd_sym_proceedings/Volume%202/Isaacs.pdf on February 21, 2010

80 Jacquemart, Georges for National Cooperative Highway Research Program (1998) Synthesis of Highway Practice 264: Modern Roundabout Practice in the United States p 42 Retrieved from http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_264.pdf on March 1, 2010.

lower.[81]Of the crashes that do occur, because vehicles speeds are lower,[82] injuries are usually less severe. [83] This finding is collaborated by Bruce Corben who states, "It has also been reported in a number of studies that intersections controlled by traffic signals generally exhibit lower safety performance than comparable intersections controlled by roundabouts"[84]. In essence, roundabouts are safer than traffic signals.

- Increasing safety for pedestrians. Rather than crossing lanes of traffic for vehicles in both directions (at least four lanes, two in each direction), pedestrians encountering roundabouts walk around the intersection and when crossing lanes of traffic they only deal with traffic flowing in one direction. The U.S. Insurance Institute for Highway Safety reports that, "Studies in Europe indicate that, on average, converting conventional intersections to roundabouts can reduce pedestrian crashes by about 75 per cent."[85]
- Maintaining intersections. Light-controlled intersections cost approximately US$5,000 for electricity and bulb replacement. [86] Aside from initial landscaping, roundabouts are largely maintenance free.[87]
- Increasing vehicle capacity. Roundabouts have a higher capacity than other traffic control measures such as stop signs.[88]
- Reducing traffic delays. Because a roundabout uses a slower but continuous flow of traffic, "…delays were reduced by as much as 75 per cent after construction of a roundabout …The roundabout handles traffic more efficiently, and can thus accommodate a higher volume of traffic," [89] writes Isaacs *et al.*

An article by Isaacs and Barrett summarizes the benefits of modern roundabouts as follows:

> All over the world, roundabouts that have been properly designed and constructed at appropriate locations have demonstrated that they are superior to signalized intersections in safety, capacity, environmental considerations, economics and esthetics. The

81 Wallwork, Michael J. P.E (2000) A New Perspective on Road Design. Retrieved from http://www.roundabouts.net/roaddesign.html on February 13, 2010

82 Wallwork, Michael J. P.E (2000) A New Perspective on Road Design. Retrieved from http://www.roundabouts.net/roaddesign.html on February 13, 2010

83 Insurance Institute for Highway Safety (July 28, 2001) Status Report: Roundabouts p2. Retrieved from http://www.iihs.org/externaldata/srdata/docs/sr3607.pdf on February 22, 2010

84 Corben, Bruce (1989) Crashes at Traffic Signals. Retrieved from http://www.monash.edu.au/muarc/reports/muarc007.pdf on February 20, 2010

85 Insurance Institute for Highway Safety (2010) Q&As: Roundabouts. Retrieved from http://www.iihs.org/research/qanda/roundabouts.html#cite16 on April 18, 2010

86 Isaacs, Beatrice and Jill P. Barrett (2003) Use Of Roundabouts In An Urban Setting. Retrieved from http://www.urbanstreet.info/2nd_sym_proceedings/Volume%202/Isaacs.pdf on February 21, 2010

87 Wallwork, Michael J. P.E (2000) A New Perspective on Road Design. Retrieved from http://www.roundabouts.net/roaddesign.html on February 13, 2010

88 Wallwork, Michael J. P.E (2000) A New Perspective on Road Design. Retrieved from http://www.roundabouts.net/roaddesign.html on February 13, 2010

89 Isaacs, Beatrice and Jill P. Barrett (2003)Use Of Roundabouts In An Urban Setting. p5 "Roundabouts vs Signalized Intersections: Capacity" Retrieved from http://www.urbanstreet.info/2nd_sym_proceedings/Volume%202/Isaacs.pdf on February 21, 2010

> geometry of roundabouts eliminates most of the angles and traffic flows that create the potential for crashes at signalized intersections, while the continuous movement of vehicles, albeit at slower speeds, increases the capacity of an intersection.[90]

All studies report that once initial distrust of roundabouts is overcome, the benefits of the circular traffic system are multifold.

Challenges

Though replacing signalized intersections with modern roundabouts has numerous benefits, changing an intersection's configuration also has challenges. Some of these challenges may even make conversion impossible:

- Optimizing diameter of outside circle. Multilane roundabouts often compare more favourably on a space per lane basis than do single lane roundabouts.[91] Other studies consider smaller circle diameters to be beneficial because they slow down average traffic speed.[92]
- Disrupting platoon within a signal network. Traffic signal synchronization depends on standard speeds and specific traffic lengths between intersections. Roundabout timing is often more erratic than standard traffic signals.[93]
- Experiencing unequal traffic volumes from different directions. The National Cooperative Highway Research Program states problems occur with, "Locations with heavy flows on the major road and low flows on the minor road, where the equal opportunity treatment of the approaches causes undue delays to the major road."[94]
- Locating roundabout on a flat plateau. The U.S. National Cooperative Highway Research Program states that roundabout construction requires a surface with a grade of no more than three to five per cent.[95]

90 Isaacs, Beatrice and Jill P. Barrett (2003) Use Of Roundabouts In An Urban Setting. p4 "Roundabouts vs Signalized Intersections" Retrieved from http://www.urbanstreet.info/2nd_sym_proceedings/Volume%202/Isaacs.pdf on February 21, 2010

91 Jacquemart, Georges for National Cooperative Highway Research Program (1998) Synthesis of Highway Practice 264: Modern Roundabout Practice in the United States p 42 Retrieved from http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_264.pdf on March 1, 2010.

92 Jacquemart, Georges for National Cooperative Highway Research Program (1998) Synthesis of Highway Practice 264: Modern Roundabout Practice in the United States p 47 Retrieved from http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_264.pdf on March 1, 2010.

93 Jacquemart, Georges for National Cooperative Highway Research Program (1998) Synthesis of Highway Practice 264: Modern Roundabout Practice in the United States p 42 Retrieved from http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_264.pdf on March 1, 2010.

94 Jacquemart, Georges for National Cooperative Highway Research Program (1998) Synthesis of Highway Practice 264: Modern Roundabout Practice in the United States p 42 Retrieved from http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_264.pdf on March 1, 2010.

95 Jacquemart, Georges for National Cooperative Highway Research Program (1998) Synthesis of Highway Practice 264: Modern Roundabout Practice in the United States p 42 Retrieved from http://onlinepubs.trb.org/

- Accomodating "special" users. Proximity to fire stations or rail crossings as well as the number of cyclists, pedestrians and persons with disabilities using the intersection must all be taken into account. [96]
- Public perception. Mandavilli *et al.,* recount that:

> Without a successful education program or first-hand experience and observation, the public can incorrectly associate all "roundabouts" with the older, inefficient, confusing traffic circles or rotaries they have experienced or heard negative remarks about or with neighbourhood traffic circles, generally disliked in many areas.[97]

Example

Roundabouts can be used in any situation if the parameters are correct. This means roundabouts may be found on city streets, arterials, small towns and even rural areas. One example:

Vail and Avon, Colorado[98]
In Colorado, every intersection along a stretch of highway between Vail and Avon has been converted to a roundabout. The mountain pass is now aptly named "Roundabout Valley". A 2010 report by Oursten Roundabout Engineering states the following project lessons:

- The modern way to eliminate traffic congestion is to build roundabouts at the most heavily impacted intersections.
- Roundabouts eliminate congestion, leaving beauty in its place.
- Roundabouts are safer and more efficient than traffic signals.
- Roundabouts are safer and more efficient than cross intersections.
- It usually costs much less to widen nodes than to widen links, especially where links are expensive, as at interchanges, at the ends of tunnels and bridges, and through built-up areas.

The total cost for the project was US$2.8 million , which resulted in annual cost savings of US$85,000 for traffic direction officers. Queues no longer exceed 10 vehicles and serious accidents have been reduced from five to three in the year following implementation. The crash rate for the first year of operation dropped to 22 crashes in the after period from a

onlinepubs/nchrp/nchrp_syn_264.pdf on March 1, 2010.

96 Jacquemart, Georges for National Cooperative Highway Research Program (1998) Synthesis of Highway Practice 264: Modern Roundabout Practice in the United States p 42 Retrieved from http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_264.pdf on March 1, 2010.

97 Mandavilli, Srinivas, Eugene R. Russell and Margaret J. Rys (2003) Operational Efficiency of Roundabouts p7. Retrieved from http://www.urbanstreet.info/2nd_sym_proceedings/Volume%202/Russell.pdf on February 21, 2010

98 Oursten Roundabout Engineering (2010) Roundabout Interchanges. Retrieved from http://www.ourston.com/index.php?id=71 on March 1, 2010.

yearly average of 25 crashes in the before period. The project received a high approval rating, 4.4 on a scale of 5. [99]

99 Oursten Roundabout Engineering (2010) Roundabout Interchanges. Retrieved from http://www.ourston.com/index.php?id=71 on March 1, 2010.

5.3 Traffic Signal Synchronization

Explanation

When driving somewhere it often seems like your luck for lights is either really good or really bad; either you hit every red or you fly through on all green lights. The reason for this is not magic but a specific sequence of traffic signal synchronization. The lights are timed in such a way that allows a vehicle to move from signal to signal without needing to stop. Traffic signal synchronization can include, "…the development and implementation of new signal timing parameters, phasing sequences, improved control strategies and, occasionally, minor roadway improvements."[100]

In an article entitled, *The Benefits of Retiming Traffic Signals* author Sunkari writes, "Signal timing strategies include the minimization of stops, delays, fuel consumption and air pollution emissions and the maximization of progressive movement through a system."[101] In essence, by coordinating traffic signal timing a traffic authority aims to reduce travel times and air pollution.

Benefits

Documented evidence suggests the benefits of traffic signal synchronization include:

- Eliminating extra costs due to additional infrastructure.[102] Sunkari states that signal synchronization "…can produce benefit to cost ratios as high as 40:1."[103] Expressing the amount of funding required to perform the maintenance required for optimal signal performance, the U.S. National Transportation Operations Coalition argues that:

> To support this level of routine signal timing updates nationally, transportation agencies would need to spend an amount equivalent to less than 0.2 per cent of the total national expenditure on highway transportation. When the figure is put into context, the cost of improving signal timing is miniscule,

100 Sunkari, Srinvasa (2004) The Benefits of Retiming Traffic Signals "What is Signal Retiming?" p 26 ITE Journal, Retrieved from http://www.spcregion.org/downloads/ops/Other%20Studies/BenefitsofRetimingTrafficSignals.pdf on February 28, 2010

101 Sunkari, Srinvasa (2004) The Benefits of Retiming Traffic Signals p 26 "What is Signal Retiming?" ITE Journal, Retrieved from http://www.spcregion.org/downloads/ops/Other%20Studies/BenefitsofRetimingTrafficSignals.pdf on February 28, 2010

102 Sunkari, Srinvasa (2004) The Benefits of Retiming Traffic Signals "What is Signal Retiming?" p 26 ITE Journal, Retrieved from http://www.spcregion.org/downloads/ops/Other%20Studies/BenefitsofRetimingTrafficSignals.pdf on February 28, 2010

103 Sunkari, Srinvasa (2004) The Benefits of Retiming Traffic Signals, p27 "Why is signal retiming conducted?" ITE Journal, Retrieved from http://www.spcregion.org/downloads/ops/Other%20Studies/BenefitsofRetimingTrafficSignals.pdf on February 28, 2010

compared to annual highway expenditures. [104]

- Moving significant amounts of traffic along major roads.[105]
- Reducing travel time on arterials. A case study in Austin, Texas reports a time savings of 9.8 per cent.[106] Though not yet completed, a traffic signal synchronization program in Denver, Colorado expects savings of five to 15 per cent.[107]
- Reducing number of stops. The Austin, Texas case study reported 28 per cent fewer stops. [108]
- Reducing fuel consumption. The Austin, Texas case study reported a reduction of 3.5 per cent.[109]
- Reducing "emergency" calls with a regular maintenance schedule. The Austin, Texas case study reports that performing regular checks on signals cut the number of traffic light incidents in half. [110]

Challenges

Though improving the timing of signalized intersections has numerous benefits, changing an intersection's configuration also has challenges. These challenges may include:

- Requiring regular maintenance. Sunkari writes,

> Signal timing is effective only as long as the traffic patterns that were used to generate the signal timing are reasonably constant…Traffic engineers should review traffic signal and system performance continuously. Ideally, signal timing should be reviewed every year to evaluate effectiveness and efficiency…At a minimum, an operating agency should budget to retime traffic signals at least every three years, especially in developing areas

104 National Transportation Operations Coalition (2007) National Traffic Signal Report Card: Technical Report. p21 "Where Do We Go From Here?—Improving the score, Routine Signal Timing Evaluations" Retrieved from http://www.ite.org/REPORTCARD/technical_report%20final.pdf on February 21, 2010

105 Wallwork, Michael J. P.E (2000) A New Perspective on Road Design. Retrieved from http://www.roundabouts.net/roaddesign.html on February 13, 2010

106 National Transportation Operations Coalition (2007) National Traffic Signal Report Card: Technical Report. p14 "Case Studies" Retrieved from http://www.ite.org/REPORTCARD/technical_report%20final.pdf on February 21, 2010

107 United States Department of Transportation - Federal Highway Administration (2009) SAFETEA-LU 1808: CMAQ, "Denver's Traffic Signal System Improvement Program (TSSIP): Estimation of Air Quality Benefits" Retrieved from http://www.fhwa.dot.gov/environment/cmaqpgs/fhwahep09026/index.htm on February 28, 2010.

108 National Transportation Operations Coalition (2007) National Traffic Signal Report Card: Technical Report. p14 "Case Studies" Retrieved from http://www.ite.org/REPORTCARD/technical_report%20final.pdf on February 21, 2010

109 National Transportation Operations Coalition (2007) National Traffic Signal Report Card: Technical Report. p14 "Case Studies" Retrieved from http://www.ite.org/REPORTCARD/technical_report%20final.pdf on February 21, 2010

110 National Transportation Operations Coalition (2007) National Traffic Signal Report Card: Technical Report. p13 "Case Studies" Retrieved from http://www.ite.org/REPORTCARD/technical_report%20final.pdf on February 21, 2010

and/or areas with sustained growth. [111]

- Delaying drivers on side streets. In order to move large volumes of traffic efficiently along major corridors, the minor corridors suffer from delays.[112]
- Financing the signal retiming process. [113][114] The typical cost of retiming a signal intersection is US$2,500 according to Sunkari.
- Justifying spending on traffic lights is difficult because of other more pressing matters.[115] The National Transportation Operations Coalition agrees with other research on the issue, stating:

> More sustained, stable and consistent resources must be committed to the management processes and professionals who design, operate and maintain traffic signal assets to provide significant reductions in congestion, delay, fuel consumption and emissions. [116]

Example

Traffic signal synchronization can lead to time and energy savings in specific situations. In order to assess the type of savings your community can achieve a study may need to be completed:

Nashville, Tennessee
Following a traffic signal timing optimization study, Davidson County in Metro Nashville, Tennessee implemented a traffic improvement project. Though the top priority of the project was to improve traffic flow, the County also aimed it - and succeeded - at reducing greenhouse gas emissions. As a result of the project, fuel consumption per vehicle decreased by 11.4 per cent.[117] The benefits of the project include:

111 Sunkari, Srinvasa (2004) The Benefits of Retiming Traffic Signals, p28 "How Often Should Signal Retiming be Conducted?" ITE Journal, Retrieved from http://www.spcregion.org/downloads/ops/Other%20Studies/BenefitsofRetimingTrafficSignals.pdf on February 28, 2010

112 Wallwork, Michael J. P.E (2000) A New Perspective on Road Design. Retrieved from http://www.roundabouts.net/roaddesign.html on February 13, 2010

113 Sunkari, Srinvasa (2004) The Benefits of Retiming Traffic Signals, p28 "What is the Cost of Retiming Traffic Signals?" ITE Journal, Retrieved from http://www.spcregion.org/downloads/ops/Other%20Studies/BenefitsofRetimingTrafficSignals.pdf on February 28, 2010

114 National Transportation Operations Coalition (2007) National Traffic Signal Report Card: Technical Report. p20 "Where Do We Go From Here?—Improving the Score"
Retrieved from http://www.ite.org/REPORTCARD/technical_report%20final.pdf on February 21, 2010

115 Sunkari, Srinvasa (2004) The Benefits of Retiming Traffic Signals, p28 "What is the Cost of Retiming Traffic Signals?" ITE Journal, Retrieved from http://www.spcregion.org/downloads/ops/Other%20Studies/BenefitsofRetimingTrafficSignals.pdf on February 28, 2010

116 National Transportation Operations Coalition (2007) National Traffic Signal Report Card: Technical Report. p20 "Where Do We Go From Here?—Improving the Score"
Retrieved from http://www.ite.org/REPORTCARD/technical_report%20final.pdf on February 21, 2010

117 Kimley Horn and Associates Ltd for The Metropolitan Government of Nashville and Davidson County's Department of Public Works (2008) Traffic Signal Timing Optimization Study for

- Reducing traffic congestion. Residents did achieve a significant savings in fuel costs
- Reducing harm to the environment. Fuel savings and resultant greenhouse gas savings
- Improving fiscal health. The rate of return on initial investment can be 27:1.[118]

the Metro Nashville Signal System Supplement III. p4 "Results" Retrieved from http://74.125.93.132/search?q=cache:vWHxo4gnNqIJ:www.nashville.gov/pw/pdfs/SummaryReportIII.pdf+Traffic+Signal+Timing+Optimization+Study+for+the+Metro+Nashville+Signal+System+Supplement&cd=1&hl=en&ct=clnk&gl=ca&client=safari on February 28, 2010

118 Kimley Horn and Associates Ltd for The Metropolitan Government of Nashville and Davidson County's Department of Public Works (2008) Traffic Signal Timing Optimization Study for the Metro Nashville Signal System Supplement III. p8 "Conclusions" Retrieved from http://74.125.93.132/search?q=cache:vWHxo4gnNqIJ:www.nashville.gov/pw/pdfs/SummaryReportIII.pdf+Traffic+Signal+Timing+Optimization+Study+for+the+Metro+Nashville+Signal+System+Supplement&cd=1&hl=en&ct=clnk&gl=ca&client=safari on February 28, 2010

5.4 Creating Caution: Naked Streets, Removal of Lights, Use of Yield Signs

> We only want traffic lights where they are useful and I haven't found anywhere where they are useful yet… In short, if motorists are made more wary about how they drive, they behave more carefully.[119]
>
> - Hans Monderman
> Traffic planner, Shared Space
> Drachten, The Netherlands

Explanation

Tom Vanderbilt argues in his book *Traffic* that active vigilance at an intersection through the removal of traffic signal devices can actually work to improve safety. Rather than driving becoming a rote activity, removing signs and signals makes the driver an active participant in road safety.[120] North Americans seem to oppose Vanderbilt's observations, arguing that light-controlled intersections have a higher guarantee of safety. The Transport Research Laboratory sides with Vanderbilt. As quoted in *The Telegraph*, "It is a myth that signals guarantee safety."[121] Though it may be a myth, the North American public still views signalized intersections as safer than those controlled only by signs. The argument for a reduced number of signals is largely falling on deaf ears.

A number of techniques can be used to increase a driver's awareness of his or her situation while at the same time reducing idling and increasing safety. The following strategies can be used:

- Naked Streets - "The concept works on the principle that motorists are more likely to drive carefully if they use their own judgment, rather than unthinkingly obeying instructions. The question of who has priority is deliberately left open, making drivers more cautious."[122]
- The removal of traffic lights. Reducing the number of "stops" a vehicle makes reduces the number of times a vehicle needs to accelerate. Braking and accelerating are very fuel-intensive driving scenarios. By eliminating these phases from the driving cycle the emissions produced by a vehicle can be drastically reduced.
- The use of yield signs rather than stop signs or lights. Using yield signs rather than signal lights eliminates the start-stop phase of driving. In his article *A New Perspective*

119 Millward, David (12:01AM GMT 04 November 2006) Is this the end of the road for traffic lights? Telegraph. Retrieved from http://www.telegraph.co.uk/news/uknews/1533248/Is-this-the-end-of-the-road-for-traffic-lights.html on March 7, 2010

120 Gourlay, Chris (September 6, 2009) Councils to cut crashes with 'naked streets'. Times Online. Retrieved from http://www.timesonline.co.uk/tol/news/politics/article6823324.ece on March 7, 2010

121 Cassini, Martin (12:01AM BST 14 Oct 2006) Rip Them Out. The Telegraph Retrieved from http://www.telegraph.co.uk/motoring/road-safety/2743688/Rip-them-out.html on March 7, 2010

122 Gourlay, Chris (September 6, 2009) Councils to cut crashes with 'naked streets'. Times Online Retrieved from http://www.timesonline.co.uk/tol/news/politics/article6823324.ece on March 7, 2010

on Road Design, Wallwork states that the yield sign is, "An under-utilized device which, when the sight distance requirements are met, is more efficient than a stop sign… In other countries the yield sign is the control of choice as it does not require the driver to stop." [123]

Benefits

Documented evidence suggests the benefits of creating caution through the use of alternative intersection controls include:

- Reducing the need for enforcement. Yield signs or the elimination of signs altogether rely on individual judgment for choosing safe crossing. Police are not required to issue tickets for merely coming to a rolling stop rather than a complete stop at yield signs or at uncontrolled intersections.
- Encouraging more conscientious driving. Vehicle operators are required to actively engage with other road users to establish dominance and safe passage.
- Reducing greenhouse gas emissions. The same argument that is made in favour of roundabouts, that is that the action of stopping and waiting is more fuel intensive than simply slowing down, can be used to justify an increased use of yield signs, the elimination of stop signs and Naked Streets.
- Increasing safety for road users. For example, "Removing some road markings and railings in Kensington High Street, west London, led to accidents falling by 44 per cent over two years."[124]
- Reducing costs. Dedicating resources for the maintenance and operation of traffic signals is no longer required
- Improving spatial quality with non-signalized intersections[125] [126]

Challenges

Using signs over signals, or eliminating signs and signals altogether has numerous challenges. These include:

- Combating driver inattention. Drivers usually pay attention to traffic signals but stop signs are often ignored. Numbers as high as 68 per cent are reported for ignoring stop

123 Wallwork, Michael J. P.E (2000) A New Perspective on Road Design. Retrieved from http://www.roundabouts.net/roaddesign.html on February 13, 2010

124 Gourlay, Chris (September 6, 2009) Councils to cut crashes with 'naked streets'. Times Online Retrieved from http://www.timesonline.co.uk/tol/news/politics/article6823324.ece on March 7, 2010

125 Noordelijke Hogeschool Leeuwarden (2007) The Laweiplein Evaluation of the reconstruction into a square with roundabout. "Summary" p6. Retrieved from http://www.fietsberaad.nl/library/repository/bestanden/Evaluation%20Laweiplein.pdf on March 13, 2010

126 Noordelijke Hogeschool Leeuwarden (2007) The Laweiplein Evaluation of the reconstruction into a square with roundabout. "Summary" p6. Retrieved from http://www.fietsberaad.nl/library/repository/bestanden/Evaluation%20Laweiplein.pdf on March 13, 2010

signs.[127]The public is concerned that the number of inattentive drivers will be even higher without any signals.

- Negotiating driver unfamiliarity. Drivers from areas outside of where the alternative intersections are may be confused by the "new" situation, though in most situations this means drivers have an increased level of attentiveness rather than making mistakes that would jeopardize other road users.
- Facing potential liability in accident situations. Any sign can be blamed for accidents. Blaming a sign for an incident is more persuasive than blaming a traffic signal.[128] This may make municipalities less willing to erect yield signs or remove traffic signals as they could fear being sued for improper maintenance or a lack of proper signage.
- Combating the perception that these intersections are not as safe as those controlled by traffic lights. A report detailing the safety concerns at unpaved intersections states that the elderly, automobile drivers and cyclists all perceive unsignalized intersections to inherently be more risky than lights.[129]

Example

The removal of traffic signals may be appropriate in any number of situations. Rural areas are one example:

Ultra-Low Volume Unpaved Intersections
In rural Nova Scotia many of the intersections that municipalities control will fall under the description of ultra-low traffic. With any intersection, it is important to match the conditions that the intersection will be used under with the ideal model for those specifications. In his report on ultra-low volume intersections, Souleyrette outlines the process by which any intersection conversion or installation should be approached.[130] Ideally, this includes:

- Recommending procedures for removal or conversion of two-way Stop control from low volume rural locations that include:
- Establishing a formal policy,
- Consulting with agencies, legal counsel and traffic control experts,
- Reviewing manuals on uniform traffic control devices as well as applications for Stop and Yield signs
- Giving appropriate public notice,
- Documentation and follow-up review.

127 Wallwork, Michael J. P.E (2000) A New Perspective on Road Design. Retrieved from http://www.round-abouts.net/roaddesign.html on February 13, 2010

128 Wallwork, Michael J. P.E (2000) A New Perspective on Road Design. Retrieved from http://www.round-abouts.net/roaddesign.html on February 13, 2010

129 Noordelijke Hogeschool Leeuwarden (2007) The Laweiplein Evaluation of the reconstruction into a square with roundabout. "Summary" p6. Retrieved from http://www.fietsberaad.nl/library/repository/bestanden/Evaluation%20Laweiplein.pdf on March 13, 2010

130 Souleyrette, Reginald R. et al. (2005) Safety Effectiveness of Stop Control At Ultra-Low Volume Unpaved Intersections. Retrieved from http://pubsindex.trb.org/view.aspx?id=776741 on March 14, 2010.

Table 2: Summary of intersection advantages

Intersection improvement	Ability to reduce idling	Ideal uses	Challenges	Examples
Roundabouts	High - Uses yields instead of stops	Modern roundabouts are especially great for non-conventional interchanges	Need to overcome initial public opposition. Are often associated with "old school" rotaries	England builds 1000 per year. Numerous examples in Kansas and other US mid-west states
Traffic signal synchronization	Moderate - Reduces stop time and can shave minutes off commute	Can be used with any existing interchange that has lights	Ideally need to be maintained at least every three years. May induce traffic because of better flow	Popular in North America
Creating caution	High - reduces unnecessary stops and starts	Intersections that are currently four way or two way stops	General perception that stop signs or intersections with lights are "safer" than uncontrolled intersections	Drachten, Netherlands. Tested with small schemes in London, Brighton and Ashford in Kent. [2]

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6.0 Evaluating Idling Reduction Options

The information presented in this report offers numerous solutions to the problem of needless idling. The solutions are geared towards both municipal and provincial-level decision makers as well as the staff who direct programs and personnel.

6.1 Reaching the Target

Given that the evidence for needing to reduce greenhouse gases is clear, the question is not whether to reduce the amount of needless idling, the question is how to best achieve these reductions. The options presented in the report have been compiled into a chart found in Appendix C. The options for idling reduction separated into the five chapters are:

Education:
- Incentives to Act
- Fleet Driver Re-education
- Fleet Challenges
- Commitments and Pledges

Policy:
- Idling Control Policy
- Right-sizing Fleets
- Alternative Fuels
- Setting a Target
- Fleet Management and Vehicle Maintenance

Regulation:
- Idling Restriction By-laws
- Land-use Restrictions

Managing Traffic Flow:
- Roundabouts
- Traffic Signal Synchronization
- Creating Caution: Naked Streets, Removal of Lights, Use of Yield Signs

The six criteria used to evaluate these opportunities are
- Purpose (of the idling restriction measure)
- Publics Reached (what segments of the population is the measure geared towards)
- Initial Cost (what level of investment is needed to initially employ this opportunity)
- Time till Savings (when does the opportunity result in greenhouse gas emission savings)

- Type (what type of campaign is to be initiated. Categories used are behavioural - information campaign, management - requires support at a bureaucratic or corporate level, legislative - requires the leadership of town council or of another government level, and structural - requires a shift to constructing a community in a different way)
- Jurisdiction (what level of government can initiate a change)

A seminal work by York *et al.* outlines the need to evaluate environmentally-driven behaviour change models by two criteria: elasticity and plasticity. [131] Following York's work, Carrico *et al*. explain:

> When this logic is applied to the issue of behavioural sources of emissions, elasticity can be conceptualized as the level of CO2 emissions associated with a given behaviour, and plasticity as the capacity for producing a meaningful level of behaviour change within a given time frame. [132]

Elasticity was not included as a measure of evaluating opportunities; the savings that each opportunity affords is highly contextual. For an education program the number of people reached is fundamental. For the use of roundabouts, it depends on the number of vehicles traveling through it, for a four-way stop converted to yield signs, the congestion of the intersection will determine the greenhouse gas savings. Until the exact situation where the opportunity would be used is decided, it is impossible to estimate greenhouse gas savings. However, plasticity has been included in the evaluation system with the level of potential ranked as high, moderate or low.

The opportunities chart allows users to understand the options for reducing needless idling at a glance.

131 Carrico, Amanda R. and Paul Padgett, Michael P. Vandenbergh, Jonathan Gilligan, Kenneth A. Wallston. (2009) Costly myths: An analysis of idling beliefs and behaviour in personal motor vehicles. Energy Policy 37: 2881-2888.

132 Carrico, Amanda R. and Paul Padgett, Michael P. Vandenbergh, Jonathan Gilligan, Kenneth A. Wallston. (2009) Costly myths: An analysis of idling beliefs and behaviour in personal motor vehicles. Energy Policy 37: 2881-2888.

Appendix A
Appropriate and Inappropriate Uses of Roundabouts

The following information can be found at:
Jacquemart, Georges for National Cooperative Highway Research Program (1998) Synthesis of Highway Practice 264: Modern Roundabout Practice in the United States. Retrieved from http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_264.pdf on March 1, 2010.

Appropriate Locations and Conditions

- High accident locations, especially locations with high accidents related to cross movements or left-turn or right-turn movements.
- Locations with high delays.
- Locations where traffic signals are not warranted.
- Four-way stop intersections.
- Intersections with more than four legs.
- Intersections with unusual geometry (Y-intersections or acute-angle cross intersections).
- Intersections with high left-turn flows.
- Intersections with changing traffic patterns.
- Intersections where U-turns are frequent or desirable, i.e., in conjunction with access management strategies (raised median) along commercial corridors.
- At locations where storage capacities for signalized intersections are restricted, or where the queues created by signalized intersections cause operational or safety problems, i.e. diamond interchanges, intersections near rail underpasses, bridges, and tunnels.
- To replace a pair of closely spaced intersections.
- Along congested arterials, in lieu of full-length road widening.
- Intersections where the character or speed of the road changes, e.g., at entry points to a community or at junctions where a bypass road connects to an arterial.
- Intersections that are important from an urban design or visual point of view (as long as the basic engineering and safety criteria can be satisfied).

Inappropriate Locations and Conditions

The following conditions are generally mentioned as being unfavourable for roundabouts:

- Locations where there is insufficient space for an acceptable outside diameter. Single-lane roundabouts generally consume more space than equivalent signalized intersections at the junction itself, but their approaches are often narrower. Multi-lane roundabouts compare more favourably in terms of space consumption.
- Locations where it would be difficult to provide a flat plateau for the roundabout construction. Most guides recommend maximum grades of three to five per cent depending on design speed.
- Locations within a coordinated signal network, where the roundabout would disrupt the platoons.
- Locations with heavy flows on the major road and low flows on the minor road, where the

equal opportunity treatment of the approaches causes undue delays to the major road. Other conditions are sometimes mentioned as potentially problematic; however, they do not necessarily eliminate the roundabout as an improvement alternative. As for any other intersection, these conditions need special attention regarding design and operational aspects, and a detailed analysis of alternatives is required. Such conditions include:

- Presence of numerous bicycles or pedestrians. These can be addressed through special design features such as separate bicycle lanes, zebra striping, pedestrian underpasses, or pedestrian-activated signals farther away from the roundabout.
- Presence of numerous disabled and blind users. Provision of special surface treatment should be considered to mark the pedestrian paths. Pedestrian activated signals with audible messages can be considered.
- Large proportion of heavy vehicles. These can be addressed through more generous dimensions.
- Presence of fire station. Similar design precautions are taken as with signalized intersections. Special signals can be set up.
- Rail crossings. Precautions are taken similar to other intersections.
- Junction at top or bottom of grade. If the sight distances at the approaches are not adequate, special advance signs or signals need to be installed.
- Proximity of adjacent signals. Undisciplined drivers may block a roundabout as they do at a signalized intersection. Most of the guidelines (3, 10-12, 17-21, 23, 29) describe appropriate locations or conditions for roundabout installation, listed as follows:
- High accident locations, especially locations with high accidents related to cross movements or left-turn or right-turn movements.
- Locations with high delays.
- Locations where traffic signals are not warranted.
- Four-way stop intersections.
- Intersections with more than four legs.
- Intersections with unusual geometry (Y-intersections or acute-angle cross intersections).
- Intersections with high left-turn flows.
- Intersections with changing traffic patterns.
- Intersections where U-turns are frequent or desirable, i.e., in conjunction with access management strategies (raised median) along commercial corridors.
- At locations where storage capacities for signalized intersections are restricted, or where the queues created by signalized intersections cause operational or safety problems, i.e. diamond interchanges, intersections near rail underpasses, bridges, and tunnels.
- To replace a pair of closely spaced intersections.
- Along congested arterials, in lieu of full-length road widening.
- Intersections where the character or speed of the road changes, e.g., at entry points to a community or at junctions where a bypass road connects to an arterial.
- Intersections that are important from an urban design or visual point of view (as long as the basic engineering and safety criteria can be satisfied).
- Locations where there is insufficient space for an acceptable outside diameter. Single-lane roundabouts generally consume more space than equivalent signalized intersections at the

junction itself, but their approaches are often narrower. Multi-lane roundabouts compare more favourably in terms of space consumption.

• Locations where it would be difficult to provide a flat plateau for the roundabout construction. Most guides recommend maximum grades of three to five per cent depending on design speed.

• Locations within a coordinated signal network, where the roundabout would disrupt the platoons.

• Locations with heavy flows on the major road and low flows on the minor road, where the equal opportunity treatment of the approaches causes undue delays to the major road. Other conditions are sometimes mentioned as potentially problematic; however, they do not necessarily eliminate the roundabout as an improvement alternative. As for any other intersection, these conditions need special attention regarding design and operational aspects, and a detailed analysis of alternatives is required.

Appendix B
Drafting Idling Restriction Bylaws

Example of a bylaw drafted for the Town of Antigonish:

Idling Control By-law

Preamble

WHEREAS Section 172 of the *Municipal Government Act* authorizes the Town to regulate with respect to the health, well being, safety and protection of persons from nuisances, activities and things that, in the opinion of Council, may be or may cause nuisances, including odours, fumes and noise; AND WHEREAS motor vehicles are sources of particulate matter, nitrogen oxide, carbon monoxide, sulphur oxide, volatile organic compounds, greenhouse gas emissions and excess auditory vibrations; AND WHEREAS such emissions have negative affects on local, regional and global Climate, air quality and quality of life and, as such, constitute a nuisance and negatively affect the health safety and well-being of residents of the Town of Antigonish; THEREFORE the Council of the Town of Antigonish enacts this By-law.

Short title

1. This by-law may be cited as the "**Idling Control By-law**".

Definitions

2. In this By-law:
(a) **"idle"** means the operation of a Vehicle's internal combustion engine while the vehicle is stationary; "idling" has a corresponding meaning;
(b) **"Public Transport Vehicle"** means a bus or van, other than one being operated as a taxi, for the conveyance of passengers from any point within the Town to any point either within or outside of the Town;
(c) **"Vehicle"** means any motorized vehicle but does not include any vehicle designed to run exclusively on rails.
(d) **"Town" or "Town of Antigonish"** means the jurisdictional region of the Town of Antigonish in Nova Scotia, Canada;
(e) **"*Peace Officer*"** means a member of the Royal Canadian Mounted Police; a member of a community or regional police service or a special constable;
(f) ***"Person"*** means an individual, society, partnership or corporation;
(g) **"*Work*"** means, in respect of an internal combustion engine operating in a stationary Vehicle or
in stationary Mobile Equipment, the powering of equipment or apparatus engaged in: the operation of any Vehicle held stationary by a Traffic Control Device; necessary operations for the loading or unloading of Mobile Equipment or a Commercial Vehicle; providing heating, air-conditioning or refrigeration necessary for the preservation of perishable goods or cargos

carried by or contained in a Commercial Vehicle or an Emergency Vehicle; maintaining emergency lights, communications equipment, computer equipment or other emergency equipment, whether in respect of an Emergency Vehicle or not, during any time the operator or passengers of such Vehicle are involved in a response to an emergency or, in the case of an Emergency Vehicle, at any time the operator or passengers of such Vehicle are involved in training for emergency responses; maintaining emergency lights, communications equipment, computer equipment or other emergency equipment in respect of a Vehicle operated by a Peace Officer during his or her duties at any time such Peace Officer is involved in a law enforcement activity; operating systems or equipment necessary for the secure functioning of armoured Vehicles; excavation, winching, hauling, lifting, lowering, erecting, mixing, cleaning, painting, pouring, pumping, packing, tamping, cutting, or other similar activities; delivering necessary medical care to a Vehicle occupant; maintaining interior temperatures in a Commercial Passenger Vehicle engaged in embarking or disembarking passengers; or
removing frost, mist or condensation present on the windshield of a Vehicle or Mobile Equipment.

Words importing the masculine gender only include the feminine gender and vice versa whenever
the context so requires; and words importing the singular shall include the plural and vice versa whenever the context so requires.

General Prohibitions

2. No person shall cause or permit a Vehicle to idle in the Town of Antigonish.

Exemptions

4. It shall be a defence to a charge pursuant to section 3 of this By-law if the Vehicle was:

(a) engaged in an activity justified under the “work” provision as found in the definition section
(b) idling for a purpose required by provincial or federal legislation;

Offenses

(a) Any Person who contravenes this Bylaw is guilty of an offence and is liable on summary conviction to a fine of not less than $150.00 and not more than $10,000. This amount is provided for by the *Provincial Offences Procedure Act* (Nova Scotia) as amended.

(b) A notice of form commonly called an Offence Ticket having printed wording approved by the Municipal Manager, may be issued by a Peace Officer or a Municipal Compliance Officer to any Person alleged to have breached any provision of this Bylaw, and the said notice shall require the payment to such official in the amount specified in this Bylaw or the *Traffic Safety Act*, (Alberta), as amended or the regulations pursuant to the *Provincial Offences Procedure Act* (Alberta), as amended.

(c) When a Person is served with an Offence Ticket

pursuant to Section 16.3 of this Bylaw and the recipient of the Offence Ticket voluntarily delivers payment to the Municipal Manager of the Town within fourteen (14) days of the date the Offence Ticket is issued, the specified penalty shall be reduced by ten (10%) percent.

(d) An Offence Ticket shall be deemed to be sufficiently served: if served personally on the accused; if mailed to the address of the registered Owner of the Vehicle concerned; or to the Person concerned; or if attached to or left securely and visibly upon a Vehicle in respect of which an offence is alleged to have been committed.

Administration and Enforcement

5. The By-law shall be administered and enforced by any Peace Officer employed by the Town of Antigonish and any Town employee appointed to do so by the Chief Administrative Officer of the Town.

Appendix C
HRM's Right-Sizing Policy

http://www.halifax.ca/council/agendasc/documents/090707ca1115.pdf

1 Mandavilli, Srinivas, Eugene R. Russell and Margaret J. Rys (2003) Operational Efficiency of Roundabouts. Retrieved from http://www.urbanstreet.info/2nd_sym_proceedings/Volume%202/Russell.pdf on February 21, 2010

2 Gourlay, Chris (September 6, 2009) Councils to cut crashes with 'naked streets'. Times Online Retrieved from http://www.timesonline.co.uk/tol/news/politics/article6823324.ece on March 7, 2010

Appendix D
Chart Evaluating Idling Reduction Options

Appendix D

Opportunity	Jurisdiction	Type	Time to Savings	Initial Cost	Reached	Purpose	Plasticity
Education							
Incentives to Act	all levels	Behaviour	Immediate	Minimal	Broad	Foundational	moderate
Fleet Driver Re-Education	all levels	Behaviour	Immediate	Minimal	Targeted	Foundational	high
Fleet Challenges	all levels	Behaviour	Immediate	Minimal	Targeted	Foundational	high
Commitments/Pledges	all levels	Behaviour	Immediate	Minimal	Targeted	Foundational	moderate
Policy							
Idling Control Policy	all levels	Management	Immediate	Minimal	Targeted	Messaging	moderate
Right-Sizing Fleets	all levels	Management	Medium-term	Minimal	Targeted	Operational	moderate
Alternative Fuels	all levels	Management	Immediate	Variable	Targeted	Operational	moderate
Setting a Target	all levels	Management	Immediate	Minimal	Broad	Messaging	moderate
Fleet Management	all levels	Management	Immediate	Minimal	Targeted	Operational	moderate
Regulation							
Idling Restrictions By-laws	municipal	Legislative	After adoption	Minimal	Broad	Messaging	high
Land-use Restrictions	municipal	Legislative	Longer-term	Minimal	Broad	Operational	low
Managing Traffic Flow							
Roudabouts	municipal	Structural	Medium-term	Significant	Broad	Operational	high
Signal Synchronization	municipal	Structural	Immediate	Ongoing	Broad	Operational	moderate
Creating Caution	municipal	Structural	Medium-term	Variable	Broad	Operational	moderate
Vehicle Standards							
Vehicle Regulations	federal	Legislative	Longer-term	Minimal	Broad	Operational	high
Stop-start Technology	federal	Legislative	Longer-term	Variable	Broad	Operational	high

Chart Evaluating Idling Reduction Opportunities