Federation of North Vancouver Community Associations

FONVCA AGENDA

THURSDAY October 15th 2009

Place: DNV Hall 355 W. Queens Rd V7N 2K6
Time: 7:00-9:00pm
Chair: Dan Ellis – Lynn Valley C.A.
Tel: 604-816-8823 **Email:**ellis7880@shaw.ca

Regrets: Del Kristalovich

1. Order/content of Agenda

2. Adoption of Minutes of Sep 17th

http://www.fonvca.org/agendas/oct2009/minutes-sep2009.pdf

3. Old Business

3.1 OCP Roundtable – Updates

3.2 Resilient Cities: email sent to Mayor & Council as per action item 5.3 -Sep 17 FONVCA minutes. **(attached)**

4. Correspondence Issues

4.1 Business arising from 3 regular emails:

4.2 Non-Posted letters – 0 this period

5. New Business
Council and other District issues.

5.1 Policy on green waste limit

- need to increase bag limit (6→10)
- need for unlimited amounts once spring & fall

Recommend that FONVCA make a formal request for above.

5.2 Democracy at work in Cranbrook

Page A4 SUN Sep 17/2009:
http://www.vancouversun.com/news/Citizens+battle+heard+local+town+halls/2003164/story.html
http://www.dailytownsman.com/article/20090827/CRANBROOK0101/308279959/over-3000-signatures-delivered-to-city-hall
(attached)

5.3 Billboards to come to DNV

http://www.canada.com/vancouversun/news/westcoastnews/story.html?id=abca4ddb-c48c-4989-89bc-00c1caeff067&k=52132 **(attached)**
http://www2.canada.com/northshorenews/news/story.html?id=0cb4ef25-f800-4127-96d2-e20f5ac43aec **(attached)**
"It's unlikely the billboards are going to cause a significant increase in crashes," said Anita Bedell, spokeswoman for the Department of Indian and Northern Affairs.
CROA response:
http://www.fonvca.org/agendas/oct2009/Citizens-for-Responsible-Outdoor-Advertising-PRESS-RELEASE.pdf
"It is a given that a billboard can constitute a traffic hazard"
It follows that Electronic Messaging Centres (EMCs), which provide more visual stimuli than traditional signs, logically will be more distracting and more hazardous.
Legal Reference:
(http://www.ca1.uscourts.gov/pdf.opinions/07-2098-01A.pdf)
Safety Reference: **(attached)**
http://www.fhwa.dot.gov/REALESTATE/elecbbrd/chap2.htm

5.4 BC Greenhouse Gas Emission Legislation

http://www.townsfortomorrow.gov.bc.ca/docs/ghg_assessment_guidebook_feb_2008.pdf **(attached)**

5.5 NS Police Services Review

http://www.dnv.org/article.asp?a=4103
The report is 318 pages!
Discussion of possible impacts on the community.

6. Any Other Business

6.1 Legal Issues

(a) **Local Government in BC** – 4th edition by Bish
http://ubcm.civicweb.net/contentengine/launch.asp?ID=4244
Freely availably as 250page pdf guide useful for all residents!
Alternate:
http://www.ubcm.ca/assets/Library/Publications/Local~Government~in~British~Columbia/LGBC-All.pdf
Great reference work for involved citizens and politicians.

(b) **Retroactive Legislation to "Fix" UBC Parking Tickets – follow-up of FONVCA item 6.1(a) 16Apr09**
SUN Article of 6Oct2009 by Richard J. Dalton JR.
Retro Legislation OK if in public interest? **(attached)**

(c) **Seismic Test for Mid-Rise Wood Frame Buildings**
http://www.fonvca.org/agendas/oct2009/SEISMIC.pdf
(attached)

6.2 Any Other Issues (2 min each)

a)
b)

7. Chair & Date of next meeting.

Thursday November 19th 2009

Attachments

-List of Email to FONVCA - ONLY NEW ENTRIES
OUTSTANDING COUNCIL ITEMS-Cat Regulation Bylaw; District-wide OCP; Review of Zoning Bylaw; Securing of vehicle load bylaw; Snow removal for single family homes bylaw.

Correspondence/Subject Ordered by Date
14 September 2009 → 11 October 2009

LINK	SUBJECT
http://www.fonvca.org/letters/2009/14sep-to/John_Hunter_23sep2009.pdf	Mutual Aid Firefighters Costs
http://www.fonvca.org/letters/2009/14sep-to/Monica_Craver_23sep2009.pdf	Mountain Biking
http://www.fonvca.org/letters/2009/14sep-to/Corrie_Kost_28sep2009.pdf	DNV share of Fed/Prov grants

For details/history see
http://www.fonvca.org/letters/index-letters-total-sep2009.html

Agenda Item 2.

FONVCA
Minutes September 17th 2009

Attendees

Brian Platts **(chair)**	Edgemont C.A.
Diana Belhouse	Save Our Shores
Dan Ellis **(notes)**	Lynn Valley C.A.
Val Moller	Lions Gate N.A.
Eric Andersen	Blueridge C.A.
Corrie Kost	Edgemont C.A.
K'Nud Hille	Norgate Park C.A.

The meeting was called to order at 7:10 PM

Regrets: Paul Tubb, Lyle Craver, Del Kristalovich, Cathy Adams

1. ORDER / CONTENT OF AGENDA
Added: 6.2(f) Office of Cultural Affairs - Eric

2. Adoption of Minutes of July 16th
Minutes of July 16 were approved as circulated.

3. OLD BUSINESS
3.1 OCP Roundtable Update
Corrie distributed his notes of the Roundtable meeting of Sep 2/2009.
The Roundtable will meet again Sep 23rd, after which two public Visioning Workshops will be held Oct 6th and 8th. Community associations are urged to publicize these events to their members.
Concerns were expressed that:

a) if the Roundtable is a committee of Council (as opposed to staff), it is legally obligated to open its deliberations to the public.
b) Roundtable's freedom to develop concepts and air opinions confidentially should not be stifled by having the public attend, because the OCP content will later be deliberated publicly.
c) Parks Visioning process being launched now seems to be independent of the OCP, which should establish high-level objectives and principles first. This issue will be brought back to the next Roundtable meeting.

4. CORRESPONDENCE ISSUES

4.1 Business arising from 1 regular e-mail
.One e-mail regarding the siting of mobile homes on a property being re-developed in an established single-family neighbourhood. This has been brought to Council, but there has been no resolution yet.

4.2 Non-posted letters – 0 this period.

5. NEW BUSINESS
Council and other District Issues

5.1 Synopsis of Sustainability
http://www.pollutiononline.com/nl/845483/733151
mostly relating to environmental stewardship - written by Ferdous Noman - was distributed.

5.2 School Board All-Candidates Meeing
6 of 7 School Board candidates came to Blueridge CA's all-candidatesmeeting, and conducted themselves impressively.

5.3 Resilient Cities
See
http://www.gaininggroundsummit.com/theme.htm
for theme of the Oct 20-22/2009 Vancouver Conference (attached to agenda).

Concern expressed that the power / funding imbalance between levels of government severely challenges cities' ability to plan for resilience. FoNVCA asks that DNV give strong consideration to attending the conference (Councilors and/or Staff) **and** reporting back to the public on the very significant issues being discussed. (ACTION ITEM)

5.4ACT:Adaptation to Climate change Theme
http://www.sfu.ca/act/ and SUN article of Sep 10/2009 "Brace for wild B.C. weather…"
http://www.metrovancouver.org/planning/development/agriculture/AgricultureDocs/Climate_Variable_Mapping_report_final.pdf
Material attached to agenda package illustrates the expected change in annual temperatures for Lower Mainland by 2050.

5.5 Spirit Trail Through Norgate
Concern expressed that the Spirit Trail has been routed through Norgate without consideration of local neighbourhood concerns, resulting in loss of a strip of Welch St road allowance which until now has formed part of the parkland there. No offer of anything in return.

6. ANY OTHER BUSINESS

6.1 Legal Issues

(I) Can a councilor be charged under section 30.4 of the Freedom of Information and Protection of Privacy Act which reads: *An employee, officer or director of a public body or an employee or associate of a service provider who has access, whether authorized or unauthorized, to personal information in the custody or control of a public body, must not disclose that information except as authorized under this Act.* Perhaps section 73(a) applies?

Protection of public body from legal suit

73 *No action lies and no proceeding may be brought against the government, a public body, the head of a public body, an elected official of a public body or any person acting on behalf of or under the direction of the head of a public body for damages resulting from*

(a) the disclosure, or failure to disclose, in good faith of all or part of a record under this Act or any consequences of that disclosure or failure to disclose

The above relates to the case where Coun. Brian Skakun (of Prince George) had been charged with disclosing personal information.

It will be interesting to follow this case…

(II) **Supreme Court of BC: Virdis vs. City of North Vancouver – Bewicke zoning suit**
http://www.canlii.org/en/bc/bcsc/doc/2009/2009bcsc1118/2009bcsc1118.html
The key element [57 in above URL] is that a Mayor's "initiation" of reconsideration must be within 30 days of defeat BUT this may mean council will not reconsider it for a much longer period! Note also in [60] "courts have held that the failure of a council to observe its own procedures is only an irregularity and not fatal to the bylaw passed, unless the required procedure is a statutory procedural requirement."
The question is: **When is a statutory violation just a procedural error – or visa-versa?**
Also attached to FONVCA package were the NSN article of Aug 26/2009 "When a majority doesn't win" and "Urban panning" – VIEWPOINT on page A6 -NSN on August 19/2009 and "Court dismisses Bewicke zoning suit" on page A3

6.2 Any Other Issues (2 min each)

a) Page F6 SUN 22Aug/2009 on tank systems to capture rainfall – **at $2/storage litre**- environmentalism and common sense collide.
b) BC on-line gambling web-site raises weekly stakes from $120 to $10,000. Who are the addicts?
c) Families need cars to commute from affordable areas – by Harvey Enchin- page A4 SUN July 23/09 where he opined that "*people are not going to give up private automobiles. Neither will they stop raising children or wanting backyards for them to play in"*
d) Municipal Law – outline and references was attached to package. It contained many useful references on Local Government, Growth Management, Planning, Zoning & Land use control, and Municipal Law.
e) Municipal Election Violations A4 SUN Sep 16 outlined the difficulty of private citizens having to go to court to enforce the rules of municipal elections. Elections BC should oversee municipal voting (as it does for Provincial Elections).
f) Office of Cultural Affairs. The issue here seems to be that this Office requires far too much paperwork for minor applications.

7. CHAIR AND DATE OF NEXT MEETING

7:00pm Thursday October 15th 2009
Dan Ellis – Lynn Valley Community Assoc.
Tel: 604-985-7880 email: ellis7880@shaw.ca

Meeting was adjourned at ~ 9:00PM.

Agenda Item 3.2

Subject: [Fwd: Still time to register for Smart Growth BC/Gaining Ground conference]
From: Corrie Kost <kost@triumf.ca>
Date: Fri, 09 Oct 2009 12:25:22 -0700
To: Mayor and Council - DNV <Council@dnv.org>
CC: 'FONVCA' <fonvca@fonvca.org>

Your Worship & Members of Council,

At our last FONVCA meeting we discussed the upcoming conference on "Resilient Cities" and in our minutes noted...

"Concern expressed that the power / funding imbalance between levels of government severely challenges cities' ability to plan for resilience. FoNVCA asks that DNV give strong consideration to attending the conference
(Councilors and/or Staff) **and** reporting back to the public on the very significant issues being discussed."

I thus forwarded the above comment with a link to the appropriate site ie.
http://www.gaininggroundsummit.com/theme.htm

Yours truly,

Corrie Kost

Subject: Still time to register for Smart Growth BC/Gaining Ground conference
From: "Smart Growth BC" <Smart_Growth_BC@mail.vresp.com>
Date: Fri, 09 Oct 2009 00:08:31 +0000
To: kost@triumf.ca

SmartGrowthBC

Citizens battle to be heard at local town halls

Interesting, isn't it? On the one hand, there are all these politicians wringing their hands about voter turnout declining at all levels. And, on the other, when issues that go to the heart of communities come up, politicians only listen to what citizens have to say after they are forced to mobilize to be heard.

BY DAPHNE BRAMHAM, VANCOUVER SUN SEPTEMBER 17, 2009

Local government is closest to the people. So why are civic politicians so determined to lock out their citizens?

In far too many communities, it's difficult to access information about who funds the campaigns of mayors and councillors. Worse, if citizens get that information, it's almost always left to them to be investigator, prosecutor and bill-payer for any legal action against candidates, financial agents and campaign organizers who fail to comply with the Local Government Act.

But at least as disturbing is the trend to silencing public debate on crucial issues.

Two stunning examples come from the East Kootenays, where until last year's economic meltdown, Alberta money drove an unprecedented real estate boom and continues to tempt local politicians.

This week, Cranbrook council only backed off a massive annexation that would almost double the current urban footprint after nearly 20 per cent of eligible voters demanded a referendum -- an extraordinary proportion since only 30 per cent voted in the last election.

Council had already agreed to freeze the taxes for 20 years or until the site was divided into parcels of 50 acres or less. Annexing the two parcels of land (owned by two numbered companies, one with strong Alberta ties) will also immediately increase the value.

In the middle of summer, council tried to sneak through the annexation under the alternate approval process outlined in the Local Government Act. It's a reverse-onus thing that other cities such as Powell River have tried to use to ram through unpopular developments.

Under the alternate process, unless 10 per cent of the eligible voters go to city hall or to the city's website, get an elector response form and indicate that they are opposed to council making a decision without a referendum, council is free to do what it wants.

Amazingly, a group called Citizens for a Livable Cranbrook managed to get nearly double the 1,475 signatures needed.

The referendum is set for Nov. 14 and will cost $37,000. It's a cost that may have been avoided if Mayor Scott Manjak and councillors a) had made the annexation a central part of their election campaigns last November; and, b) held public consultations after they were elected.

No one knows why council is so keen to ram this through. There's no way to check online who financed the various campaigns and when I asked for copies of all candidates' election financing reports, I was told it would cost approximately $150 for copying and/or faxing.

Council has so far refused to release a $500,000 consultant's report on growth management completed earlier this year and referendum supporters have been told it's unlikely to be released before the vote. Surely, that would help citizens make an informed decision before voting in the referendum.

Just up the road, there's another example of duck-and-cover involving the aptly named Jumbo Glacier Mountain Resort Development proposed nearly 25 years ago.

The $450-million proposal to build a 6,500-bed, 22-lift, ski resort on Crown land in a wilderness area 55 kilometres west of Invermere is wildly unpopular among locals.

Several polls suggest anywhere from a slim majority to 80 per cent of regional residents oppose the development that proponents have touted as a rival to Zermatt, Switzerland.

For a month last year, activists including first nations leaders blocked the logging road that leads to the site -- a road that taxpayers will almost certainly have to pay to upgrade should the development go ahead.

And among the celebrities enlisted to the fight are singer Bruce Cockburn and homegrown hockey star Scott Niedermayer.

But public debate was effectively ended in August when the East Kootenay regional district board fobbed all decision-making power off on the B.C. government with a request that it designate the site as a resort municipality.

Conveniently (and perhaps with Jumbo in mind), the Liberals enacted legislation in 2007 that empowers the government to establish resort municipalities and appoint people to run them. There will be no elections in resort municipalities set up under this legislation. Local council members will be appointed by the province.

Premier Gordon Campbell and Community and Rural Development Minister Bill Bennett, whose riding is just down the road, insist that citizens' in-put will be sought. But there's no necessity for it.

Residents are livid. They already live with the effects of massive and rapid development in Invermere, Radium, Revelstoke and Golden.

Local newspapers are full of letters blasting the regional district directors and the province for ignoring citizens and their opinions. And some citizens are trying to gather 5,000 names on a petition to have the regional district's request overturned.

Interesting, isn't it? On the one hand, there are all these politicians wringing their hands about voter turnout declining at all levels. And, on the other, when issues that go to the heart of communities come up, politicians only listen to what citizens have to say after they are forced to mobilize to be heard.

The problem is not that people don't care.

It's that they've lost faith in a so-called democratic system that allows and even encourages politicians to shut citizens out.

dbramham@vancouversun.com

Agenda Item 5.2

Cranbrook Daily Townsman

Published August 27, 2009
LOCAL NEWS

Over 3,000 signatures delivered to City Hall

By BONNIE BRYAN

A group of people gathered outside City Hall on Wednesday, Aug. 26, to deliver more than double the number of signatures needed to trigger a referendum on the issue of the East Hill boundary expansion.

Brought to City Hall in a wheelbarrow, Elector Response Forms were taken inside by volunteers from the crowd in bundles of 200, for a total of 3,024.

According to the Alternative Approval Process 10 per cent of eligible voters (1,475) must sign an Elector Response Form to force the City to hold a referendum on the issue.

Citizens for a Livable Cranbrook (CLC) Society President Sharon Cross spoke to the crowd before the forms were delivered.

“This entire mobilization of the community has been an incredibly inspiring event,” she said. “We have taken a stand and given our desires a voice. We have spoken in favour of going for a referendum. This is truly a grassroots movement.”

The event at City Hall was a celebratory one, with redGirl performing, people cheering and some people holding placards with slogans like “Here’s to a planned future for Cranbrook,” and “We grow with democracy.”

CLC Vice President Wayne Stetski thanked the crowd and all those who were part of the campaign to collect signatures.

“Today is a great day for the citizens of Cranbrook and for grassroots democracy. Thank you for your role in making this happen,” he said to the crowd. “What have we learned? We’ve learned first and foremost that informed citizens make good decisions. We have the signed electoral forms to prove it. We have learned the people of Cranbrook care passionately about our City and its future and they want a direct say in how that future unfolds.”

The CLC began canvassing neighbourhoods and collecting signatures soon after the AAP was announced. Soon it wasn’t only CLC members doing so.

“A lot of us didn’t think we could achieve the 1,475 forms but when we broke down the numbers we thought it would be doable. It would be a challenge but doable. So, ‘Yes We Can’ became our mantra,” Cross said. “When we started going door to door others came forward wanting to help. The people out on the streets canvassing started running into others doing the same thing on their own and we got creative.”

The 3,024 forms are just the ones collected during canvassing and there are likely more that have already been turned in to City Hall. Cross said the number of people who want a referendum speaks volumes.

“I think this is a testimony to the will of the people of Cranbrook to stand up and have a say. I think they are fed up and tired with things being rammed down their throat, they want to have a say,” she said. “They have a vision, I say let’s all come together as a community and have a vision about where we want to go because through diversity you come up with the best ideas.”

Stetski had a few ideas for alternatives to the boundary expansion the City has proposed. He said the City should seek land already in the boundaries of Cranbrook for housing and industrial park space.

“If there isn’t it may be appropriate to add a 50 acre blip to the City,” he said. “In my mind you don’t need 9,000 acres.”

Stetski also suggested the City could work with the Regional District of East Kootenay to reserve the land in the East Hill area for future development without bringing it into Cranbrook’s border.

Coun. Bob Whetham attended the event and liked what he saw.

“I think it’s really inspiring that so many people have come out to assert their democratic right to vote,” he said. “I think our next step should be to realize that people would like a voice in this decision, whatever it comes out to be, but we need to be able to provide an opportunity for public discussion.”

Cranbrook Mayor Scott Manjak said they were glad to see the community involvement in the issue.

“Myself and Council are very pleased to see the amount of community involvement on this issue,” he said. “This is an important issue and it’s good to see people engaged in what’s going on.”

The deadline to return signed Electoral Response Forms to City Hall is today at 4:30 p.m. The forms will then be validated and staff will provide a report to City Council at its Monday, September 14 regular meeting that will outline options to consider — either holding a referendum on the subject or abandoning the expansion plan.

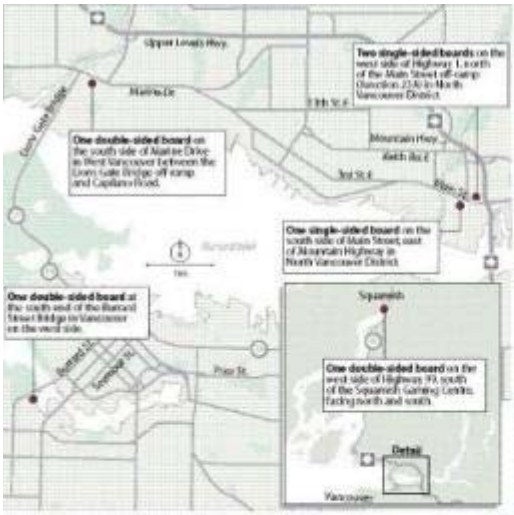
Story URL: http://cranbrooknews.ca/article/20090827/CRANBROOK0101/308279959/over-3000-signatures-delivered-to-city-hall

canada.com

Squamish Nation to put up 6 billboards before Christmas

The Squamish Nation says it will erect large billboards by Christmas on native land near both North Shore bridges, at Vancouver's Burrard Bridge and near the Stawamus Chief hiking area outside Squamish.

BY THE VANCOUVER SUN SEPTEMBER 23, 2009



The Squamish Nation says it will erect large billboards by Christmas on native land near both North Shore bridges, at Vancouver's Burrard Bridge and near the Stawamus Chief hiking area outside Squamish.

The controversial plan was recently green-lighted by the federal government.

Toby Baker, the first nation's senior operating officer, said Tuesday that six billboards will be erected at the four locations.

The plan is a scaled-down version of a proposal rejected earlier by the federal government. It will see one billboard at the North Shore approaches to the Lions Gate Bridge, three near the north end of the Ironworkers Memorial Crossing at Second Narrows, one in Kitsilano beside the south end of the Burrard Bridge and one outside Squamish, as part of a casino and gas station development.

The federal government approved the plan last month despite widespread public opposition to the earlier version.

Baker said the Squamish Nation respected public opinion and scaled the project down to one-third of the original plan.

"All the opposition was taken into account, and influenced our conclusion to scale it down from 15 structures to six," he said in an interview.

Each billboard will be 10 feet high and 30 feet wide and will feature three-sided rotating slats.

"We expect there will be a demand for advertising in these positions," Baker said, he said, saying the first nation expects revenue "in the multiple millions."

He said the money will be used to provide programs and services for the Squamish Nation.

The nation expects more opposition once the billboards are in place, he said, but is prepared to deal with that and is "in a position to do as it chooses."

The Vancouver billboard will be placed at the southwest end of the Burrard Bridge, directly opposite the Molson's brewery.

The signs will "look like giant television screens that will only be showing static images," Baker said.

Six advertising messages will be displayed every minute -- one every 10 seconds.

A study on the potential for driver distraction caused by the signs showed that "it's unlikely the billboards are going to cause a significant increase in crashes," said Anita Bedell, a spokeswoman for the Department of Indian and Northern Affairs.

"The findings aren't conclusive insofar as distracting and causing damage," Bedell added.

Baker said the commercial use of the six billboard sites may open doors to future development on reserve lands, such as shopping centres.

The nation has been stalled in these efforts so far because of impediments in the Indian Act, he said.

"We're looking to collectively overcome those challenges [from the federal government] that will allow us to take development in marketable form to the mainstream consumer."

West Vancouver Mayor Pam Goldsmith-Jones and District of North Vancouver Mayor Richard Walton said they'd had no notice of the new billboard plan, but thought residents would still be overwhelmingly opposed.

mfhill@vancouversun.com

canada.com
WHERE PERSPECTIVES CONNECT

Friday » October 9 » 2009

Revised Squamish Nation billboard plan approved

Jane Seyd
North Shore News

Sunday, September 20, 2009

A controversial plan by the Squamish Nation to erect huge billboards in several high profile locations across the North Shore has been given the green light to proceed by federal regulatory agencies.

Signs near the approaches to the Lions Gate Bridge and Ironworkers Second Narrows Memorial crossing are among six large billboards approved by the government, along with other signs near the Squamish Chief and near the approach to the Burrard Bridge in Kitsilano.

The Department of Indian and Northern Affairs and the federal environmental assessment office granted official approval to the Squamish billboards last month, more than two years after the project met with widespread public opposition.

So far, there's no indication as to when or if the Nation intends to go ahead with the plan.

Now that approvals are in place, "It's up to the Squamish in terms of their business plan," said Anita Bedell, spokeswoman for the Department of Indian and Northern Affairs.

Bedell said the environmental assessment didn't identify any issues that would have put a halt to the billboard project. Approval was granted Aug. 24.

The project approved by the government is a scaled down version of earlier plans and includes six signs in four locations: one on the approach to the Lions Gate Bridge, three signs on the approaches to the Ironworkers Second Narrows Memorial Crossing in North Vancouver, one in Kitsilano near the south end of the Burrard Bridge and one near the base of the Stawamus Chief, as part of a casino and gas station development just outside the town of Squamish.

The signs will be 10 feet high and 30 feet wide and will feature three-sided rotating slats.

A study on the potential for driver distraction caused by the signs near North Shore bridges showed, "It's unlikely the billboards are going to cause a significant increase in crashes," said Bedell.

Earlier versions of the billboard project had called for 13 signs at various locations. The Squamish submitted the most recent plan for the billboards to the environmental assessment office in June.

Calls to the Squamish Nation were returned by the band's public relations consultant, Alyn Edwards, who said he wasn't aware of any billboard plans. "As far as I know there are no plans to revise or revive the billboard program," said Edwards.

Both West Vancouver Mayor Pam Goldsmith-Jones and District of North Vancouver Mayor Richard Walton said the municipalities work closely with the Squamish Nation but haven't had notice of any billboard plans.

Walton said there have been no discussions on the issue for the past two years, although he added, "My understanding is there is still a contract in place between the Squamish and the advertising company."

Both mayors said they expect people in their municipalities would still be overwhelmingly opposed to the idea of billboards going up on the North Shore.

Two years ago, all three North Shore mayors wrote to the minister of Indian and Northern Affairs, urging him to reject the billboard plan, after residents opposed the project on the grounds the billboards would be ugly eyesores that would mar the beauty of the North Shore.

CLOSE WINDOW

Research Review Of Potential Safety Effects Of Electronic Billboards On Driver Attention And Distraction

2 Literature Review

The literature review researched two types of information to understand the safety implications of electronic billboards. One research effort examined current state practices in the regulation of EBBs to determine, for example, the features of those displays at which the regulation is directed and the consistency of regulation among the states. The other type of information was derived mostly from research studies that had the objective of understanding driver behavior in the presence of electronic billboards and/or tri-vision signs. Information of the latter type can provide a source for informed state planning.

The review begins with a description of electronic billboards, tri-vision signs, and a discussion of the relationship of these two display types to changeable message signs used for transmitting roadway status information. The next section describes the results of the review of current state practices on billboard regulation and this is followed by the review of research studies.

2.1 Types of Electronic Billboards

Technology has advanced sufficiently for billboards to provide dynamic and realistic views much like color television. The advanced EBB has the capability to present multiple views and objects that have realistic motion. In contrast, tri-vision signs provide one of three views with rotating cylinders and generate mechanical motion or movement. Since both the EBB and tri-vision sign incorporate components that display motion, some of the issues associated with EBBs are also associated with tri-vision signs. These two types will be compared in functional terms.

For the purpose of the present report, the definition of an EBB is a programmable display that has the capability to present a large amount of text and/or symbolic imagery. Some EBBs present images in realistic motion and in a large variety of colors. The tri-vision sign is defined as a display device capable of presenting three separate images sequentially by rotating triangular cylinders. Appendix A shows examples of EBBs and a tri-vision sign.

The EBB consists of several visual characteristics. EBBs present high-resolution color images, complex visual arrangements, rich variation in color, and a vast amount of images. Operational characteristics include electric power and remote control though a computer terminal. The EBB screen display elements are typically arranged in a matrix. The shape of the EBB is usually rectangular, but irregular shapes are possible. An example is the EBB on the NASDAQ Marketsite's Tower in New York City's Times Square. This EEB wraps around the corner of the building.(1) The NASDAQ video screen is eight stories high and covers 10,736 square ft with light-emitting diodes (LEDs).

The EBB can vary in complexity. Whereas some EBBs display motion, fine detail, and a rich variety of color, other EBBs provide a simpler image. This image is often composed of a short sequence of words in which each letter is defined by a small number of matrix elements such as a 4x6 matrix or a 5x7 matrix. The elements are typically light emitting (i.e., LEDs or incandescent) and presented against a dark background. This simpler version of the EBB shares features of the display used by governmental agencies for presenting information to drivers. This display is referred to as a changeable message sign (CMS) in this paper. The CMS typically employs a matrix technology to provide variable messages displays. Other equivalent terms currently used for this sign are variable message sign (VMS) and, to a lesser extent, dynamic message sign (DMS). The permanent CMS is found mounted above the roadway whereas a portable CMS is usually mobile and is located on the shoulder of the roadway.

Whereas the EBB can display a vast number of images, the tri-vision sign is more limited. The typical tri-vision sign is composed of a series of vertical or horizontal cylinders each of which has a triangular cross section. Each partial rotation of the group of triangular cylinders produces a different image. A single tri-vision sign typically displays, at any given time, one of three images. Although the final composite image does not provide motion, there is still movement due to the transition from one image to another as the cylinders rotate. This movement can act as an attention-getting feature that attracts the driver's attention to the display. One such feature present during the rotation is the partial viewing of two images in transition, where one image advances as the other retreats. Another feature is the change in reflective qualities among the different sides of the triangular cylinders during the transition.

2.2 State Regulations and Policies on Electronic Billboards

2.2.1 Introduction

This section of the literature review pertains to the regulation of EBBs across the United States. A review of existing states' regulations and policies is presented first since it is believed that this will provide the reader with an understanding of how EBBs fit into various states' outdoor advertising policies. Each state's regulations generally derive from the 1965 Highway Beautification Act (HBA). A detailed history and overview of the federal outdoor advertising control program, which includes the HBA, can be found on the FHWA's ORES web site: http://www.fhwa.dot.gov/realestate/oacprog.htm. A review of state outdoor advertising regulations revealed that common billboard guidelines governing EBBs and tri-vision signs do not exist. While states generally have consistent regulations governing static billboards, regulations covering EBBs and tri-vision signs vary widely. Implementation practices differ significantly from state to state. A broad spectrum of regulations exists, ranging from lenient control to the prohibition of outdoor advertising.

2.2.2 Sources of Information

Federal and state Department of Transportation (DOT) personnel provided information regarding state regulations and policies. The information pertained to whether states regulate EBBs, and if so, in what manner. The sources of information are described briefly as follows:

> **State Outdoor Advertising Regulations.** Efforts were made to obtain the most current billboard regulations nationwide. These regulations were collected from various sources, such as the state DOT directly, a state's website, or from the National Alliance of Highway Beautification Agencies' (NAHBA) website. Overall, regulations were obtained from 44 states.
> **Personal Communication.** In addition to obtaining state documents, the researchers contacted states and FHWA division offices. Since a supporting contractor was to be directly contacting state DOTs, an introductory e-mail message was sent from FHWA Headquarters to each Division Office to notify the FHWA Division Office and the state DOTs of the contractor's role. The FHWA contractor contacted state personnel who were knowledgeable of their state's billboard regulations. The telephone calls were of an unstructured nature, and their purpose was to determine if local constituents had submitted comments or complaints about EBBs, and if research had been conducted on EBBs in the state.

FHWA Division Offices. Nine FHWA Division Offices were contacted. FHWA's ORES recommended some of the selected Division Offices and others were selected randomly.

State DOTs. Some state DOT personnel were contacted at the suggestion of their local FHWA Division Office while other states were selected randomly. Ten state DOTs were contacted by telephone.

National Alliance of Highway Beautification Agencies (NAHBA). In the early 1990s, a group of individuals responsible for directing or managing their state's outdoor advertising program formed the NAHBA. The Alliance meets regularly to discuss new developments in technology, upcoming legislation, and ways to improve or stream-line regulation of outdoor advertising, junkyards, landscaping, and visitor centers. Additionally, NAHBA maintains a website that contains outdoor advertising regulations of numerous states and the federal government.

A NAHBA meeting was held in Washington, D.C., in late January 2001. Two members of the research team and their FHWA contracting officer technical representative met with NAHBA members after the formal meeting had ended. Representatives of Florida, Kentucky, Missouri, Oklahoma, and Utah were present. The meeting served a purpose similar to the telephone calls, except that it allowed a more interactive conversation in more detail.

NAHBA provided the responses from an informal email questionnaire pertaining to EBBs and a tri-vision sign survey to the research team. These are presented in a subsequent section of this report.

2.2.3 State Regulations and Practices

In a July 1996 memorandum to FHWA Regional Administrators, the ORES provided additional interpretation of advertising technology to the individual states regarding off-premise changeable message signs. An off-premise sign is a sign that disseminates information that **does not** directly relate to the use of the property on which the sign is located. ("Changeable message signs are acceptable for off-premise signs regardless of the type of technology used, if the interpretation of the State/Federal agreement allows such signs," page 1, paragraph 2, sentence 4 of the memorandum).

In a July 1998 memorandum, the ORES reaffirmed their policy that off-premise signs using animated or scrolling displays that are dependent on flashing, intermittent, or moving lights were not conforming signs. This decision was made after careful review of a videotape showing the full-motion EBB erected in Scottsbluff, Nebraska. It was concluded that such signs raise "significant highway safety questions because of the potential to be extremely bright, rapidly changing, and distracting to motorists," (page 1, paragraph 4, sentence 1 of the memorandum).

A majority of states have a policy regarding the lighting of billboards, and through this policy, states regulate EBBs. While common themes are present in most lighting regulations, each state's laws have unique wording. As an example, the Arkansas State

Highway and Transportation Department's Outdoor Advertising Policy,[2] Regulations for Control of Outdoor Advertising on Arkansas Highways, as authorized by Arkansas Act 640 of 1967 and Highway Commission Minute Order No. 77-6, section III, subsection D, Lighting states:

A. Lighting Signs may be illuminated, subject to the following restrictions:

1. Signs, which contain, include, or are illuminated by any flashing, intermittent, or moving light or lights are prohibited, except those giving public service information such as time, date, temperature, weather, or similar information.
2. Signs which are not effectively shielded as to prevent beams or rays of light from being directed at any portion of the traveled ways of the Interstate or Primary highways and which are of such intensity or brilliance as to cause glare or to impair the vision of the driver of any motor vehicle, or which otherwise interferes with any driver's operation of a motor vehicle are prohibited.
3. No sign shall be so illuminated that it interferes with the effectiveness of, or obscures an official traffic sign, device, or signal.

2.2.4 National Alliance of Highway Beautification Agencies

Tri-vision Sign Survey. A 1999 survey sponsored by and presented at the annual NAHBA conference reviewed the tri-vision sign advertising regulations of every state and Washington, DC. The following results show that a majority of states are addressing current advertising technologies in their outdoor advertising regulations. At the time of the survey:

Nine states had specific regulations governing signs,
Nine states had regulations on tri-vision signs that were either being drafted or in pending legislation,
Fifteen states had regulations regarding moving parts and/or lights,
Nine state had no regulations on tri-vision sign, and
Six states as well as Washington, DC, prohibited tri-vision signs.

Table 1 provides a summary of tri-vision sign exposure dwell times and transition times that were presented in the 1999 NAHBA survey.

Table 1. Timing Boundaries of Several Tri-Vision Sign Policies.

Timing Boundaries	Average	Maximum	Minimum
Minimum Exposure Dwell Time (sec) [1]	7.32	10	4
Maximum Transition Twirl Time (sec) [2]	2.16	4	1

Source: NAHBA 1999 Conference.

1. *Minimum Exposure Dwell Time:* For billboards that change messages, (e.g., tri-vision sign or CMSs), the exposure time can be defined as the minimum amount of time, in seconds, that a message must be shown. Some minimum exposure times have been derived from analytical calculations (based on speed limit and the number of faces of a billboard that can be seen) while other minimum exposure times have come in the form of recommendations from outdoor advertising suppliers or have been based upon engineering judgment.
2. *Maximum Transition Twirl Time:* The transition time is the amount of time, in seconds, that is required for a billboard (such as and EBB or tri-vision sign) to automatically change messages. Many states have set a maximum transition time for this change. The maximum was originally determined by taking into account the mechanical constraints of older tri-vision signs and attempting to limit the amount of visual distraction caused by a sign's transition. Due to advances in technology, transitions executed by a full-motion video billboard are virtually instantaneous.

Electronic Sign Data. In early February 2001, NAHBA asked its membership to answer four questions regarding EBBs. One question relevant to this research is: "Do you have a definition of an electronic sign?" Of the 20 responses that were received, five states had a definition, 14 did not have a definition, and one state was in the process of rewriting its definition.

2.2.5 State Outdoor Advertising Regulations

A review of statutes was conducted to identify state prohibitions on specific characteristics of signs. This review is presented in Appendices B and C. The results indicate, in part, that of 42 states:

Thirty-six states had prohibitions on signs with red, flashing, intermittent, or moving lights,
Twenty-nine states prohibited signs that were so illuminated as to obscure or interfere with traffic control devices, and

Twenty-nine states prohibited signs located on interstate or primary highway outside of the zoning authority of incorporated cities within 500 ft of an interchange or intersection at grade or safety roadside area.

Additional information on other sign characteristics includes insufficient shielding of light, timing limits, and sign location relative to traffic control devices.

2.2.6 Concerns about Electronic Billboards

Numerous states have attempted to identify a relationship between EBBs and safety by using traffic conditions as a surrogate measure. The states of Nevada, Utah, Texas, New York, New Hampshire, and Massachusetts reported no evidence of increased traffic safety problems after the installation of electronic information displays in their city centers and along their highways. Additionally, five state DOT personnel were asked if a crash relationship with EBBs existed in their states; the responses were that a relationship between crashes and EBBs was not identifiable. However, one belief is that EBBs are typically on congested roadways where drivers have time to look at the sign, so it is difficult to determine if the EBBs cause crashes, let alone traffic congestion.

2.3 Reports on Billboards and Safety

Determining the effect of roadway commercial advertising billboards on safety is a difficult endeavor for several theoretical and methodological reasons. First, crash frequency is often used as a measure of safety, yet crashes occur relatively infrequently, so changes in frequency may be subtle and are not easily attributed to particular factors. In addition, distraction effects may interact with other factors, such as weather. Furthermore, crash reporting procedures differ across jurisdictions and may not refer to billboard distraction as a factor in the crash. Additionally, drivers may be unlikely to identify distraction as the cause of a crash for liability reasons. Regardless of these difficulties, researchers have examined the effects of billboards on safety. The results are mixed and inconclusive, as shown below.

2.3.1 The Wachtel and Netherton Report

The safety and aesthetics of commercial electronic variable message signing were reviewed by the FHWA in 1980[(3)] and are summarized below. Part of that effort included a review of published studies on the safety effect of roadside advertising signs, including several field and laboratory studies from 1951 to 1978 on non-electronic advertising billboards, and one analysis in 1976 of an electronic advertising sign in Boston.

The Minnesota Department of Highways concluded from a field study in 1951 that an increase in commercial billboards would result in an increased crash rate. A 1951 field study conducted by Iowa State College concluded that more crashes caused by driver inattention occurred on road segments that contained billboards. The Michigan State Highway Department in 1952 found that advertising signs did not correlate with the roadway's crash experience, except for illuminated (neon) signs, which did correlate with an increased crash rate. A 1961 study of California Route 40 concluded that road segments with billboards experienced significantly more crashes than segments without billboards. A 1967 field study compared the crash history of three locations in Chicago before and after the installation of three illuminated, commercial changeable message signs. Crash rates did not change at two of the sign locations, but the third sign location showed an increase of crashes. The third sign had alternating lights, showed several advertising messages, and was illuminated by bright white lights. The rapid increase in crashes led state highway officials to request that blue lights replace the white lights.[(3)]

The Tele-Spot sign in Boston was an off-premise commercial electronic sign. The sign was visible from the Central Artery in the midst of complex on- and off-ramps, regulatory signs, and guide signing. The Massachusetts Outdoor Advertising Board conducted an analysis of traffic crashes three years before and two and a quarter years after sign installation. The analysis showed an overall reduction in the Average Daily Traffic (ADT) and crashes along the expressway, but on the areas of the expressway from where the Tele-Spot was visible, the crash reduction was 10 percent less than the overall reduction. The Board regarded the 10-percent difference as an indication that the Tele-Spot sign was a distraction and a safety risk, and consequently revoked the license for the sign.[(3)]

2.3.2 Wisconsin DOT Report

The Wisconsin DOT examined the crash rates on Interstate 94 eastbound and westbound adjacent to the Milwaukee County Stadium[(4)]. The analysis compared the crash rates three years before and three years after the installation of a variable message advertising sign. The sign, installed April 13, 1984, displayed sporting scores and advertisements, and changed images an average of 12 frames per minute. The purpose of the comparison was to assess whether the presence of the sign correlated with a change in the crash history of I-94. To determine crash rate, the Wisconsin DOT inventoried crashes that occurred on the segment on I-94 from where the sign was visible, categorized them into side-swipe and rear-end crashes, and determined the ADT from an automatic traffic recorder. The crash rate was derived from the equation:

crash rate per million vehicle miles = crash frequency/(length of segment) *ADT *10^6)

Eastbound Segment. The crash rate for the three years before installation was 3.12 crashes per million vehicle miles traveled (VMT). The three-year crash rate after installation was 4.25 crashes per million VMT. The increase in crash rate after installation was 1.13 crashes per million VMT, or 36 percent. Specifically, the rate of increase for sideswipe crashes was 8 percent, and the rate of increase was 21 percent for rear-end crashes.

Westbound Segment. The crash rate before installation was 2.91 crashes per million VMT, and 3.53 per million VMT after installation, an increase of 0.62 crashes per million VMT or 21 percent. The rate of increase was 35 percent for both sideswipe crashes and rear-end crashes.

The Wisconsin DOT concluded from its analysis that the variable message sign had an effect on traffic safety, notably an increase in the rate of sideswipe crashes. In addition, the report concluded that the greater increase in crashes for the eastbound segment was due to the orientation of the sign towards eastbound traffic. (This sign was removed 16 years after it had been installed, when the Milwaukee County Stadium was demolished. A similar sign was installed on the new stadium.)

2.3.3 The Curriden Article

A recent court case in Texas arose from a crash in an airport caused by a driver reading an electronic sign that listed departure and arrival times, and gate information. The driver stopped his vehicle to read information on the sign. A second vehicle swerved around the stopped vehicle and side swiped a vehicle in the adjacent lane, resulting in a three-vehicle crash. Two drivers were injured in the crash and sued the airline that owned the EBB. A jury found that the EBB was the indirect cause of a multiple vehicle crash at the airport and returned a negligence verdict against the airline. The airport subsequently removed the EBB.[5]

2.4 Potential Safety Factors

2.4.1 Distraction

The review of crashes presented previously suggests that EBBs may be associated with a higher crash rate under certain conditions. If this possibility is verified through further research, then it can be asked whether these crashes are a result of driver distraction in which the distracting stimulus is the EBB.

Distraction can be a framework in which to view EBBs and safety. The safety consequences of distraction from the driving task can be profound. Treat et al.[6] found that driver inattention and improper lookout increase the likelihood of crash occurrence and are major factors underlying the causes of crashes. According to Wang, et al.,[7] an analysis conducted by the National Highway Traffic Safety Administration (NHTSA) of causal factors of crashes showed that distraction by sources external to the vehicle accounted for 3.2 percent of the crashes. The external sources included people, events, and non-specified objects. The NHTSA analysis did not identify the external objects, nor did it identify billboards as among the sources of distraction. However, the data suggest that, on occasion, external stimuli can be sufficiently distracting to drivers, causing or resulting in a crash.

Distracting Stimuli. One type of distracting stimulus is the unexpected event that results in an involuntary reaction. This type of stimulus is unanticipated and produces a surprise or orienting response - the person will redirect his or her attention to the new event to identify it and assess its significance. Such a stimulus may be an event that is not typical for that time or place, e.g., a flash of light, movement or sound.

A more subtle form of distracting stimulus can be one in which the stimulus has a less surprising quality, and thus presents more time for the driver to decide whether to attend to the stimulus and how much attention to direct to the stimulus. Dorneim[8] documented that this has been has been a problem for pilots. In some situations, a pilot will occasionally attend more to a secondary task and neglect the primary task of flying the plane, sometimes resulting in a crash. Although the task of flying is obviously different from driving, there may be lessons to be learned for drivers. NASA is currently conducting research on ways to avoid this type of air crash. It may prove useful to check the progress of this research to see whether NASA research results have implications for driver distraction. Some of the research questions involve understanding how people know when to return their attention to a task, as well as identifying the limits of switching between tasks.

Measures of Distraction. For this project, driver distraction is characterized as deterioration in driving performance, the primary task, while attending to a second, non-driving task. The second task is subordinate to the driving task. An example of a non-driving task is operating an audiocassette system or using a cellular telephone. When the safe operation of the vehicle is degraded by the performance of the second task, the second task is defined as a "distractor."

Safe operation or control of the vehicle is recorded with measures of effectiveness (MOE) for driving. These measures include lateral deviation of the vehicle and maintenance of appropriate speed, as indicated by headway measures. Lack of control indicated by excessive lateral deviation or inappropriate speed could result from distraction, sleepiness, inability to see the road because of weather or lighting, poor perception of road geometry requirements, or other reasons. Since there are multiple factors that can contribute to lack of vehicle control, the design of a distraction study must take into account these other factors and ensure that they do not confound the design and allow misinterpretation of the data.

Lateral deviation can be measured by analysis of variability in steering wheel position, and/or varying distance of the vehicle from a lane marking on the road. When measuring lateral deviation, a certain amount of variability in deviation is expected. Greater-than-normal lateral variation may indicate a degree of lack of vehicle control. An example of lateral deviation occurs during the performance of a non-driving task such as the selection, orientation, and insertion of an audiocassette into the cassette player while performing the primary task of negotiating a curve. If the cassette operation is performed in the same manner and at the same rate as when the vehicle is motionless, there is a high likelihood of lateral deviation. This scenario of cassette operation would be an example of a distracting task.

Another measure of safe vehicle control is the maintenance of appropriate speed. One driving behavior that would lead to improper speed is the selection of a more or less constant speed (speed invariance) when nearby vehicles change speed. This could result in an unsafe headway condition. Lack of safe control due to improper speed selection could be due to reasons similar to those listed above for lateral deviation. Another behavior measured by speed is the slowing of a vehicle to view an item external to the vehicle. Braking for emergencies may also be considered for a measure of distraction.

2.4.2 *Conspicuity of Displays*

To what degree does an external, conspicuous stimulus unrelated to driving distract a driver from the driving task? This question is basic to the notion that a billboard may degrade driving performance by diverting attention away from the driving task. If a billboard degrades driving performance, it may be useful to identify the components of the billboard that can distract drivers. Some possible distracting components of a display are motion, complexity, and illumination. If such qualities are relevant to distraction, do they act alone or do they interact with each other? To the extent that these qualities are identifiable, it may be possible to understand their effect on distraction.

A brief review conducted by Hughes and Cole[(9)] identified the physical properties of a conspicuous object. Important properties that contribute to conspicuity include object size, object contrast with its immediate background as well as the complexity of the background. An additional property is "the boldness of the graphics used to display a message."

According to Cole and Hughes,[(10)] conspicuity consists of two types: attention conspicuity and search conspicuity. Attention conspicuity is the ". . .capacity of an object to attract attention, and. . .might be measured by the probability of the object being noticed when the observer has not had his or her attention directed to its likely occurrence." Search conspicuity is ". . .the property of an object that enables it to be quickly and reliably located by search." Cole and Hughes suggest that eye movement that is responding to a stimulus in the peripheral visual field can be used to infer attention conspicuity in the visual mode. Such movement may be a "quasi-reflex eye movement that is related to human defense reaction."[(10)]

Theeuwes[(11)] challenged the view that conspicuous objects attract attention automatically. Instead, drivers will attend to the driving task and not a distractor. His past research showed that subjects ignored salient objects that were irrelevant to a search task. In a subsequent study, participants were instructed to locate a task-related stimulus (a blue sign) in a video taken from the driver's perspective. Distracting stimuli (e.g., a pedestrian in an orange jacket) were present in some experimental conditions, but not others. The results indicated that when the target stimulus, or blue sign, was in an expected location, the presence of the distractor had no impact. However, when the target was in an unexpected location, thus increasing the search time, the presence of the distractor increased the time required to locate the target above that due to expectation effects.

The visual environment affects the conspicuity of objects. Since drivers obtain travel related information by searching the visual environment for a target, such as a street sign, outdoor advertising can compete with targets of driving-related information. The concept of "visual noise" refers to non-target objects in an environment and can be used to determine a sign's conspicuity in a particular environment. Akagi et al.[(12)] state that "Objects causing visual noise can be defined as objects that hinder drivers' field of view, such as billboards and buildings along roadsides." This study reported that increases in the visual noise (i.e., the number of signs in a roadway location) correlated with longer search time required for drivers to locate a target sign.

In a study performed by Hughes and Cole[(9)] regarding the conspicuity of roadside objects, drivers reported "all the objects or things that attracted their attention" as they drove through 20 km of residential streets and arterial roads. Afterwards, they observed a film of the same route, taken from the driver viewpoint. Advertising displays accounted for 13.7 percent of reports in the driving study and 10.2 percent in the laboratory study. Driving related objects (road, traffic control devices (TCDs), vehicles, and people) accounted for 51.4 percent of reports in the driving task and 57.9 percent in the laboratory study. Other non-driving task elements included immediate and general roadway surroundings. Advertising elements were reported equally on arterial and shopping center routes, and more so than on residential streets. However, in residential streets, drivers directed more attention to non-driving related elements. This suggested a possible spare attention capacity.

A field study by Luoma[(13)] analyzed driver eye fixations on roadside advertisements during a 50 km drive in Finland. Results indicated that accurate perception of advertisements was associated with longer fixation times (2.3 sec) than the times for pedestrian markings and speed limit signs (0.4 sec to 0.5 sec). The author concluded, "...long fixation times indicate that the characteristics of roadside advertisements related to information ergonomics are poor."[(13)] Information ergonomics is the practice of providing information in the most efficient way, such that viewers can access the information quickly and clearly.

Roadway Context. Determining whether billboards influence driver behavior would require understanding the roadway context of a billboard. For example, roadway factors such as the angular distance of a billboard, billboard placement and volume characteristics of an intersection, may influence driver responsiveness to visual stimuli and the experience of workload. In this sense, information on the effect of the roadway context on driving performance should assist in defining appropriate billboard locations. Research on driver search behavior in high and low volume intersections by Rahimi, Briggs and Thorn[14] in 1990, suggests that higher volumes of traffic affect driver eye and head movements. The research indicates that the greater visual complexity associated with the high volume intersection required drivers to search the environment *more* than in the low volume intersections. It can be conjectured that additional visual stimuli, such as billboards, may add additional demand to driver workload in high-volume intersections.

2.4.3 Legibility

One event that can be considered a distraction occurs when a driver passes a sign where the text has poor legibility. The weakness in legibility may be due to poor character font design, improper spacing of letters, or other factors. However, if the information is of sufficient interest, the driver may try to read all of the text anyway. Such a decision could take time away from the driving task thus increasing crash risk. If on the other hand, the sign had text that met legibility standards, less effort would be required to read the sign. Although this situation is a more subtle distraction than that due to perceived motion in a sign, it still could present potential for crash risk. Legibility information is available for CMSs. Although the CMS is restricted to providing roadway related information, its legibility requirements may be relevant to the design of the simpler EBB

Luminance and Luminous Contrast. Garvey and Mace[15] examined CMSs to identify the features that contribute to their visibility. Both field and laboratory studies were employed following a review of the literature. Of particular interest in this report are the requirements for lighting, such as the luminance value and contrast ratio necessary for legible viewing. The study discussed requirements for displays such as LEDs, fiber optics, lamps, flip discs, and reflective discs. The authors provide guidelines that are aimed at improving the visibility of all CMSs, regardless of technology.

Minimum luminance values were recommended for CMS visibility. These values are based on the 85th percentile driver accommodated at 198 m (650 ft). Age and position of the sun were two of the most significant factors when determining minimum luminance. Values are presented for drivers in two age ranges (16-40 and 65 or older). When the CMS is backlit (sun behind and above CMS) or under washout conditions (low sun shining directly on CMS), 1000 cd/m^2 is recommended for both age groups. This value accommodates less than 50 percent of older drivers at any luminance level with extreme sun angles. When the sun is directly behind the CMS, few if any people will be able to read the characters under any luminance level. When the sun is overhead the 65 years and over group still requires 1000 cd/m^2, but only 850 cd/m^2 are required for the younger group. During overcast or rain, 600 cd/m^2 is required for the older group and 350 cd/m^2 for the younger. For the nighttime condition, both groups require a luminance of 30 cd/m^2.

According to Garvey and Mace,[15] there should be a minimum luminous contrast between the unlighted and lighted elements on a CMS; a maximum luminous contrast was not provided. Contrast orientation should always be *positive*, that is, the characters should be lighted against a dark or less luminous background. A negative contrast is likely to result in a 25 percent shorter legibility distance.

Contrast luminance for a CMS was determined with the formula:

$$\frac{L_t - L_b}{L_b}$$

where:

L_t = luminance of a character module with all of the elements "on"

L_b = luminance of a character module with all of the elements "off."

The minimum acceptable contrast luminance is 5, and the optimal contrast luminance varies from 5 to 50.

A summary of existing literature on sign visibility performed by Kuhn, Garvey and Pietrucha,[16] examined the two main research areas of sign detection; that is, sign conspicuity and sign legibility. The emphasis was on the more familiar and traditional sign rather than electronic signs. It is likely, however, that the design of an electronic sign would benefit from some of this information. A series of visibility guidelines for on-premise signs was presented. (An on-premise sign disseminates information that directly relates to the use of the property on which it is located.) Later research by Kuhn[17] compared lighting methods (external illumination, internal illumination with opaque background, internal illumination with translucent background and neon) under day and night conditions to examine sign visibility features.

Claus and Claus[18] addressed the issue of startling types of signs, such as those employing "flashing or animation to catch attention." These authors discuss different types of motion or movement. One of these is ". . .jumping arrows, or rapidly chasing or flashing lamp borders. . . (that) should perhaps be limited to midways and to rows of theater marquees." They did allow for other pictorial sequences that may be more acceptable as well as alternating displays such as the time and temperature display.

Alphanumeric Characters and Their Spacing. The design or selection of font type and the spacing between characters (letters), words and sentences are critical in achieving effective legibility of signs, especially when legibility is defined by the distance at which a sign can be read. Garvey & Mace[15] provided draft guidelines for the design of the elements and characters that compose a word and word groupings on a CMS, in which the character font is composed of light emitting elements. To achieve effective legibility, a number of features are considered. It is important to address each of the features, since they interact with each other. For example, to design an upper case character font, use a 5 x 7 matrix of light emitting elements. However, with a small matrix of this size, it is well to avoid thickening of a line in a character (e.g., as in an "I" or "T") by adding another row or column of elements because the legibility distance is shortened by about 25 percent.

Font design for exterior signs should be simple without serifs. Additional information was provided on the height of the character, the proportion of the character or width-to-height ratio, and stroke width of the character. Further information was provided on the spacing between letters, between words and between lines of characters. Signs with light emitting elements have special characteristics. Light emitting elements provide high contrast between characters and background and thus provide superior performance over reflective signs at night. However, the light intensity requires careful adjustment. According to Garvey and Mace, [15] high contrast produced by lighted elements at night can "create halation or irradiation, blurring letters with wide stroke widths."

Message Length. A series of studies was performed by McNees and Messer[19] to evaluate urban freeway guide signing. A study relevant to EBB issues examined the reading time required for guide signs. Study variables included "bits" (i.e., the amount of information on each panel) and number of sign panels. A typical sign panel contained an exit number, exit direction, cardinal direction, route number, and two destinations. It also included symbols such as a shield, and directional arrows. Examples of bits of information were: "I-395," "Washington, D.C." and "South." Each sign panel had, on average, six bits of information. The display time of the sign simulated the total time a driver would have available to read a guide sign in a typical freeway environment. The display times provided for reading the signs represented three traffic conditions: "extreme" (2.5 sec display time), "minimum" (4 sec display time), and "desirable" (6 sec display time). Median reading times for these conditions were: 1.7 sec (extreme), 2.0 sec (minimum), and 2.9 sec (desirable). The results indicated that the time used to read the signs was dependent on quantity of information per sign as well as time available to perform the task. Based on these results, the authors concluded that the information content of a highway guide sign should not exceed six bits of information per panel.

2.5 The Driver

2.5.1 Driver Age

The analysis of distraction should consider the effect of driver age. If a significant portion of the driving population is more susceptible to distraction, then research on the relationship between distraction and safety should recognize this susceptibility. Such research could provide information about age-related differences regarding visual capability or reaction times that are relevant to driver reaction to EBBs. Both older drivers and young/inexperienced drivers are examined in this discussion.

The highway safety community recognizes that the probability of crash involvement varies with driver characteristics, most notably age. Highway data analysis demonstrates that the young driver and older driver populations have high crash involvement, and elevated injury and fatality rates. According to the Transportation Research Board's Special Report Number 229,[20] the high involvement rate of older drivers in crashes is second only to the rates of young drivers

Experience and age *may* be important factors to consider in the evaluation of the effects EBBs have on safety. The research literature provides a firm foundation for stating that age and experience need to be considered. If EBBs are ultimately found to have a high degree of attention conspicuity - that they compel drivers to attend to them - then it is reasonable to expect that populations such as older or inexperienced drivers, who have less attention to spare, will be placed at greater risk by EBBs.

The Older Driver. According to Barr and Eberhard,[21] the safety and mobility of older drivers, generally defined as 65 years of age and above, are highly relevant to transportation planning. Because of an increasingly aged population, the number and proportion of older drivers are rising. By 2020, Waller[22] has estimated that 17 percent (50 million people) of the United States population will consist of people 65 years and older, compared to 12 percent in 1988. The proportion of older adults licensed to drive is increasing. For example, in 1980, 60 percent of older adults (at least age 65) were licensed drivers, compared to 70 percent in 1989. These data point to the need to include older drivers in research programs on roadway safety, including the evaluation of EBBs and distraction.

Older drivers have a high crash risk per mile.[22] They are involved in a disproportionate number of fatal crashes and multi-vehicle crashes where they were the responsible party,[23, 24] and are over-represented in crashes that involve turns, merges, and yielding the right of way.[25]

Recent studies performed by Ball and Owsley[26] point to cognitive demands as influential factors in driving. Visual processing speed and the ability to handle selective and divided attention demands may have the greatest impact on crash rates. An increase in age did not directly contribute to crash involvement. However, an increase in age correlated with lower processing speed and decreased attention. The fact that attention and visual processing speed degrade with age may be symptomatic of the increasing inability of older drivers to encode and process all but the most important information in the driving environment.

The Younger Driver. The young driver (16 to 24 years old) is more likely to be involved in a crash than drivers of other ages, and a driver under 23 years of age is 2.5 times more likely to be killed in a crash than drivers 25 years and older, according to the NHTSA.[27] Whereas the young driver crash risk on a per-mile driven basis is greater than the crash risk of other drivers, their risk decreases on the continuum from 16 to 24 years old, according to Lerner et al.[28]

Incidents involving younger drivers are attributed to age and experience-related factors. Widely recognized age-related factors reported by Decina et al.[29] include risk-taking and alcohol consumption. Experience-related factors include the psychomotor, perceptual, and cognitive skills required for steering and maintaining speed, driving during high risk periods (such as at night), inefficient or inappropriate scanning behavior, poor hazard recognition, and poor driving judgment and decision-making.

The young driver demonstrates poorer coordination of separate driving tasks and tends to concentrate on one aspect of performance, such as maintaining lane position.[29] According to Mournat et al.,[30] the visual scanning behavior of a young driver is less effective than that of mature drivers because the young driver tends to focus more closely in front of the vehicle. Furthermore, Miltenburg and Kuiken[31] report that the inexperienced driver is likely to have attention drawn to irrelevant but "attention-getting" objects. The aforementioned research suggests that the young driver may be more vulnerable to distractions than the more mature driver. The data indicate that the young driver has weak situational awareness and relatively poor focus on the driving task itself. Thus, distracting stimuli, inside or external to the vehicle, may adversely affect the young driver.

2.5.2 Driver Familiarity with Route

Commuters and visitors require different information while traveling. The familiar driver requires more information on traffic conditions and incidents, whereas the visitor requires more navigational and guidance information. A field study of driver visual search and scan patterns performed by Mourant et al.[30] showed that drivers' visual fixations on traffic, road and lane markers, and bridges and road signs decreased as the drivers became more familiar with the routes. One conclusion from these data is that drivers who are familiar with a roadway may be less likely to attend to familiar signs, including EBBs. Thus, differences between visitors and commuters in visual attention to commercial signs may be a relevant variable in assessment of distraction effects of EBBs since more eye-catching displays may be needed to attract the commuter.

2.6 Measures of Effectiveness

2.6.1 Surrogates

Commercial EBBs are designed to "catch the eye" of drivers. Their presence may distract drivers from concentrating on the driving task and the visual surrounds. Research in other areas share a concern about driver distraction and may be applicable to the question of EBBs and driving performance. Investigations of driver distraction and safety have notably focused on two cases: cellular telephone use while driving, and in-vehicle information displays. In each case, the application of a new technology raised concerns about driver distraction. The following sections highlight research in these areas.

Cellular Telephone Use in Vehicles. The number of cellular telephone users reported by Cain and Burris[32] in 1998 was 63 million, and at a growth rate of 40 percent per year, the NHTSA[33] estimates that the number of users will reach 80 million by 2000. The increase in the number of cellular telephone customers, in combination with high-profile crashes involving cellular telephone use, has raised public awareness of the safety aspects of in-vehicle telephone use and led to legislative initiatives aimed at restraining telephone use in vehicles.

Crash Risk Analyses. Redelmeier and Ticshirani[34] performed an epidemiological study of crash risk associated with cellular telephone use linked customer telephone bills to crash records maintained at the New York Collision Reporting Center to identify telephone use at the time of a crash. The study concluded that cellular telephone use quadrupled the risk of a crash during the call. Another epidemiological study performed by Violanti[35] found a 34 percent increase in risk of crash among vehicles with celluar telephones.

Application to EBBs. Using cellular telephones while driving imposes at least three tasks: first, manually manipulating the telephone, which could affect control of the vehicle; second, glancing at the telephone, which requires looking away from the roadway; and third, engaging in conversation, which may disrupt concentration. The relevance of information on cellular telephone use to EBBs lies in visual (glancing) and cognitive (mental engagement) behaviors. Viewing EBBs or using a telephone requires drivers to look away from the roadway for some period. Similarly, reading a sign could disrupt a driver's concentration, just as engaging in a telephone conversation might.

According to Cain and Burris,[32] hands-free telephone use carries about the same risk observed in hand-held use, and a NHTSA report[33] cites that a telephone conversation is a factor in crashes more frequently than dialing. Cain and Burris[33] believe that the type of conversation is significant in determining crash risk, and McKnight and McKnight[36] believe that complex and intense conversations the riskiest and simple conversation relatively risk-free. Thus, becoming mentally preoccupied can be as distracting to a driver as manually operating a telephone or glancing away from the roadway.

In-vehicle Information Systems. Advances in communications technology have enabled the development of electronic devices that display traveler-related information to drivers in transit. Such devices can potentially redirect (or distract) a driver's attention from the primary task of driving. An examination of in-vehicle distractions may contribute to an understanding for potential out-of-vehicle distractions such as EBBs.

The presence of in-vehicle devices that provide traveler-related information, such as turn-by-turn directions, has raised questions regarding the amount of time taken away from the driving task by the information display. One concern is that a driver will underestimate the amount of time required to use the device, take longer than expected, thus taking too much time away from the driving task. This is similar to the concern in which a driver spends too much time looking at a stimulus external to the vehicle.

In order to measure visual distraction associated with the use of in-vehicle devices, a methodological approach was developed based on eye glances. This method calculates the total number and average duration of eye glances required to operate specific in-vehicle devices. Data compiled from research in the late 1980's defined the average time for a single glance and the average number of total glances required to use a variety of devices. Devices were the speedometer, mirrors, standard radio, climate controls, smoking/lighting, fuel gage, heating/air conditioner, map, and others. For example, using the radio required 1.20 sec of glance time and 3.5 total glances, and reading the map required 1.70 sec of glance time, and 5.0 total glances. Wierwille and Tijerina[37] performed one investigation into this issue that compared exposure levels for in-vehicle devices to number of crashes associated with the use of these devices. Exposure was the number of glances, multiplied by the time for a single glance, multiplied by the frequency of use. When the variety of in-vehicle devices was examined in light of both number of crashes and their exposure, a linear relationship resulted such that the greater the exposure, the greater the number of crashes. This study suggested that the ". . .relative number of accidents is directly related to visual resource allocation for in-vehicle tasks." The data regarding amount of time used for in-vehicle devices reported in this study may be a useful starting point for estimating the maximum amount of time that a driver can attend to a distraction outside the vehicle.

2.6.2 Current Measurement of Distraction

It would be beneficial to measure the effect that EBBs have on driver distraction. Such measures for EBBs and other stimuli external to the vehicle have not yet been developed. However, there is one approach being developed for in-vehicle information systems that, with some refinement, may serve as a measure of EBB distraction.

Olsson and Burns[38] describe a peripheral detection task (PDT) that is designed to measure visual distraction and driver mental workload. This study included measures of reaction time and correct detection rate for drivers who were asked to report the presence of an LED dot shown briefly at slightly different locations on a windshield while: 1) driving on country roads and a motorway and 2) performing a secondary task while driving. The dots were projected 11-23 degrees to the left of the straight-ahead view and 2-4 degrees above the horizon. This location approximates the visual angle that corresponds to a pedestrian or some roadside signs.

Statistically significant results indicated that a CD manipulation task and a backwards counting task required a longer performance time and resulted in fewer correct detections than the baseline driving task. Since these drivers missed more targets when performing a secondary task and because it took longer to report the targets that were spotted, the PDT may be useful in assessing the distractibility of in-vehicle systems. The authors briefly discuss the necessity of defining a criterion such as a percentage correct detection rate and/or reaction time that would define driver distraction.

If the PDT can be applied to in-vehicle systems, it may also be applicable to stimuli external to the vehicle such as EBB and tri-vision signs. It would be necessary to adapt the methodology from an in-vehicle task to a vehicle-external stimulus and to define a criterion for distraction. The PDT procedure might also be employed in addition to the driver performance measures described above, i.e., measures of lateral deviation and speed selection.

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Agenda Item 5.4

VERSION 1

Greenhouse Gas Emission Assessment Guide

For British Columbia Local Governments

February 20, 2008

IMPORTANT:

This Guide will be updated frequently
Please ensure you are using the most up-to-date version

This is the first version of the Greenhouse Gas Assessment Guide for Local Government Projects. It is a "live" document, and will be updated frequently. Digital copies and updates will be made available through the "Examples/Best Practices" pages on the Provincial LocalMotion (www.localmotion.gov.bc.ca/examples.html) and Towns for Tomorrow (www.townsfortomorrow.gov.bc.ca/examples.html) grant program websites. As this is a "live" document feedback is appreciated.

The guide has been developed in a partnership between the Community Energy Association and the Ministry of Community Services.

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Contents

1. Overview

Climate change is one of the greatest challenges facing British Columbia and the world. Governments, businesses and individuals around the world are learning how to change their practices and procedures to meet this challenge, by identifying ways to reduce emissions of the greenhouse gases that cause climate change.

This guide provides local governments with background information and guidance for calculating greenhouse gas (GHG) emissions reductions for various common infrastructure types. It will:

- build capacity in understanding and calculating GHG emissions;
- provide a resource to complete infrastructure grant applications and program requirements for such programs as the Provincial Towns for Tomorrow and LocalMotion programs, and the Federal/Provincial/Union of BC Municipalities Gas Tax Program;
- support local government British Columbia Climate Action Charter commitments; and
- encourage overall GHG reduction for communities.

The main aim of the guide is to assist local governments in estimating the GHG emissions reductions that will arise from infrastructure projects. These estimates will be approximate, and GHG calculation need not be a daunting or complex task. The guide will also aim to provide suggestions for further resources, enabling local governments to find further help in estimating GHG emissions reductions.

The guide does not provide the basis for a detailed and rigorous assessment of GHG reductions. Rather, it will provide an introduction to the approaches and principles of a GHG assessment, and enough information to provide approximate estimates of the GHG reductions that may arise from some infrastructure projects.

The guide is organized into four sections: Section one introduces the context of climate change from a local government perspective. Section two provides an overview of GHG emissions assessment, while section three provides the key parameters necessary for calculating GHG emissions. Finally, section four provides calculation methodologies for specific types of local government project.

1.1 Climate change and local government

Climate change is a priority for British Columbia. The impacts of climate change are already felt in many communities in British Columbia, from the economic and environmental devastation of the Mountain Pine Beetle epidemic to storms and floods which have affected communities across the Province.

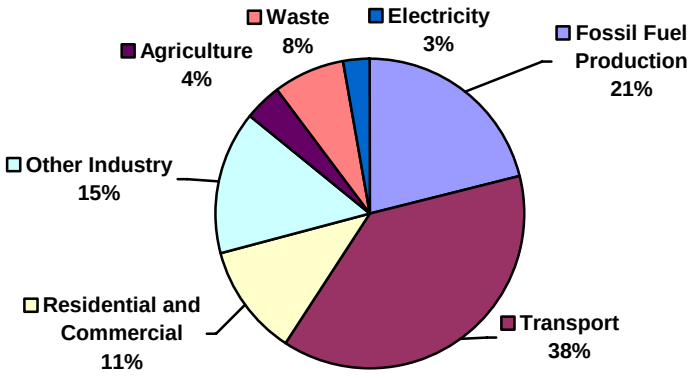
The provincial government, and many local governments, have committed to significant reductions in GHG emissions to help mitigate the impacts of climate change. The provincial government has committed to cutting GHG emissions by 33% by 2020, from 2007 levels. This target, along with an 80% reduction in GHG emissions by 2050, has been passed into law. The provincial government has also committed to becoming 'carbon neutral' in its operations by 2010, and is encouraging local governments to follow this example by becoming carbon neutral in their operations by 2012 through signing and implementing the Climate Action Charter[1]. As of February 2008, ninety five local governments have signed on to the Charter and are beginning to develop options for reducing their GHG emissions.

Local governments play a central role in implementing GHG reduction strategies:

- Providing strong Council and staff leadership – by setting an example at a local level, local governments can help foster behaviour changes;
- Reducing corporate GHG emissions (e.g. fleet management, constructing energy efficient civic buildings);
- Constructing infrastructure that enables the community at large to reduce GHG emissions (e.g. multi use commuter trails, and renewable district energy systems);
- Making land use planning decisions that enable GHG emissions reductions throughout the community (e.g. transit orientated urban design, and orientation of buildings to foster passive solar heating).

Local governments have significant influence over GHGs. In addition to GHGs that are directly emitted by local government operations (e.g. buildings, vehicles, infrastructure, landfills), local governments have indirect influence on around 45% of BC's GHG emissions[2]. This is because local government decisions around land use and infrastructure greatly influence buildings (residential and commercial sectors), transportation (urban sprawl and the use of transit vs. driving) and waste.

B.C. Greenhouse Gas Emissions (2005)



Source: BC Ministry of Environment

1.2 Greenhouse gases

This guide focuses solely on greenhouse gases (GHGs), which are the main cause of climate change. The guide does not address approaches to reducing other air pollutants. There are many GHGs, but the most important are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). These gases differ in the degree to which they contribute to climate change. For example, methane is over 20 times more damaging than the same amount of carbon dioxide. However, it is customary to report all greenhouses gases as a single figure, measured in "tonnes of carbon dioxide equivalent" or tCO_2e. The emissions factors used to calculate GHGs in this guide are all reported in tCO_2e, so there is no need to do separate calculations for different GHGs.

Major sources of GHGs include:

1. **Combustion of fossil fuels used to generate electricity**. Although most of the electricity produced in BC is generated in hydroelectric stations, a small amount is generated in diesel and natural-gas-fired power stations. BC also imports power from other jurisdictions outside of the province, many of which produce power less cleanly than BC (for example, from coal).
2. **Combustion of fossil fuels in transportation**. Most of our transportation modes (shipping, aviation, trains and cars) are powered directly by the combustion of fossil fuels. Transportation is the single largest contributor to GHG emissions in BC.
3. **Combustion of fossil fuels for space and water heating**. In BC, buildings account for around 11% of GHG emissions[3]. The majority of this is from natural gas consumption, although propane and heating oil also play a role.
4. **Decomposition of organic wastes**. Organic wastes, including paper, wood, waste food and sewage solids all emit GHGs as they decompose. In aerobic conditions, decomposition largely produces carbon dioxide. However, under anaerobic conditions, such as in landfills and some sewage lagoons, decomposition produces significant quantities of methane, a more potent GHG.
5. **Destruction of "carbon sinks"**. Trees, other plants and soils absorb and store carbon dioxide from the atmosphere. Destruction of forests, green space and other ecosystems within a community causes the release of that carbon dioxide into the atmosphere, and prevents the ecosystem from absorbing further carbon dioxide.

Because methane is such a potent greenhouse gas, the projects that reduce methane emissions may create the greatest reductions for the size of the project. Such projects include the capture and destruction (e.g. flaring) or beneficial use (e.g. energy production) of landfill gas and digester gas arising from anaerobic digestion of sewage.

1.3 Infrastructure projects that reduce greenhouse gas emissions

Local government infrastructure projects will influence greenhouse gas emissions in a number of ways. The table below shows how some common kinds of projects will lead to GHG emissions reductions. This guide does not currently cover all sources of GHGs, nor does it cover all types of local government infrastructure project. However, the approaches and principles laid out in this guide can be adapted to other types of project where necessary.

Project category	Example project	GHG emissions reduction
Transportation Infrastructure	Bike paths on commuter route	Reduction in use of vehicles for commuting, leading to reduced use of fossil fuels
	Transit amenities	Increased use of transit, reduced use of vehicles for commuting, and therefore reduced use of fossil fuels
Energy Systems	Installation of renewable energy equipment	Reduced use of conventionally generated electricity and/or fossil fuels
Buildings	Energy efficiency retrofits (e.g. new lights, efficient boiler, etc.)	Reduced use of electricity and/or fossil fuels
	Construction of new "green" buildings that are more energy efficient than normal buildings.	Reduced use of electricity and/or fossil fuels
Water and Wastewater	Increased efficiency of system components (e.g. pumps, UV lamps, etc.)	Reduced use of electricity
	Water use reduction (e.g. water meters, leak detection and repair etc)	Reduction in requirement to pump and treat water/wastewater, leading to reduced use of electricity
Solid Waste	Waste Diversion (e.g. recycling, reducing and re-use programs, composting, etc.)	Reduced volume of waste at land fill and subsequent emissions of landfill gas
	Landfill gas collection	Reduced emissions of landfill gas
	Landfill gas use for energy	Reduced use of conventionally generated electricity and/or fossil fuels

Note that it is possible for a single project to lead to GHG emissions reductions in a number of different ways. For example, a wastewater treatment plant upgrade might include energy efficiency upgrades to the building/system; new equipment that reduces water use; and wastewater heat recovery technology that supplies energy to a district heating system. The reductions from each source should be calculated separately and totalled. Using the example above, the total GHG emission reductions from the wastewater treatment plant upgrade are calculated by adding up the following:

energy efficiency upgrade reductions + water efficiency upgrade reductions
+ district heating reductions.

This edition of the guide will not cover carbon sequestration – that is, the absorption of carbon dioxide from the atmosphere by vegetation or other carbon 'sinks'. This information may be included in later versions of the guide.

Carbon "Neutral" and Offsets

Many BC local governments have committed to becoming 'carbon neutral' by 2012, through signing the Climate Action Charter. This means that they will emit no *net* GHG emissions from local government operations. This can be achieved by first reducing GHG emissions as much as practical, and then offsetting the remaining GHG emissions through various strategies. This guide will not deal with offsets. The standards of rigour to validate and verify carbon reductions that are sold as offsets are much higher than the simplified calculation approaches introduced here. Further editions of this guide may help provide further guidance to local governments on these issues.

2. Calculating GHG emissions reductions

2.1 Use of this guide

This guide provides a starting point for a basic assessment of likely GHG emissions reductions. **Use the results with caution, and be modest about the accuracy of the emissions reduction estimates.** A comprehensive assessment of likely GHG emissions reductions can be an expensive and detailed process, which would likely require the involvement of expertise from outside local government. Local governments seeking to provide more robust assessments of GHG emissions reductions arising from projects should seek help from expert consultants.

2.2 Basic principles of GHG assessment

1. *Conservativeness*
   There will always be some uncertainty in GHG emissions calculations. Always make assumptions that will tend to under-estimate emission reductions, rather than over-estimate, particularly when uncertainty is high.

2. *Transparency*
   Document the sources of all data and describe assumptions when reporting estimated GHG emissions reductions.

3. *Accuracy*
   Attempt to reduce uncertainty as much as possible, by using the most accurate available data, and by considering all possible project impacts on GHG sources.

4. *Relevance*
   Data and assumptions should be relevant to the task of estimating GHG emissions reductions. Where possible, use locally-specific data. For some factors, the guide provides provincial or national average figures to be used where no local data is available. For example, the average cycle commuter distance in Canada is 5km[4]. In Kelowna, however, the figure is 8km[5] and the commuter distance may be lower than the national average. When reliable local data is available it should be used in place of the provincial or national average figures provided in section 3.3 of this guide. Where possible, this guide has identified resources to enable local governments to determine local data.

2.3 Absolute and relative GHG emissions reductions

Not all infrastructure projects will lead to net GHG emissions reductions. For example the construction of new infrastructure will often lead to a net increase in GHG emissions. However, where these projects take steps to reduce the likely GHG emissions arising from the project, it is still possible to report emissions reductions relative to a 'business-as-usual' future. For example, a new building will lead to an increase in overall greenhouse gas emissions even if it is highly energy efficient. However, a highly energy efficient building will reduce emissions in comparison to a business-as-usual building.

The table below provides examples of projects likely to lead to absolute and relative GHG emissions reductions.

Projects leading to <u>absolute</u> GHG emission reductions (GHG emissions after the project lower than emissions before the project)	**Projects leading to <u>relative</u> GHG emission reductions** (GHG emissions after the project higher than emissions before the project, but lower than a business-as-usual project)
▪ Energy efficiency retrofits in existing buildings and facilities ▪ Renewable electricity projects ▪ Commuter bike routes ▪ Water conservation projects ▪ Upgrades to existing water and wastewater infrastructure that result in energy reduction	▪ New energy efficient and "green" buildings (such as a state-of-the-art energy efficient ice arena) ▪ New water treatment facilities that are more energy efficient than industry standard

2.4 Baselines

Whether the reductions are absolute or relative, they will be calculated in relation to a 'baseline' future.

- For projects that will lead to absolute emissions reductions, the baseline will usually be current emissions, or current energy use. For example, the baseline for a building energy efficiency retrofit program is the current energy use. This is available from energy bills or the utility service provider (e.g. BC Hydro).
- For projects that lead to relative emissions reductions, the baseline will usually be the standard emissions for new infrastructure of that type. For example, the baseline for a new building might be the minimum energy efficiency requirements laid out in the forthcoming updates to the BC Building Code.

For the project types covered by the guide, baseline considerations will be highlighted in each calculation. In general, the guide uses the simplest possible baseline approach. However, it is worth pointing out that a more thorough and detailed emissions reduction assessment would require a more advanced approach to setting an appropriate baseline:

- ***Baseline time limit*.** Any baseline is only valid for a limited time period. If an appropriate valid time period for a baseline has not been assessed, it is impossible to say what a project's lifetime GHG emissions reductions will be. Instead, it is only possible to calculate annual reductions over the short term.

  This guide will not set a baseline time limit. Thus local governments can only report expected emissions that will arise in the short term (next few years).

- ***Static vs. dynamic baselines.***
  For many types of infrastructure, the emissions are not expected to change significantly from year to year. For example, a building will use a similar amount of natural gas for heating from year to year. In these cases, a '**static**' **baseline** is acceptable.

  However, some emissions sources do change significantly over time. For example, electricity consumed in BC is likely to become significantly less GHG intensive between now and 2016, following the 2007 BC Energy Plan's commitment to become less dependant on imported electricity (which is produced less cleanly than energy in BC). In theory, baseline emissions arising from electricity consumption will fall year by year, and a '**dynamic baseline**' should be used to reflect this.

  This guide will only consider static baselines.

2.5 Primary and secondary effects

Most attention should be paid to the major effects of a project on emissions. For example, the primary effect of installing a renewable energy system in a local government building is reduced use of conventionally generated electricity and/or natural gas, leading to emissions reductions. However, local governments should also consider 'secondary effects'. These are additional ways in which the project might affect GHG emissions.

There are two major kinds of secondary effects:

- ***One-time effects***. For some projects, there may be significant GHG emissions associated with the development or construction of a project. These might include the clearance of carbon 'sinks' (such as trees and other vegetation); GHGs emitted during construction (e.g. excavator's fuel use); and GHGs emitted during the production of certain materials, particularly cement. Where possible, local government projects should seek to reduce these emissions (e.g. utilizing high-volume fly-ash cement).
- ***Upstream and downstream effects***. Some kinds of projects may reduce emissions for the project itself, but cause emissions to increase elsewhere. For example, a project that used significant quantities of biomass energy might result in a local shortage of biomass fuel, causing other local institutions to use fossil fuels, rather than biomass. These kinds of effects are often mediated through market prices, and are likely to be negligible for most local government projects.

A thorough examination of the possible secondary effects arising from projects is beyond the scope of this guide. However, local governments are encouraged to research and report these if known in order to achieve the most accurate GHG inventory for a given project.

3. Key Parameters

All GHG emissions should be reported in metric tonnes of carbon dioxide equivalent (tCO_2e) emitted per year. Usually, this will be straightforward, because emissions factors for fossil fuel use and electricity have all been provided in terms of tCO_2e. However, in cases where these are not relevant (for example, with landfill gas emissions), it may be necessary to convert methane (CH_4) or nitrous oxide (N_2O) figures into tCO_2e:

1 tonne of CO_2 = 1 tonne of CO_2e
1 tonne of CH_4 = 21 tonnes of CO_2e
1 tonne of N_2O = 310 tonnes of CO_2e
Source: Environment Canada.
These figures are known as the "global warming potentials" of CO_2, CH_4 and N_2O.

3.1 GHG factors

The use of electricity and fossil fuels lead to GHG emissions. This table provides data on the amount of GHGs emitted for each unit of electricity or fossil fuels used.

GHG source	GHG factor	Data source and notes
Conventional electricity (grid-connected)	0.000022 tCO_2e/kWh	This number will change every year, since the relative contributions of hydro and fossil-fuel-fired electricity generating facilities changes every year. This number does not include imported electricity (future editions of the guide may). This figure is the GHG factor currently recommended by the BC Climate Action Secretariat
Natural gas	0.051 tCO_2e/GJ	Environment Canada[6]
Propane	0.00154 tCO_2e/litre	Environment Canada[7]
Heating oil	0.00284 tCO_2e/litre	Environment Canada[8]
Gasoline	0.00241 tCO_2e/litre	Environment Canada[9]
Diesel	0.00276 tCO_2e/litre	Environment Canada[10]

This edition of the guide will not cover alternative vehicle fuels such as biodiesel or hydrogen. That information may be included in later versions of the guide.

3.2 Unit conversions

It is important to ensure that all parameters are converted into the appropriate units before GHG emissions are calculated. The table below provides some useful conversion factors.

GHGs and sources	Preferred units	Common conversions
Electricity	kWh (Kilowatt hours)	1kWh = 0.0036 GJ
Natural gas	GJ (Gigajoules)	1 GJ = 26.9m^3 = 949 cubic feet = 0.948 million BTUs
Propane, heating oil, gasoline and diesel	litre	1 litre = 0.220 imp. gallons = 0.265 US gallons

Other conversion units are available found from the National Energy Board of Canada, at: http://www.neb.gc.ca/clf-nsi/rnrgynfmtn/sttstc/nrgycnvrsntbl/nrgycnvrsntbl-eng.html

3.3 Benchmark data

Benchmark figures are regional or national averages for energy consumption or GHG emissions that arise from particular processes or facilities. They can be used as a basis for calculating GHG emissions reductions when locally-specific data is not available, for example, where no engineering or transportation studies have been undertaken. Local data provides the best reference to calculate GHG emissions.

This section provides some benchmarks that can be used where local data is not available. It is important to recognize that these benchmarks are approximate, and GHG emissions calculations based on these benchmarks will be less accurate than those using locally-specific data. **It is recommended that benchmarks be only used where local data is not available or in such examples where it is cost prohibitive to collect such data. It is important to justify why local data has not been collected.**

Buildings benchmarks[11]
Electricity use in existing institutional buildings: 150 kWh/m^2 This figure includes office buildings and libraries, but is not appropriate for recreation centres.
Natural gas use in existing institutional buildings: 0.6 GJ/m^2 This figure includes office buildings and libraries, but is not appropriate for recreation centres.
Transportation benchmarks
% of non-recreational cyclists who would have driven, if they were not cycling[12]: 50%
Average BC cycling commuter distance[13]: 5km each way[14], 10km return trip
GHG factor for vehicle transportation: 0.000277 tonnes CO_2/km (based on average fuel efficiency of cars, SUVs and light trucks in BC of 11.5l/100km[15], and the GHG factor for gasoline).
Water benchmarks[16]
Average energy use for supply and treatment of groundwater: 0.482 kWh/m^3
Average energy use for supply and treatment of surface water: 0.375 kWh/m^3
Average BC resident daily water use[17]: 0.426m^3/day.
Wastewater benchmarks[18]
Average energy use for collection and primary treatment of sewage: 0.175 kWh/m^3
Average energy use for collection and secondary treatment of sewage: 0.320 kWh/m^3

4. Example project types and outline assessment methodologies

The current draft of the guide covers project examples in the categories of:
- Renewable energy (heating and electricity) systems
- Buildings
- Transportation
- Water and wastewater

This guide does not currently cover projects related to solid waste, with the exception of the energy-related reductions that will occur as a result of waste-to-energy or landfill gas utilization projects. Future versions of the guide may address these.

4.1 Renewable energy systems

Renewable energy systems reduce the amount of conventionally generated energy used. Since conventional energy (whether electricity, natural gas or other fossil fuels) leads to GHG emissions, the use of renewable energy will lead to reductions in GHG emissions.

Methodologies are provided here for estimating the GHG emissions reductions arising from both heat and electricity generating technologies. In general, renewable heating systems that reduce direct use of fossil fuels such as natural gas or propane will create the greatest GHG emissions reductions. Examples of local government renewable heating systems can be found in the Community Energy Association's renewable energy guide *Heating Our Communities*[19].

Project category	**Renewable Heating Systems**
Project types	Biomass heating system, renewable district heating system, solar, air and water heating systems, geoexchange (ground-source heat pumps) and heat recovery systems.
Description	The use of renewable heating systems will decrease the use of conventional energy (electricity, natural gas or other fossil fuels). Electricity and fossil fuels use creates GHG emissions; reductions in their use results in a decrease in GHG emissions.
GHG sources	Conventional heating systems, which may be powered with: Natural gas, electricity, other fuels (propane, fuel oil). For the purposes of this guide, biomass heating systems are considered to have no net GHG emissions[20].
Information required	Expected reductions in the use of conventional energy for heating. This information will be available from feasibility studies carried out for the project.

Calculation methodology	GHG emission reductions will depend on the amount of conventional energy avoided as a result of using the renewable energy system. The GHG emissions factor depends on the kind of heating system that is already being used, or that would have been used if the renewable energy system was not being installed (i.e. electric, natural gas or propane). For renewable heating systems in new buildings, the feasibility study for the system should identify what a 'base case' non-renewable heating system would have been. This provides the 'baseline', against which the renewable heating system is compared (e.g. solar water heating instead of a natural gas water heater).
Calculation	GHG emissions reductions = expected reduction in use of conventional heating * GHG factor for conventional heating system (electricity, gas, propane or fuel oil)
Notes	Requires local government to have adequate data on expected conventional energy use reductions associated with the project. These expected energy savings should already have been identified in the feasibility studies undertaken for the energy project.
Example	The Lillooet Recreation Centre was fitted with a solar water heating system in 1998. The solar water heating system reduced the use of propane by 18,000 litres per year. The GHG factor for propane is 0.00154 tCO2e/L. GHG emissions reduction = 18,000 L * 0.00154 tCO2e/L = 27.7 tCO2e per year
Information sources/links	▪ The energy savings expected from alternative energy systems can be calculated using RETScreen, a free software tool available from Natural Resources Canada. www.retscreen.net. ▪ The Community Energy Association (www.communityenergy.bc.ca) can provide advice and guidance on local government energy projects.

Project category	**Renewable Electricity Systems**
Project types	Solar photovoltaic panels, microhydro, landfill gas utilization, biomass-fired-cogeneration.
Project description:	The electricity generated can either be used within local government facilities or can be sold to the grid (via BC Hydro's Net Metering or Standing Offer Program)[21]. The use of renewable electricity systems will decrease the use of conventional electricity. Conventional electricity use creates GHG emissions; and reductions in this use result in a decrease in GHG emissions.
GHG sources	Conventional electricity generation.
Information required	Expected renewable electricity production, in kWh/year. This will be available from the feasibility studies that will have been undertaken for the project.
Calculation methodology	Emissions reductions will simply be the amount of electricity produced by the renewable energy system, multiplied by the GHG factor for conventional electricity.
Calculation	GHG emissions reductions = electricity produced * GHG factor for electricity
Notes	This methodology is only appropriate for projects connected to the main BC electricity grid. Off-grid facilities that are currently powered by diesel generators will have to calculate their expected reductions in diesel use in order to estimate emissions reductions.
Examples	An 80kW solar photovoltaic system in Abbotsford would be expected to produce around 97,000 kWh per year[22]. The GHG factor for electricity is 0.000022 tCO2e/kWh. Electricity produced = 97,000 kWh/year GHG emissions reduction = 97,000 kWh * 0.000022 tCO_2e/kWh (GHG factor for electricity) = 2.1 tonnes of CO_2e per year
Information sources/links	▪ The energy savings expected from alternative energy systems can be calculated using RETScreen, a free software tool available from Natural Resources Canada. www.retscreen.net. ▪ The Community Energy Association www.communityenergy.bc.ca can provide advice and guidance on local government energy projects.

4.2 Energy efficiency in buildings

Buildings – through their heating, lighting, ventilation and other services – consume significant amounts of energy, which leads to GHG emissions. Existing buildings can be retrofit with energy efficiency technologies that will reduce energy use and hence reduce GHG emissions.

While the construction of new buildings will lead to a net increase in GHG emissions, highly energy efficient 'green' buildings will have reduced GHG emissions compared to a 'business-as-usual' building. Methodologies are provided here both for estimating GHG emissions reductions arising from building energy efficiency retrofits, and for estimating the relative GHG emissions reductions that arise from the construction of new energy efficient buildings. Where possible, it is better to reduce emissions from existing buildings, rather than to build new energy efficiency buildings. Rather than constructing new buildings, consider redeveloping vacant or under-used buildings.

Note that energy efficient buildings and retrofits are likely to generate long term financial savings as a result of reduced energy costs. The buildings that will likely yield the biggest savings, both financial and in terms of GHGs, are swimming pools and ice arenas, since these both use significant amounts of energy for heating and cooling. Opportunities may include using the waste heat from an ice arena to heat water for the swimming pool, resulting in significant cost and GHG emissions savings.

For advice and support about energy efficiency in new and existing buildings, contact Green Buildings BC for Local Governments www.greenbuildingsbc.com.

Project Category	**Buildings**
Project types	Building energy efficiency retrofits or upgrades
Description	Energy efficiency retrofits or equipment upgrades will reduce the consumption of electricity and fossil fuels used within the building, resulting in a decrease in GHG emissions.
GHG sources	Natural gas, electricity, other fuels (propane, fuel oil)
Information required	Feasibility study, or existing energy consumption and percentage savings estimate.
Calculation methodology	Energy savings from undertaking the retrofit or upgrade. In most cases savings will be determined through a feasibility study (Recommended). If not available, rough savings can be estimated using existing consumption and percentage savings. Most retrofit projects will save between 10% and 30% of a building's energy[23]. Usually, the more comprehensive the retrofit (longer-paybacks, more capital investment), the higher the savings. If a retrofit only addresses electrical systems (e.g. lighting), the savings should not be applied to natural gas or other fuels, and vice-versa. Existing consumption can be found from past utility bills, or by calling your utility representative.
Calculations	Energy savings = Existing consumption * % savings (or from feasibility study - recommended)

	GHG emissions reductions = energy savings * GHG factor
Notes	• Feasibility studies or other energy calculations should be performed by a qualified professional. Estimates calculated by others (e.g. equipment suppliers, contractors) should be checked against existing consumption. • Some projects may also result in water savings. However, GHG reductions from water conservation on individual buildings may be too small to be calculated. See the Water Project Category for GHG reductions due to water conservation.
Examples	An energy retrofit feasibility study for the Parkinson Recreation Centre in Kelowna in 2003 indicated potential annual savings of 10,400 GJ natural gas and 592,000 kWh electricity. Measures assessed included HVAC upgrades, lighting upgrades and retrofits of new efficient mechanical equipment such as pumps. The GHG factor for natural gas is 0.051 tCO2e/GJ and for electricity is 0.000022 tCO2e/kWh. Natural gas GHG emission reductions = 10,400 GJ * 0.051 tCO2e/GJ = 520 tonnes CO_2e Electricity GHG emission reductions = 592,000 kWh * 0.000022 tCO2e/kWh = 13 tonnes CO_2e Therefore, total GHG emission reductions for this project = 520 tonnes CO_2e (from natural gas) + 13 tonnes CO_2e (from electricity) = 533 tonnes CO_2e per year
Information sources/links	▪ Green Buildings BC for Local Governments can provide information and case studies on energy retrofit projects. www.greenbuildingsbc.com

Project Category	**Buildings**
Project type	New buildings that are more energy efficient than current 'business-as-usual' practice. Typically this will be a certified 'green' building using a standard such as LEED (Leadership in Energy and Environmental Design).
Description	New buildings that incorporate energy efficiency features or are built to a higher energy standard (e.g. LEED), will use less electricity and fossil fuels, and therefore produce fewer GHGs, than an average new building.
GHG sources	Natural gas, electricity, other fuels (propane, fuel oil)
Information required	Energy study with estimated energy savings compared to a typical new building of the same type.
Calculation methodology	Energy savings will be determined through an energy study comparing the new building to the baseline. The baseline is the typical energy use of a similar type of new building. In most cases energy savings estimates will be available through a feasibility study or computer simulation. If the savings are in comparison to a typical building, they can be used directly (recommended). If there is no feasibility study, a benchmark figure for a typical building can be used, although this will lead to a less accurate GHG estimate. ▪ Benchmark electricity use in institutional buildings: 150 kWh/m^2 ▪ Benchmark natural gas use in institutional buildings: 0.6 GJ/m^2 Note that some feasibility studies will determine savings relative to the Model National Energy Code for Buildings (MNECB)[24]. This is an old standard and current construction practices have become considerably more efficient; ask your consultant to estimate the savings in comparison to a typical new building.
Calculations	Energy savings should come from a feasibility/energy study. GHG emissions reductions = energy savings (versus a conventional building) * GHG factor Where this is not available, a benchmark approach can be used: Energy savings = building floor area (m^2) * energy use benchmark * % energy savings
Notes	• Emissions reductions arising from energy efficiency measures in new buildings will be relative, not absolute reductions (see section 2.3 for an explanation of relative vs. absolute reductions). • In most cases, energy use in new buildings should be viewed from a whole building perspective, rather than by individual system (e.g. lighting, boilers, etc.). Comparisons to recognized standards such as ASHRAE 90.1[25] are the most appropriate. Exceptions to this would include systems not covered under ASHRAE 90.1 (e.g. ice rink refrigeration systems). Energy savings for such systems should be determined by a qualified professional. • Some projects may also result in water savings. However, GHG reductions from water conservation on individual buildings may be too small to be calculated. See Water section for calculations of GHG reductions due to water conservation.

Examples	A new 6,000 m² municipal hall is proposed to be LEED Gold, with estimated annual energy savings of 200,000 kWh and 500 GJ compared to a typical municipal hall. GHG factor for electricity is 0.000022 tCO2e/kWh and GHG factor for natural gas is 0.051 tCO2e/GJ. Natural gas GHG emission reductions = 500 GJ * 0.051 tCO2e/GJ (natural gas GHG factor) = 25.5 tCO_2e reduced Electricity GHG emission reductions = 200,000 kWh * 0.000022 tCO2e/kWh (electricity GHG factor) = 4.4 tCO_2e Therefore total GHG emission reductions from this project = 29.9 tonnes CO_2e per year
Information sources/links	▪ LEED Canada - www.cagbc.org ▪ BC Building Code - http://www.housing.gov.bc.ca/building/green/index.htm ▪ ASHRAE 90.1-2004 - http://www.ashrae.org/technology/page/548 ▪ MNECB - http://www.nationalcodes.ca/mnecb/index_e.shtml ▪ Green Buildings BC for Local Governments can provide information and case studies on energy retrofit projects. www.greenbuildingsbc.com

4.3 Transportation

Transportation is the single largest contributor to GHG emissions in British Columbia. Local governments have significant influence over transportation, through land use planning decisions, and through the construction of local transportation infrastructure.

The methodology below has been developed to estimate GHG emissions reductions arising from non-recreational bike paths and lanes. Other transportation-related infrastructure projects may also lead to emissions reductions, including construction of transit amenities, the provision of transit buses, or upgrades to local government fleets. In each case, the methodology involves estimating either:

- reduction in use of single-occupancy vehicles; and/or
- reduction in fuel consumption from fleet upgrades.

These estimations are very specific to the characteristics of the project and community; they cannot be accurately described within this guide.

Advice for reducing emissions from **fleet vehicles** is available from the E3Fleet program, administered by Fraser Basin Council (www.e3fleet.com). The GHG Protocol Initiative has developed a spreadsheet tool for calculating emissions from fleet vehicles, called "*CO_2 emissions from transport or mobile sources*". The tool is freely available, but users must first register with the GHG Protocol website.
http://www.ghgprotocol.org/calculation-tools/service-sector

Project Category	**Transportation**
Project type	Non-recreational bike paths and bike lanes
Description	Bike paths and bike lanes provide safe environments for cyclists, either off-road or on-road. The construction of bike paths and lanes can encourage people to use bikes, instead of cars, for utilitarian purposes (i.e., to and from work, school, shopping), thus reducing GHG emissions from vehicles.
GHG Sources	Vehicle fuel consumption
Information required	▪ Estimated number of non-recreational users of the bike path ▪ Average distance cycled ▪ Percentage of non-recreational users of the bike path who would have driven by car
Calculation methodology	The GHG emission reductions are calculated by estimating the numbers of commuters who will use the bike facility instead of driving to their destination, and then calculating the resulting emissions avoided. Assessing the **likely number of users of a bike path or lane** is a key variable in establishing an emissions estimate. If this number has already been estimated using local data and bicycle counts, use this locally-derived number[26].

	A US tool to estimate demand for bike paths is available at: http://www.bicyclinginfo.org/bikecost/step1.cfm. It is tailored for use in the US, but can be used by BC communities. Information required includes population density in the area surrounding the bike path, and the percentage of total trips in the area already made by bicycle. Where this is not known, use the BC average figure of 2%[27]. More detailed guidance on methods for estimating the likely number of users is available from the governments of New Zealand[28], US[29], UK[30] and Australia[31]. However, these tend to be lengthy documents. The guidance from New Zealand may be of most direct use. **Other important parameters** include the percentage of cyclists using the bike path that would otherwise have driven, and the average bike trip length. Where locally-specific data is not available, the following benchmarks may be used: ▪ % of non-recreational cyclists who would have driven, if they were not cycling[32]: 50%. ▪ Average BC cycling commuter distance: 5km each way[33], 10km return trip.
Calculations	Vehicle kilometres avoided = Number of bike path users/year * % of users that would have driven * average bike user trip length GHG emissions reductions = vehicle kilometres avoided * GHG factor for vehicles (0.000277 tCO_2e/km)
Notes	This calculation methodology is only relevant where bike facilities are constructed on commuter routes, or to other major destinations to which people travel by car. Recreational bike paths will not lead to a reduction in emissions, and may even lead to an increase in emissions, since people may drive to them. Where bike path construction involves the destruction of natural ecosystems (not recommended), such as forest, or the use of materials whose manufacture involves significant carbon emissions (such as cement), there may be a significant one-time increase in emissions associated with the project. In cases where expected ridership is low, such one-time effects should be reported. Where possible, steps should be taken to reduce the one-time impacts of construction.
Examples	A new bike path is built between a major subdivision and downtown. It is expected that 80 people will make return trips using the path each day (this is an average annual figure, accounting for seasonal variation and differences between week and weekend travel). Although the bike path is 7 km long, the average distance from homes in the subdivision to downtown is only 4 km. It is expected that 50% of users would have otherwise driven. Average vehicle emissions are 0.000277 tCO_2e/km. Number of bike path users per year = 80 trips/day * 365 days/year = 29,200 Vehicle kilometres avoided per year = 29,200 * 8 km round trip * 50% = 116,800 km GHG emissions reductions per year = 116,800 km * 0.000277 tCO_2e/km = 32.4 tonnes CO_2e

Information sources/links	▪ Better Environmentally Sound Transport, a BC organization dedicated to advancing sustainable transportation: www.best.bc.ca ▪ Victoria Transport Policy Institute, providing research and information on a variety of transportation topics: www.vtpi.org ▪ http://www.bicyclinginfo.org/bikecost/step1.cfm A tool to estimate demand for new bike paths.

4.4 Water and wastewater projects

Water supply and treatment, and wastewater collection and treatment, use significant amounts of energy, which in turn leads to GHG gas emissions.

The methodology below is appropriate for projects that reduce water and wastewater flow in existing infrastructure and buildings.

Where projects upgrade or replace water system equipment with more energy-efficient equivalents (such as new pumps), the feasibility work for upgrades should have identified and quantified likely electricity savings or electricity requirements of the new equipment (the latter can then be compared against known current energy use). These electricity savings can then be directly used to estimate emissions reductions by multiplying them by the GHG factor for electricity (0.000022tCO_2e/kWh).

New water supply, wastewater collection or treatment facilities would have to be compared against a baseline, which would be current industry standard practice or energy performance of alternatives being considered (e.g. through a feasibility study of options). Given the highly varied nature of water treatment systems, a benchmark figure for standard practice is not provided here. Unless an engineering study is available to compare the proposed project with a base case, it may not be possible to calculate relative emissions reductions arising from new water infrastructure.

Decomposition of organic materials in sewage also leads to GHG emissions. CO_2 arising from this process is not counted towards emissions inventories, since it is the inevitable result of the decomposition of organic wastes[34]. Under anaerobic conditions, methane is also produced. Methane can be captured and burned. Nitrous oxide can also be produced as a result of the decomposition of sewage. Where possible, local governments should identify and report these emissions sources (particularly whether methane will be captured from anaerobic digesters). However, this draft of the guide will not provide further guidance on methane and nitrous oxide emissions from wastewater treatment.

Project Category	**Water and Wastewater**
Project type	Reducing water flow in the water system and in buildings. Projects of this type include: ▪ Repair of leaks and other water conservation measures in the water supply system ▪ Low-water appliances in buildings (either existing or retrofit), such as low-flow toilets, low-water use taps ▪ Water meter programs
Description	Water supply and wastewater treatment both involve the use of energy, particularly to pump water through the system. A reduction in the volume of water passing through a supply/collection and treatment system will lead to a reduction in energy use, and hence a reduction in GHG emissions.
GHG sources	Electricity

Information required	▪ Expected reductions in water and wastewater flow (in m^3) arising from the water use reduction measures ▪ Energy use for water supply and treatment as well as from wastewater collection and treatment systems (e.g. can be found through electricity bills).
Calculation methodology	GHG reduction is calculated based on the estimated reduction in water and wastewater flow, and the resulting reductions in electricity use.
Calculations	Water electricity savings = expected reductions in flow (m^3 per year) * electricity use in water supply system (kWh) Wastewater electricity savings = expected reductions in flow (m^3) * electricity use in wastewater treatment system (kWh) Therefore total GHG emission reductions: =(Electricity savings from water supply + electricity savings from wastewater treatment) * GHG factor for electricity.
Notes	If there is locally available data on electricity used in the water supply/collection and treatment, this should be used. Only if this is not available should the benchmark data be used. Many water conservation measures will also result in an equivalent reduction in wastewater (e.g. low-flow toilets or showers). However, some measures, such as reducing lawn irrigation, will not result in any wastewater flow reduction if the water does not go into the sewer system. Areas using septic fields would also fall into this category. Where this is the case, only GHG reductions from the water supply should be calculated.
Example	A new water-metering program is expected to reduce water consumption by 30%, and wastewater flows by 15%. Total water consumption is currently 5,000,000 m^3/year and total wastewater flow is 3,000,000 m^3/year. The local government has calculated its energy use for water supply and treatment to be 0.40 kWh/m^3 and for wastewater collection and treatment to be 0.30 kWh/m^3. The GHG factor for electricity is 0.000022 tCO_2e/kWh. Water electricity savings = 5,000,000 m^3 per year * 30% * 0.40 kWh/m^3 = 600,000 kWh per year Wastewater electricity savings = 3,000,000 m^3 per year * 15% * 0.30 kWh/m^3 = 135,000 kWh per year Water electricity savings + wastewater electricity savings = 735,000 kWh per year Therefore total GHG emission reductions from this project = 735,000 kWh x 0.000022 tCO_2e/kWh (GHG electricity emissions factor) = 16.2 tonnes CO_2e per year

Information sources/links	▪ http://epa.gov/watersense/pubs/guide.htm A guide produced by the United States Environmental Protection Agency to help develop water conservation plans. ▪ www.waterdsm.org A project of the POLIS Project on Ecological Governance at the University of Victoria that provides research and analysis on water conservation measures. ▪ http://www.nationalbenchmarking.ca A project that enables Canadian municipal water and wastewater utilities to measure, track and report on their water utility performance.

Endnotes

[1] BC Climate Action Charter: http://ubcm.ihostez.com/content/pdfstorage/27805820A3714D389CFBE558FC06F7B9-ClimateActionCharter.pdf
[2] Figure estimated by the Community Energy Association, based on Environment Canada's 2004 emissions data for British Columbia.
[3] BC Ministry of Environment and Climate Action Secretariat 2007. The British Columbia GHG Emissions Profile. Victoria.
[4] [4] This 5km figure is used by the Ministry of Transportation as a rule-of-thumb for planning. It is consistent with data recently collected in Metro Vancouver as part of the University of British Columbia's Cycling in Cities project.
[5] http://www.kelowna.ca/CM/Page1057.aspx
[6] Environment Canada, National Inventory Report 1990-2005, Annex 12. Based on residential & commercial/institutional use. http://www.ec.gc.ca/pdb/ghg/inventory_report/2005_report/a12_eng.cfm#a12_1
[7] Environment Canada, National Inventory Report 1990-2005, Annex 12. Based on residential use. http://www.ec.gc.ca/pdb/ghg/inventory_report/2005_report/a12_eng.cfm#a12_1
[8] Environment Canada, National Inventory Report 1990-2005, Annex 12.: http://www.ec.gc.ca/pdb/ghg/inventory_report/2005_report/a12_eng.cfm#a12_1
[9] US EPA Guidance on estimating vehicle GHG emissions Environment Canada, National Inventory Report 1990-2005, Annex 12. Based on Tier 1 light duty vehicles.: http://www.ec.gc.ca/pdb/ghg/inventory_report/2005_report/a12_eng.cfm#a12_1
[10] US EPA Guidance on estimating vehicle GHG emissions Environment Canada, National Inventory Report 1990-2005, Annex 12. Based on Advanced control heavy duty vehicles.: http://www.ec.gc.ca/pdb/ghg/inventory_report/2005_report/a12_eng.cfm#a12_1
[11] The benchmarks for existing buildings in BC have been estimated using data from NRCan's 2005 survey of commercial and institutional energy consumption. http://oee.nrcan.gc.ca/Publications/statistics/cices05/index.cfm
[12] This figure is an estimate, partly based on the overall share of single occupancy vehicle trips as a proportion of total trips, which is 75% http://www12.statcan.ca/english/census01/products/analytic/companion/pow/bycar.cfm. However, it is thought likely that disproportionately more cyclists are shifting out of transit, rather than out of single occupancy vehicles. Although it is difficult to confirm this, a conservative assumption of 50% is recommended.
[13] Note that the BC median commuter distance is only 6.4km http://tinyurl.com/22jdad
[14] This 5km figure is used by the Ministry of Transportation as a rule-of-thumb for planning. It is consistent with data recently collected in Metro Vancouver as part of the University of British Columbia's Cycling in Cities project.
[15] NRCan Canadian Vehicle Survey 2005: http://oee.nrcan.gc.ca/Publications/statistics/cvs05/introduction.cfm?attr=0
[16] Electric Power Research Institute, 2002. *Water & Sustainability (Volume 4): U.S. Electricity Consumption for Water Supply & Treatment—The Next Half Century*. Available from www.epri.com Provides average figures for the US, which are likely similar to that in Canada
[17] Average BC residential water use in 2004, from Ministry of Environment: http://www.env.gov.bc.ca/soe/et07/03_fresh_water/water_use.html
[18] Electric Power Research Institute, 2002. *Water & Sustainability (Volume 4): U.S. Electricity Consumption for Water Supply & Treatment—The Next Half Century*. Available from www.epri.com Provides average figures for the US, which are likely similar to that in Canada

[19] Community Energy Association (2007) *Heating our Communities: renewable energy guide for local governments in British Columbia*. Vancouver. Available from www.communityenergy.bc.ca
[20] Biomass consumption is considered to incur no net GHG emissions: http://www.ghgreporting.gc.ca/GHGInfo/Pages/page15_c2.aspx#s24
[21] BC Hydro – Standing Offer Program (http://www.bchydro.com/info/ipp/ipp51323.html) and Net Metering Program (http://www.bchydro.com/info/ipp/ipp8842.html). For information about how local governments can establish renewable electricity projects and utilities, see the Community Energy Association's *Utilities and Financing: a module of the renewable energy guide for local governments in British Columbia*.
[22] Calculations based on RETScreen analysis, using climate data from Abbotsford and real solar PV system product data. RETScreen is freely available at www.retscreen.net
[23] Figure provided by Green Buildings BC for Local Governments.
[24] The Model National Energy Code for Buildings is a model energy code published by the National Research Council Canada. It was released in 1997 and has not been updated since.
[25] ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings is an internationally recognized energy efficiency standard produced by the American Society of Heating, Refrigerating and Air-Conditioning Engineers.
[26] Guidance on conducting bicycle counts is available from the Ministry of Transportation, in section seven their guidelines for completing an application to the Cycling Infrastructure Partnership Program: http://www.th.gov.bc.ca/popular-topics/cycling/cipp/Documents/CIPP_Guidelines.pdf
[27] In BC, bike share of total trips is 2% http://www12.statcan.ca/english/census01/products/analytic/companion/pow/ftorbike.cfm.
[28] New Zealand guidance on estimating bike path demand http://www.landtransport.govt.nz/road-user-safety/walking-and-cycling/cycle-network/chapter7.html
[29] http://www.fhwa.dot.gov/tfhrc/safety/pubs/vol1/Contents.htm
[30] UK guidance on estimating local demand for greenways: http://www.countryside.gov.uk/LAR/Recreation/Greenways/GreenwaysHandbook/SECTION2/Step3AssessingDemand/GreenwayDemandInTheLocalContext/index.asp
[31] Australia guidance on estimating bike path demand: http://www.austroads.com.au/documents/418_AP_R194_1.pdf
[32] This figure is an estimate, partly based on the overall share of single occupancy vehicle trips as a proportion of total trips, which is 75% http://www12.statcan.ca/english/census01/products/analytic/companion/pow/bycar.cfm. However, it is thought likely that disproportionately more cyclists are shifting out of transit, rather than out of single occupancy vehicles. Although it is difficult to confirm this, a conservative assumption of 50% is recommended.
[33] This 5km figure is used by the Ministry of Transportation as a rule-of-thumb for planning. It is consistent with data recently collected in Metro Vancouver as part of the University of British Columbia's Cycling in Cities project.
[34] See IPCC guidance on wastewater treatment CO_2 emissions for inventory purposes: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.htm

Agenda Item 6.1(b)

Legislature paves way for UBC to issue tickets

BY RICHARD J. DALTON JR., VANCOUVER SUN OCTOBER 7, 2009

Dan Barbour won a class-action suit against UBC earlier this year when the university towed his car for four unpaid parking tickets worth $200. The provincial legislature has introduced legislation that would allow the University of BC and other universities to keep millions of dollars in parking fines the B.C. Supreme Court had ruled were illegally collected.

Photograph by: Mark van Manen, Vancouver Sun

VANCOUVER - The provincial legislature has introduced legislation that would allow the University of BC and other universities to keep millions of dollars in parking fines the B.C. Supreme Court had ruled were illegally collected.

The court had ruled in March that UBC lacked the power to issue parking fines.

The matter began in 2004 after the university towed the car of Vancouver accountant Dan Barbour, claiming he had $200 in outstanding parking tickets. Barbour launched a class-action lawsuit in 2005, arguing the University Act didn't give UBC the authority to issue parking tickets.

A B.C. Supreme Court judge ruled in March that UBC, as a property owner, could recover the cost of towing and stowing illegally parked cars. But it also ruled UBC could not issue parking tickets.

The legislation, introduced Wednesday, would allow universities to issue parking tickets.

Advanced Education Minister Moira Stilwell said the legislation is "a repair of a gap," as the province had intended universities to have the power to issue parking tickets.

Stephen Owen, UBC's vice-president for external, legal and community relations, said universities must have the power to regulate parking to prevent cars from blocking traffic.

Under the legislation, previously issued tickets would still be valid, so universities would not have to provide refunds to the victors of the UBC lawsuit.

Sharon Matthews, Barbour's lawyer, issued a statement on his behalf.

"With one sweep of a pen, the government purports to take away the rights that Dan Barbour and the class members had to fight for in court," the statement said. "The result is that the B.C. government is protecting UBC from the consequences of UBC's unlawful conduct.... Retroactive legislation is bad legislation."

Stilwell said students would suffer if the university had to repay the fines.

"In general, we are always leery of retroactive legislation," she said. "But in this case ... it's in the public interest."

Robert Holmes, president of the BC Civil Liberties Association, said the retroactive application of the law is "unconscionable."

"What kind of government would use their legislative power to do something like that after due process has been followed in a court system?" he asked. "They should be ashamed of themselves."

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Agenda Item 6.1(c)

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NEWS RELEASE

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Ministry of Housing and Social Development
Ministry of Forests and Range

SEISMIC TEST VERIFIES MID-RISE WOOD BUILDING SAFETY

VICTORIA – A unique earthquake simulation has shown that taller wood-frame buildings can perform safely in a major earthquake, Minister of Housing and Social Development Rich Coleman and Forests and Range Minister Pat Bell announced today.

"This was a unique and exciting opportunity for British Columbia," said Coleman. "This leading-edge research provides key information about how mid-rise, wood-frame buildings would perform in earthquakes, so the Province can continue to maintain high standards of safety for homes for British Columbians."

"This shake test also proved to building officials around Asia-Pacific that larger wood-frame construction is resilient to earthquakes," said Bell. "In particular, the market for wood continues to grow in China as they realize that B.C. forest products and design can help build safer housing for millions of residents in earthquake zones."

Earthquake engineering researchers examined the seismic performance of a full-size, six-storey wood building on the world's largest shake table at a facility in Miki City, Japan. The structure was built from B.C. forest products using construction techniques commonly used in Canada.

The research project simulated ground shakings modelled on the Northridge earthquake, which caused major damage in the Los Angeles area in 1994. The strongest test simulated an earthquake expected to occur once every 2,500 years. The building was shaken for about 40 seconds with a force stronger than both the 1995 Kobe and 2001 Seattle earthquakes.

In April 2009, the Province increased the maximum allowable height of wood-frame residential buildings from four to six storeys. The positive test results showed that additional seismic risks in six-storey wood-frame construction can be managed with proper designs. They also support the specific design requirements for mid-rise wood-frame residential buildings in the B.C. Building Code for seismic safety.

The project was led by the Network for Earthquake Engineering Simulation, a group of 15 university labs across the U.S. working together on earthquake engineering research and education to reduce earthquake risks. Lumber and panelling used to build the test structure was provided by Forestry Innovation Investment, the Province's international marketing agency for B.C. forest products. FPInnovations-Forintek, Canada's largest wood products research centre, provided technical advice on the project.

Video of the shake table test is available in the Ministry of Forests and Range's media room http://www.for.gov.bc.ca/pab/media/, as well as on the Ministry of Housing and Social Development website at http://www.hsd.gov.bc.ca/video/wood_shake.html.

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A backgrounder follows.

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BACKGROUNDER

September 18, 2009

Ministry of Housing and Social Development
Ministry of Forests and Range

NETWORK FOR EARTHQUAKE ENGINEERING SIMULATION

The Network for Earthquake Engineering Simulation Wood Project (NEESWood) studies the seismic performance of wood-frame buildings. The first phase, completed last year, involved testing a full-size, two-storey building using a device called a shake table to simulate an earthquake. The third and final phase this year involved testing a full-size, six-storey building on a larger shake table. The Province provided $75,000 to this final phase of the NEESWood project.

Researchers gathered information about how the building performed in the mock earthquakes during the first phase and used it to develop computer simulations for wood-frame buildings. That computer modelling was refined over several months and then applied to the design of six-storey wood-frame buildings. Those findings and approaches were then verified by the major test in mid-July.

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