Using Radiance in an Integrated Design Process: Stantec Case Studies

Max Richter
Stantec Architecture

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Washington state could soon be on a different time than B.C.

The U.S. proposes to extend daylight saving time by two months

BY BRAD TADELT
VANCOUVER SUN

British Columbians might need to adjust their watches the next time they drive into Washington state.

On Tuesday, the U.S. Congress passed a provision to extend daylight saving time by two months as part of a sweeping national energy plan. The change is intended to curb energy use by cutting back on artificial lighting in the evening.

If U.S. President George W. Bush signs the bill, daylight saving time will begin the first weekend in March, instead of April, and run through to the last weekend in November, instead of October.

B.C. Energy Minister Richard Neufeld, who will oversee a provincial review of the issue, said there are pros and cons for following suit in B.C.

“[energy] savings, but it was marginal,” Moreno said, noting that energy-saving fixtures have already cut consumption in B.C.

Moreno also said extended daylight saving time would not affect energy consumption spikes, which typically happen in January in B.C.

For Vancouver traders it will be business as usual, according to Michael Bernard, spokesman for the B.C. Securities Commission.

“I think it’s a fact of life for people on the West Coast that we’re marching to the clock of another, and so I don’t see it having an enormous impact out here,” Bernard said. “What it does back [East] is another matter.”

The Toronto Stock Exchange opens and closes with the New York exchange and Ontario Premier Dalton McGuinty has already said his government is looking closely at the implications of a time change.

“We’re not anxious to have a disconnect between us and our chief trading partner. We’ll have to make an assessment as to whether or not it is in our interest,” he said.

Gillian Bentley, spokeswoman for WestJet airlines, said a north-south time zone split will be a headache for North American travellers.

The time change could also disrupt flight schedules that work around local noise restrictions, hours, Bentley said.

Most areas in B.C. adopted daylight saving time when it was legislated by the federal government in 1918 as a way of reducing energy consumption. Parts of the Peace River district, however, do not “fall back” or “spring forward” because of opposition from the agricultural community.

woman for BC Hydro, said a similar time change in B.C. would likely not have the same benefits.

“There is some indication that operating on daylight saving time year-round could produce some

1. Ecological Concerns
2. Stantec Profile
3. Daylighting tools
4. Case Studies
5. Conclusions

Turn Off the Lights!
US Government plans to extend daylight savings by two months a year.
The country will save 100,000 barrels of oil a day or 1% of national consumption through reducing artificial lighting in the evening.

Source:
(The Vancouver Sun, 21 July 2005)
Consumer Awareness
Increasing mainstream media coverage of North American energy concerns will result in increased demand for sustainable and renewable energy options in building design.

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(National Geographic, August 2005)
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Source:
(National Geographic, August 2005)
It’s not my fault

Between 1990 - 2003:
Energy consumption in Canada increased 22%

GHG emissions increased 23%

Buildings are responsible for ~30% of national energy consumption in Canada.

Buildings are responsible for 30% of GHG production in the Canada

There are ~1.8 hectares of land per capita in the world to meet our needs to survive.

Canada’s Ecological Footprint (2001): 6.4 Ha

Source:  
(Natural resources Canada, www.oee.nrcan.gc.ca)
Energy Use In Buildings


The goal is not just to reduce the size of the individual slices, but to reduce the size of the pie itself.

Lighting is the end use with the greatest potential for energy conservation.

Source:
Stantec
Canadian-based, North American professional design and consulting services firm

Publicly traded company

> 4500 employees across North America

51 years of profitability

Vancouver office
244 Staff
Architects, Engineers (M/P/E/S/C), Interior Designers and Project Managers
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Desktop Radiance

Daylighting Software

Desktop Radiance Modeled in Form-Z
Imported into AutoCAD R14 with Desktop Radiance plug-in

IES <Virtual Environment>
Modeling, simulation and analysis in IES VE
<table>
<thead>
<tr>
<th><strong>Software Package</strong></th>
<th>Radiance IES, ModellIT</th>
<th>Desktop Radiance, AutoCad R14, FormZ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Import 3D models</strong></td>
<td>No (2D DXF only)</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Modeling</strong></td>
<td>Easy for simple forms; very basic modeler</td>
<td>Can use other software to create complex geometries</td>
</tr>
<tr>
<td><strong>File management</strong></td>
<td>Clean</td>
<td>Confusing and intensive</td>
</tr>
<tr>
<td><strong>Integrated Design</strong></td>
<td>Very easy; 1 model</td>
<td>Model cannot be used by other simulation tools</td>
</tr>
<tr>
<td><strong>Software Support</strong></td>
<td>Training and support through IES</td>
<td>Yahoo web forum only</td>
</tr>
<tr>
<td><strong>Software Stability</strong></td>
<td>Seems very stable</td>
<td>Crashed occasionally</td>
</tr>
<tr>
<td><strong>Ease of Use</strong></td>
<td>Quick learning curve</td>
<td>Complicated</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>$$$</td>
<td>Free; requires AutoCad</td>
</tr>
</tbody>
</table>
Seymour-Capilano Water Filtration Project

$300 million infrastructure project

Operations and Maintenance Centre (3200 sq. m.) is targeting LEED Gold

Project Completion in 2007

Modeled building in Form-Z for export to desktop radiance

Transparency and views key design drivers

Set to achieve 2% daylight factor in 80% of building area
Seymour-Capilano Water Filtration Project
21 August - 1200 - Clear Sky - standard curtain wall sunscreen
Seymour-Capilano Water Filtration Project
Section through Control Room and Labs
Seymour-Capilano Water Filtration Project
21 December - 1200 - Clear Sky - light shelf only
Seymour-Capilano Water Filtration Project
21 December - 1200 - Clear Sky - light shelf only
Seymour-Capilano Water Filtration Project
21 December - 1200 - Clear Sky - extended light shelf with lower blinds
Daylight Dilemma in Hospitals

Hospital Authorities greatest life cycle cost is the combined cost of employees (salary, productivity, churn, benefits, etc.)

Healthcare workers spend the majority of their day in artificially lit spaces

Nurses have 40% fewer errors when working in daylit spaces

Medical errors cause 23,000 deaths/year in Canada
Daylight Dilemma in Hospitals

3 typical daylit configurations in diagnostic and treatment wards:

Articulated blocks
Wings of light
Plan enclosed courtyard

Plan enclosed courtyard is the most functional because of flexibility and no dead ends

Based on 30 ft x 90 ft courtyards and 30ft grid

Increased construction cost of $7.50/ sf | $80/ sm is recovered in 3 years based on employee productivity gains

48, 600 SF - 47% of floor space within 15 ft of glazing

3 Green Guide for Healthcare Points

Daylight in Diagnostic and Treatment Rooms - New Hospital - Vancouver, BC
Comparison of GGHC, LEED-Canada and LEED-NC 2.1
• 30’ x 90’ courtyard
• 3 floors @ 15’ fl. to fl.
• 15’ band of offices/exam rooms
• 8’ corridor on one end
Readings taken at nodes of 6’-4” x 11’4” grid, excluding nodes in the courtyard
... material properties

Walls 50% reflectance (something white)

Glazing 70% transmittance (clear)

Ceilings 85% ref.

Floors 30% ref.
35.3% LEED-NC 2.1 32.4%
55.9% LEED CANADA-NC 1.0 41.2%
... effect of a fully glazed roof

35.3% LEED-NC 2.1 32.4%

55.9% LEED CANADA-NC 1.0 38.2%
... effect of increased floor-to-floor height at noon

![Diagram showing 15' height on the left and 18' height on the right]
... effect of increased floor-to-floor height in the early morning
... effect of a fully glazed end corridor on all floors

![Diagram showing the effect of a fully glazed end corridor on all floors with LEED-NC 2.1 and LEED CANADA-NC 1.0 ratings.]
... effect of orientation of the fully glazed end corridor

<table>
<thead>
<tr>
<th>Orientation</th>
<th>LEED-NC 2.1</th>
<th>LEED CANADA-NC 1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>55.9%</td>
<td>32.4%</td>
<td></td>
</tr>
<tr>
<td>64.7%</td>
<td>27.9%</td>
<td></td>
</tr>
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</table>
Children Development Centre - Calgary, Alberta
3 options - Stantec peer review
Option 1
Total floor area: 13068 m²
Glazing percentage: 29%

LEED Canada Credit 8.1
43.4% of floor area > 250 lux
(September 21 - 1200 - clear sky)

Total Energy: 102.5 kWh/m²
Peak Heating: 2202.6 kW
Peak Cooling: 459.2 kW

Children Development Centre - Calgary, Alberta
3 options - Stantec peer review
Option 2
Total floor area: 12420 m²
Glazing percentage: 29%

LEED Canada Credit 8.1
59.6% of floor area > 250 lux
(September 21 - 1200 - clear sky)

Total Energy: 104.5 kWh/m²
Peak Heating: 2220.0 kW
Peak Cooling: 548.4 kW
Option 3
Total floor area: 13230 m²
Glazing percentage: 29%

LEED Canada Credit 8.1
53.5% of floor area > 250 lux
(September 21 - 1200 - clear sky)

Total Energy: 98.0 kWh/m²
Peak Heating: 2058.5 kW
Peak Cooling: 509.7 kW

Level 1

Children Development Centre - Calgary, Alberta
3 options - Stantec peer review
<table>
<thead>
<tr>
<th>Total Energy (kWh/m²)</th>
<th>Daylight (&gt; 250 lux)</th>
<th>Peak Heating/Cooling (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>102.5</td>
<td>43.4%</td>
<td>2202.6/459.2</td>
</tr>
<tr>
<td>104.5</td>
<td>59.6%</td>
<td>2220.0/548.4</td>
</tr>
<tr>
<td>98.0</td>
<td>53.5%</td>
<td>2058.5/509.7</td>
</tr>
</tbody>
</table>

Children Development Centre - Calgary, Alberta
3 options - Stantec peer review
Vancouver Community College - New Building - Vancouver, BC
Daylighting Studies during schematic design
Vancouver Community College - New Building - Vancouver, BC
August 21 - 1500 - Clear Sky