



REPORT TO

CORPORATE SERVICES, STRATEGIC PLANNING AND PROPERTY COMMITTEE

PASSIVE COOLING FOR SCHOOLS WITHOUT AIR CONDITIONING (ALL WARDS)

*"I can do all this through Him who gives me strength."
Philippians 4:13 (NIV)*

Created, Draft	First Tabling	Review
March 17, 2016	May 12, 2016	
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INFORMATION REPORT		

Vision:

At Toronto Catholic we transform the world through witness, faith, innovation and action.

Mission:

The Toronto Catholic District School Board is an inclusive learning community rooted in the love of Christ. We educate students to grow in grace and knowledge and to lead lives of faith, hope and charity.



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A. EXECUTIVE SUMMARY

This report provides information for passive cooling strategies which can be implemented in schools that are not equipped with any form of air conditioning.

B. PURPOSE

1. Arising from the October 2015 Corporate Affairs meeting, staff were directed to provide a report on passive cooling strategies which could be implemented to provide a more comfortable classroom environment in the months of May, June and September in schools that are not equipped with air conditioning.

C. BACKGROUND

1. On March 8, 2006 a report was presented to Administrative and Corporate Services Committee which recommended active and passive strategies to cool classrooms during the warmer periods of the school year, typically May, June and September. The report summarized the number of days during the school year when air conditioning is required based on information from Environment Canada. The basic requirements are when the temperature and/or humidex exceed 30 degrees Celsius.
2. The basic factors affecting human comfort during warm weather are temperature and relative humidity. During the summer months we often hear about temperatures being greater than 30 degrees Celsius with the humidex. The term humidex is an index developed by Canadian Meteorologists to describe how hot the weather feels to the average person by combining the outdoor ambient temperature and the relative humidity of the air. Environment Canada describes the effect of humidex as follows:
Range of Humidex: Degree of Comfort
 - Less Than 29: No Discomfort
 - 30 To 39: Some Discomfort
 - 40 To 45: Great Discomfort; Avoid Exertion
 - Above 45: Dangerous; Heat Stroke Possible
3. The following information (obtained through Environment Canada) summarizes the number of days where the ambient outdoor temperature is greater than 30 degrees Celsius and number of days where the humidex is greater than 30 degrees Celsius for the months of May, June and September 2010 to 2015.

Environment Canada Historical Weather Data

Year	Month	Number of Days Above 30C	Number of Days Humidex >30 C	Percent of School Year
2010	May	1	5	
2010	June	1	7	
2010	September	2	1	
Total		4	13	6.7%
2011	May	0	0	
2011	June	1	4	
2011	September	1	2	
Total		2	6	3.1%
2012	May	0	2	
2012	June	1	8	
2012	September	1	5	
Total		2	15	7.7%
2013	May	0	2	
2013	June	2	4	
2013	September	2	2	
Total		4	8	4.1%
2014	May	1	0	
2014	June	0	4	
2014	September	0	3	
Total		1	7	3.6%
2015	May	0	0	
2015	June	0	3	
2015	September	3	11	
Total		3	14	7.2%
Six Year Average		Average no. of days Temp > 30 degC	Average no. of days humidex >30 degC	Average % of school days *
		2.7	10.5	5.4%
* based on a 194 day school year using humidex				

4. In December 2015 staff provided a status update of the Board Energy Plan 2013-2018. From 2011 to 2014 the Board has reduced our electricity consumption by 12% through the implementation of efficient lighting and equipment, BAS technologies and occupant awareness. During that same period the Board has paid approximately 8% more for electricity in 2014 than it did in 2011 due to rising electricity costs.
5. As part of the Board's Energy Conservation Strategy, the Board has adopted a temperature set point standard of 25 degrees Celsius in buildings equipped with mechanical cooling.
6. The following passive cooling strategies can be implemented at every school to reduce heat gain:

Low Cost Measures

- Turning off or minimizing the use lights and heat generating equipment during school hours.
- Shading windows with the use of film or shades to reduce solar heat gain.
- Operate exhaust and mechanical ventilation units (where applicable) overnight to flush out heat from the building. This is known as free cooling.

Low to Medium Cost Measures

- Planting trees along the south and west façade to shade the building.
- Install ceiling or portable fans in the classrooms for evaporative cooling
- Reducing the amount of heat retaining surfaces where possible such as asphalt around the school.
- Increase the roof insulation R values when undertaking new roofing projects. The incremental cost for the extra insulation would be considered medium.

High Cost Measures

- Explore feasibility of installing white roofs during roof replacement. This will reduce the heat absorbed into the building. This type of roofing system is more expensive than a typical roofing system.

- Explore the feasibility of green roofs, though existing schools are not typically designed to support the additional loading. High capital and maintenance costs are associated with this measure. This measure is not currently supported by Ministry of Education funding.
 - Addition of solar panels will reduce the amount of heat absorbed. Staff are investigating options for installation of rooftop solar panels.
 - For window projects (replacement or new construction), investigate installation of windows equipped with operable ventilation sections to increase air flow into rooms. Currently the Board adopts the City of Toronto Municipal code for Property Standards – Chapter 629 where operable windows are limited to a 100mm opening.
7. Active (or mechanical) cooling measures such as portable AC units have been suggested for use in classrooms on hot weather days but are generally not recommended due to the following:
- increased energy consumption,
 - security (intake and discharge vents need to be fitted into an operable window),
 - added maintenance,
 - additional electrical loading (most of our older schools do not have adequate power), and
 - operating schedule (risk of units left running overnight when the building is unoccupied).
8. Another mechanical cooling strategy is the creation of cooling centres in elementary schools that are not air conditioned. This would involve the installation of variable refrigerant type (VRF) air conditioning systems in a large zone such as a library or multi-purpose room where groups of people could congregate for temporary relief during a hot school day. The typical cost to install this type of air conditioning system would be approximately \$70,000 per school, not including any related asbestos abatement. Currently we have approximately 158 schools that are not air conditioned, therefore the installation of cooling centres in each of our elementary schools would require a total estimated budget of \$11M. This initiative would also result in increased annual maintenance and utility (hydro) costs.

D. EVIDENCE/RESEARCH/ANALYSIS

1. The purpose of passive cooling is to reduce the amount of heat that is gained and stored in a building, using little to no energy. Techniques are primarily derived from the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE).
2. Previous Board reports and consultations related to the subject matter include:
 - Air Conditioning Requests at Various Schools (March 8, 2006)
 - Indoor Air Quality and Comfort Concerns (May17, 2006)
 - Indoor Air Quality & Comfort Stakeholder Consultation Process (October 23, 2006)
 - Report regarding Indoor Air Quality & Comfort Stakeholder Consultation Process (June 2, 2008)
 - Indoor Air Quality & Comfort Concerns: Survey Results (June 22, 2009)

E. VISION

VISION	PRINCIPLES	GOALS
To provide a safe and comfortable classroom environment which is conducive to learning.	Fostering Student achievement and well-being as well as Stewardship of the Board's Operating and Renewal resources.	Staff to continue exploring passive cooling measures with the aim of moving towards net zero energy buildings.

F. METRICS AND ACCOUNTABILITY

1. Implementation of passive cooling measures will have minimal impact of the Board's utility expenditures. The impact can be tracked through the Ministry of Education Utility Database as well as individual school utility bills.

2. The passive measures outlined in this report support the Board's Health and Safety Heat Protocol in Schools

G. CONCLUDING STATEMENT

This report is provided for the information of the Board.