“Heat!” – testing design approaches to mitigate excessive heat exposure for vulnerable populations in Toronto apartment buildings

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Synopsis

As climate changes, excessive summer heat will impact Torontonians, especially residents in older, high-rise buildings. Toronto Public Health proposes outdoor cooling centres as a strategy for heat mitigation. To assist municipal policy development, researchers documented issues on film, students designed cooling centre prototypes, and community members provided feedback on design proposals.

From Toronto Public Health, 2012 …
“Toronto can expect an almost five-fold increase in three-day heat waves and an increased risk of more severe or prolonged heat events by 2050, as a result of climate change. It is estimated that current heat conditions contribute to an average of 120 premature deaths per year in Toronto. Average annual heat-related deaths could double by 2050 and triple by 2080.”
(Toronto Environment Office, 2012.)

From CBC Radio, August 2016 …
Interviewer: “You did mention the fact that the federal government is developing a national housing strategy to look at affordable housing. How specifically would you like to see tenants' cooling needs addressed in that strategy?
Tracy Heffernan: “Well, I think as soon as you talk about the right to adequate housing, you're talking about the right to live in housing that is habitable. If people are dying, or their health is being compromised, this is not habitable housing.
(Robyn Bresnahan, ‘Air Conditioning as a human right?’ *The Current,* CBC Radio One. 22 August 2016.)

1. Introduction: Toronto’s high-rise landscape in the face of climate change

Toronto’s post-war landscape changed dramatically with the construction of modern high-rise residential apartment towers across the city in the period from the early 1950s into the 1970s. As a consequence, Toronto contains the second highest number of high-rises in North America (defined as a building of 12 stories and higher). (Stewart 2016) Many of these towers are found in Toronto’s inner suburbs. Home to diverse communities, these towers are located in neighbourhoods that show trends towards increased poverty, isolation, lack of economic opportunity, social need and health risks. (United Way Toronto 2018) Most of these towers lack centralized cooling plants and during periods of extreme heat in the summer, residents experience inordinate discomfort. Outdoor cooling centres offer the possibility of providing residents respite during periods of extreme heat. A research project undertaken by Ryerson University in association with Toronto Public Health explored the potential of outdoor cooling to address this issue. This paper presents findings and opportunities arising from this research.

2. Context and Background

2.1 Climate change, extreme heat and public health

The World Health Organisation estimates that the warming and precipitation trends due to anthropogenic climate change of the past 30 years have already claimed over 150,000 lives annually. (Patz et al. 2005) In the USA, since 1998, heat waves have resulted in more weather-related fatalities annually than any other natural disasters, estimated at 400 deaths per year. (United States Department of Commerce, n.d.) Heat wave effects may increase in the near future as the result of global climate change. (Cubasch et al. 2001) There has been an extensive review of the potential health effects of climate change. (Haines et al., 2004; Patz et al. 2005; Patz et al. 2006; McMichael et al. 2006; Haines et al. 2006, Ebi et al. 2006) The effects of heat, include benign disorders (fainting, sweating or hyperventilation), more acute responses (nausea, vomiting or weakness) and, most serious, heat-stroke, which can lead to renal failure and profound physiologic derangements, with a high fatality rate. (Frumkin et al. 2008) Risk factors for developing heat stroke or dying during a heat wave, including being elderly, having certain diseases, and living on upper floors. (Kilbourne et al. 1982) Poverty and minority race or ethnicity are also risk markers. (Semenza et al. 1996)

While heat-related mortality has historically been important, it remains an underestimated public health problem. (Bernard and McGeehin, 2004, p. 1520) Public health practitioners advocate the necessity of a public health approach to climate change. They argue that proactive measures need to be taken to address the impact of climate change on health.(Frumkin et al. 2008) Principal concerns include illness and fatalities related to severe weather events and heat waves, and require both primary and secondary prevention measures. Mitigation and adaptation are key to this approach. Public health practitioners are mobilizing community partnerships and actions to address this issue, developing policies and plans to support their efforts and engaging with other disciplines to research and develop innovative solutions to health problems related to climate change. (Frumkin et al. 2008) Health professionals are turning to planners, urban designers, architects and landscape architects, who can play a leading role in this matter.

Greater collaboration between architect, planners and health promoters would support the overall improvement of the health of the public in the face of climate change. This paper addresses the question of mitigating the impacts of excessive heat through architectural and site planning measures, aided by policies that are embedded in both coordinated planning and public health initiatives in order to adapt our environments to anticipate heat stress resulting from excessive heat and long-duration heat waves. Specifically, activities in Toronto point to ways in which collaboration between public health practitioners and design and planning professionals can climate-proof urban environments.

2.2 The vulnerability of urban landscapes with climate change / the urban heat island

On warm days, urban areas can be 3 – 4 ºC warmer than surrounding areas. Dark surfaces such as pavement and rooftops that absorb heat from sunlight and reradiate it, and the absence of significant areas of vegetation, especially trees and green spaces, are causes for the urban heat island. As cities expand, the heat island increases in both scale and intensity. Continued urbanization further aggravates the heat island effect. (Frumkin 2002) The sprawling regional metropolis becomes vulnerable, where the urban heat island effect could intensify extreme climatic events. (Patz et al. 2005)

2.3 Toronto’s Changing Climate

The Greater Toronto Area (GTA), a region encompassing the City of Toronto and four regional municipalities that surround it (Durham, Halton, Peel and York), is Canada’s most populous metropolitan area. With a population of 6.4 million, it is home to 20% of the Canadian population. (Statistics Canada 2018) As a result of climate change, the region is experiencing an increase in extreme weather conditions. In 2013, Toronto suffered two severe weather events – a winter ice storm and a summer flood – that gave residents a taste of what climate change will bring. The cost was over $CAD1.3 billion, the equivalent to a one-time 51% residential property tax increase. (Toronto Environmental Alliance n.d.) In 2012, Toronto recorded its earliest ever official heatwave from June 19 – 21. This summer, as of writing in July 2018, the City has issued three extended heat warmings (temperatures greater than 31 ºC). (Toronto Public Health 2018)

Climate change prompted Toronto to undertake a review of the implications of severe weather, beginning in the early 2000s. In February 2013, Toronto City Council received the outcomes of the study, *Toronto's Future Climate*, and directed the Board of Health (BoH) to review and consider the social and health impacts as a result of increased health and extreme weather conditions. The background report indicated that between the date of the report (2013) and into the next 30 years (2040-2049), average temperatures in Toronto will increase by 4.2 ºC. Average summer temperature are predicted to increase by 2.0 ºC, and the extreme daily maximum will increase by 9.2 ºC. The report indicated that the maximum daily temperature will rise from 33 ºC to 44 ºC. The number of days greater than 33 ºC will triple from 20 to 66, and the number of heat waves (three or more consecutive days with temperatures greater than 32 ºC) will increase five-fold (from .57 to 2.53). The report addressed the impact on the City and articulated adaptation responsibilities. With regard to extreme heat, the increased summer temperatures would impact energy consumption six-fold. (Toronto Public Health, 2012)

2.4 Addressing climate change health risks for Toronto Residents

Toronto's changing climate poses health risks to Toronto residents. Particular concern is directed toward the city's older high-rise apartment buildings, constructed during the first post-war residential boom of the 1960s and 1970s.

Beginning in the early 2000s, architectural and heritage researchers drew attention to this unique architectural heritage of Toronto. Under appreciated and misunderstood, Toronto's concrete architecture represents an exciting era of cultural investment, city building, and design innovation. (McClelland & Stewart 2007) The stock of over 2000 buildings, containing 30,000 apartment units, house a significant portion of the city's population at densities as high as 350 units per hectare. (Tower Renewal Partnership 2007, *Fact Sheet*) In 2008, the reinvigoration of these buildings and their sites became an initiative of Toronto's Mayor and brought attention to the social, economic and architectural renewal of apartment neighbourhoods. (Tower Renewal Partnership 2007, *The Tower Renewal Opportunities Book*). Out of this, a collaboration of designers, planners, stakeholders, building owners, academics and interested citizens came together to form the Tower Renewal Partnership (TRP) with the objective of revalorizing Toronto's high-rise heritage. A key focus of this renewal is the development of amenities, community services and facilities, lacking in many of the apartment neighbourhoods. (McClelland et al. 2011)

In 2011, Toronto Public Health (TPH) launched *Healthy Toronto by Design,* an initiative that sought to address the major impacts of urbanization and city design on health in order to highlight and strengthen the role local governments may take in creating healthy, liveable and prosperous cities. (Toronto Public Health 2011b). As part of these explorations between health and design, TPH reported on the health of Toronto's apartment neighbourhoods. In their study, *Toward Healthier Apartment Neighbourhoods,* TPH considered how Toronto's several hundred clusters of post-war high-rise apartment buildings – labelled as apartment neighbourhoods – could better support the health of their residents and people living in the surrounding communities. Improvements to building settings – including natural environments and places for people to gather – as well as improvements to lighting and security, and programs and facilities for physical fitness were investigated. (Toronto Public Health and Centre for Urban Growth and Renewal, 2012) This initiative has led to several positive outcomes.

First, Toronto established new zoning regulations for apartment neighbourhoods. The recently-adopted Residential Apartment Commercial Zone (RAC) (City of Toronto By-law

No. 572-2014) breaks down traditional single-use zoning that historically characterized these communities. Toronto's new zoning allows for a mix of uses to complement the apartment towers, allowing for broadening uses, mixing scales of development, and permitting the development of new amenities and services. It is anticipated that these new regulations will allow for these neighbourhoods to evolve as economically diverse and lively places. (Hug et al. 2013; Stewart 2018) The impact of this bylaw has yet to be fully realized. However, it holds promise for effecting needed change in apartment neighbourhoods.

Second, detailed attention was paid to the energy consumption of these inner suburb apartment buildings. Opportunities for sustainability through retrofit, including building envelope performance, air conditioning, passive conditioning through envelope renewals, and proposals for best practices are being explored. (Tower Renewal Partnership 2007.*Thermal Comfort and Cooling in Apartment Towers*)

Third, close attention was paid to the linkages between extreme heat and attendant health risks to residents in these apartment neighbourhoods in units that do not have air conditioning. A process to explore detailed options began. (Toronto Public Health 2015b). While the City of Toronto sets minimum heat requirements in rental housing during winter months, there are currently no provisions for maximum temperatures in summer months. The City considered establishing standards for maximum heat in apartment buildings. The report, *Protecting Vulnerable People from Health Impacts of Extreme Heat,* revealed that the idea of creating regulations that would legislate a maximum heat standard presented complex challenges, including reticence on the part of apartment building owners, who believed that a majority of apartment dwellers chose not to have air conditioning and also chose not to use existing indoor cooling rooms. Further, they expressed concern that such standards would have profound negative environmental consequences in terms of exacerbating the heat island effect, as well as severely straining existing electrical systems within buildings and the local electrical grid. (Toronto Public Health 2011a) (Correspondence, GTAA to BoH, 27 November 2015)

Consequently, the City pursued alternate strategies that permit property owners to meet a maximum heat standard through the provision, at minimum, of a cool location where building occupants can go during hot weather. At the direction of the Toronto BoH, TPH worked with City departments to explore strategies to mitigate extreme heat such as onsite indoor and outside cooling spaces in and near apartment buildings. A 2015 workshop, *Extreme Heat in Multi-unit Residential Buildings,* considered potential strategies to reduce the risk from extreme heat. The creation of on-site indoor and outdoor cooling centres became one strategy that was pursued. The benefits of such centres were identified, including their potential to create positive relationships among tenants, the potential of access by multiple users at various times of the day, and the ways such spaces, if situated out-of-doors, could relate to underutilized or undeveloped green spaces adjacent to existing apartment buildings. It was contended that these cooling centres would have multiple, long-term benefits, including reduction in heat island effect and improvement of community cohesiveness and interaction. Many apartment buildings already have locations on their properties which would be ideally suited for outdoor cooling use, and residents and owners were ready to act. (Toronto Public Health 2015a, Toronto Public Health 2015b)

The creation of these on-site cooling centres also would address concerns previously identified by TPH. A 2011 survey explored the relationship of Toronto residents to extreme heat. It found that many people without air conditioning often chose to stay home, even though there was a cool place nearby, citing lack of transportation (10%) or being "too far" (14%)or the perception that such places were inaccessible at night (11%), worries about personal safety (4%) or inaccessibility for disabled persons (5%). (Toronto Public Health 2011a)

A strategy of access to cooling on site was pursued by TPH. In order to explore the design of outdoor cooling centres, in 2016 TPH partnered with Ryerson University’s Department of Architectural Science to undertake a pilot study to design prototypes for outdoor cooling centres, and receive community input on design proposals.

3. Ryerson University’s Pilot Study to Investigate Outdoor Cooling Centre Design

In late 2010, the TRP undertook a community design charrette on one property to explore practical design strategies in and around the public space of the two apartment buildings on the site that would support long-term planning of the apartment neighbourhood. (Tower Renewal Partnership 2007, *Kipling Towers Community Design Charrette)* The project engaged residents to identify opportunities for property renewal. Attention focused on public spaces, services, security and wayfinding, but the specific question of heat mitigation were not addressed. The outcomes of this charrette formed the starting point for Ryerson University’s engagement.

The project’s goal was to undertake design research on behalf of TPH. This research would aid in their work with apartment building owners and community residents to address issues of energy planning and costs through creating alternate strategies for cooling in periods of extreme heat. The pilot project was viewed as part of the larger question of infrastructure renewal aimed at high-rise housing. Mitigating impacts of extreme heat through thoughtful and considered design became a key component of the pilot project. Here is how the project unfolded.

4. Heat! Cooling spaces for high-rise places

The pilot project took place from 2016 – 2018. It focused on sites identified by TPH as case studies where prototype design interventions were to be proposed. Interventions were developed by undergraduate students in Ryerson University’s Department of Architectural Science (DAS) program in their annual Collaborative Exercise in 2017 (CEx17). Design interventions were presented to focus groups comprising building residents to elicit responses on proposed design interventions. It was anticipated that the study’s outcome would form the basis of a larger investigation leading to the development of design standards and approaches for heat mitigation in Toronto’s high-rise apartment towers. A component of the study included a documentary film on the impact of excessive heat on the quality of life of occupants in high-rise buildings. The film was conceived to provide student designers and focus group participants with an overview of the issue and featured interviews with key stakeholders and typical residents.

4.1 Ethics Approvals, Owners’ Consent, Project Funding and Research Support

Prior to the commencement of research involving human subjects (filmed interviews and community focus groups) the project underwent research ethics review. Ryerson University’s Research Ethics Board (REB) approved the film (Ryerson REB 2016-225, approved 24 June 2016) and focus groups (Ryerson REB 2016-351, approved 28 October 2016). TPH REB approved the focus group (TPH REB 2016-10, approved 17 February 2017). The owners of the apartment buildings on whose sites where prototypes were developed and where focus groups were to be held gave their consent to the use of their properties and facilities. Prior to project commencement, the author, the project’s Principal Investigator (PI) secured funding for portions of the project from the Ryerson University Centre for Urban Research and Land Development (CURLD). TPH supported the project, but was unable to provide any financial support. Funding provided support for a Research Assistant (RA) and a documentary filmmaker, a graduate student in the Ryerson University School of Image Arts (SIA), where a faculty member also assisted to advise on the film.

4.2 Site Selection

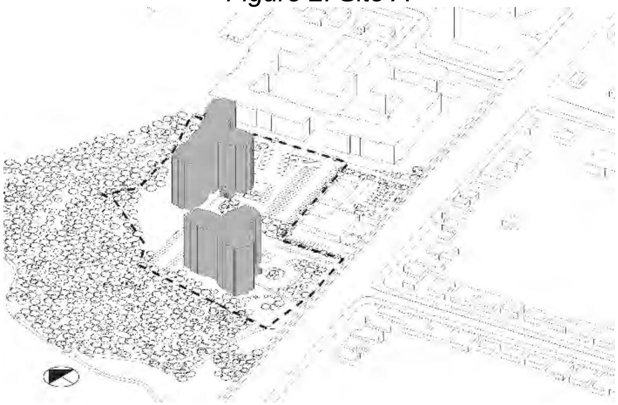
In the spring of 2016, the PI consulted with staff of the Healthy Public Policy Directorate of TPH who identified seven sites within the City as potential candidates for the development of prototypes for outdoor cooling centres. Prior to the commencement of the project, the owners and managers of buildings of these sites had expressed interest in addressing issues of extreme heat and had been actively involved with TPH. Community residents had also been active in working with the owners and building managers on this issue. TPH advised the PI that these groups would assist, as appropriate, in the implementation of the project. The sites were typical of apartment neighbourhoods located across the city. The PI researched proposed sites and obtained detailed architectural, landscape and site design information. The PI selected three sites as locations for the study based on specific criteria, including the configuration and orientation of buildings on the sites, and the availability of locations on each site for outdoor cooling centres. The property owners confirmed agreement to utilize these sites for this study. For reasons of privacy and out of respect for the residents of these sites, the addresses of these sites are not identified. (Figure 1)

Figure 1: A view of the apartment towers on one of the candidate sites (Site A)

This apartment neighbourhood located in an inner suburb of east Toronto is typical of the high-rise neighbourhoods that were part of the pilot project.
Credit: Christopher Marleau

Site A comprises two Y-shaped high-rise 14-storey apartment towers containing 168 units in a mix of types with both on-site and below-grade parking for residents. All units are rented at market rates. Site A is located on the north side of a major arterial road. The site is bordered by a ravine on the west and north, and a local community “hub” and low-rise commercial district on the south and east. Given the configuration of the towers, apartments face all four directions and, consequently, residents experience a range of sun exposure during the summer months. A small convenience store is located on the ground level of one of the apartment towers. The site borders Toronto’s ravine system to the north, an area protected by the Toronto Region Conservation Authority. (Figure 2)

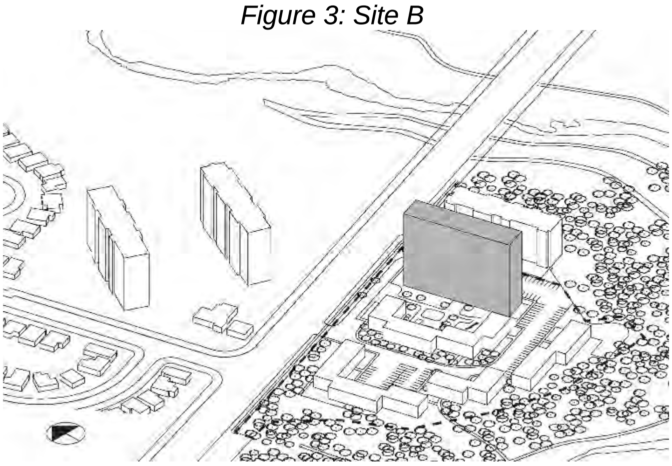
Figure 2: Site A



Site A comprises two Y-shaped high-rise 14-storey apartment towers containing 168 units in a mix of types with both on-site and below-grade parking for residents.
Credit: Drawing by Joe Ball.

Site B consists of one 19-storey slab-type apartment tower containing 192 units in a mix of types. All units are rented, some at market rates and other subsidized through housing assistance. The tower is oriented north-south and located on the south side of a major east-west arterial road. A series of three-storey townhouses sit adjacent to the east and south. A lower, high-rise apartment tower is located on the west. The site contains on-grade parking and amenity areas for outdoor recreation. The site borders Toronto’s ravine system to the south, an area protected by the Toronto Region Conservation Authority. (Figure 3)

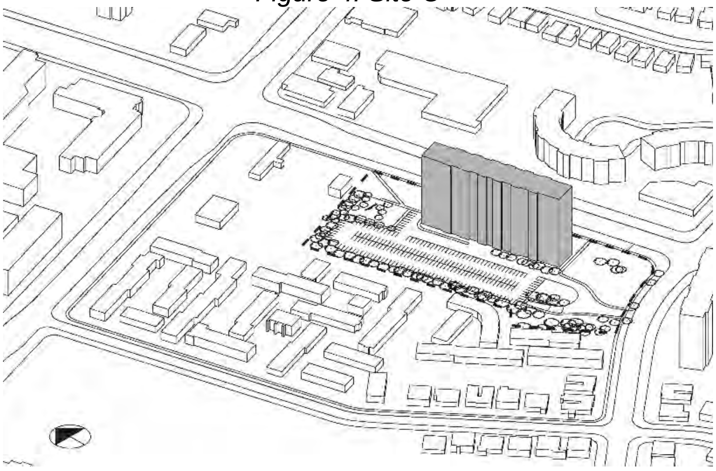
Figure 3: Site B



Site B consists of a 19-storey slab-type apartment tower, oriented north-south and surrounded by low-rise townhouses on the east and a lower apartment building on the west.
Credit: Drawing by Joe Ball.

Site C consists of a 20-storey slab-type apartment tower, oriented north-south. All units are rented at market rates. The site is located on a major north-south arterial road, close to a major east-west road and neighbourhood commercial area. The site is flanked on the west by a parking lot and a low-rise residential single-family neighbourhood beyond. A major commercial area is across the street, on the east, and there is a high-rise tower currently under construction in this location. The site is a five-minute walk from a community centre. A community day-care is operated on the ground floor of the apartment tower, the entrance of which is located on the tower’s north face. The building main entrance is situated on the building’s east side, although access is provided to the parking lot on the western side of the building through a lobby that bisects the ground floor from east to west. (Figure 4)

Figure 4: Site C



Site C consists of a 20-storey slab-type apartment tower, oriented north-south, with parking along the western side of the property.
Credit: Drawing by Joe Ball.

All sites are served by public transport. The sites were documented in film, still image and digital mapping.

4.3 Film, "Heat! cooling spaces for highrise places"

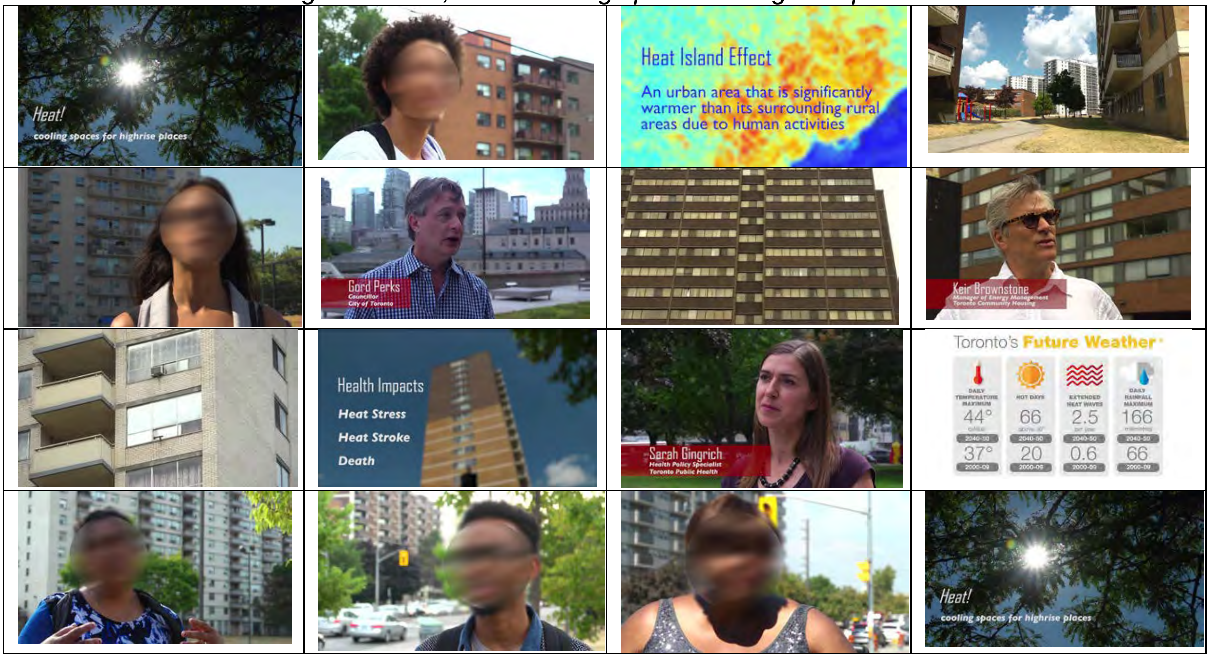
During the summer of 2016, which was reported as Toronto's hottest to date, the filmmaker and RA conducted and filmed interviews in the vicinity of the three sites. They recorded interviews with approximately 15 residents in these communities. Positioning themselves on public property, the RA presented the project to potential interviewees and requested an interview, describing the project and its objectives. Subjects were selected randomly. Each subject confirmed that they lived in a high-rise building in the neighborhood, were in residence there during the summer (i.e. they did not have access to another summer location, such as another residence or a summer home), and did not have air conditioning in their unit. All interviewees provided consent as per REB requirements.

The RA followed a standard set of questions querying the interviewee's response to Toronto's summer heat, how they kept cool during the summer heat, and what measures they took, either in their unit or away from it, to keep cool. Filming took approximately 20 minutes per interview. Water was made available to interviewees and, as much as possible, all interviews were conducted in the shade.

The PI identified a number of experts on heat, heat island, climate change, building management, architecture and public health. The REB approved specific questions for each expert. Each expert agreed to an on-camera interview and signed a release form permitting their name and affiliation to be included in the film. The researcher interviewed six interviews and their observations were filmed.

The documentary filmmaker and researcher completed the collection of film interviews in the late summer of 2016. The filmmaker and PI reviewed film footage and prepared a film treatment. Editing of filmed interviews and review of the rough-cut of the film took place in the fall of 2016. The PI secured a composer to compose music to accompany the film. In late fall 2016 the PI and the SIA faculty advisor reviewed the final rough cut of the film and the final version was completed in January 2017. (Figure 5)

Figure 5: Film, Heat! cooling spaces for highrise places



Still images from the film, Heat! cooling spaces for highrise places. Faces of residents interviewed have been blurred to protect their identity.
Credit: Peter Conrad, filmmaker.

The PI screened the sixteen-minute film, “*Heat! cooling spaces for highrise places”*, during the CEx17, where the filmmaker and SIA faculty advisor discussed the role of film-making in architectural research and documentation. Following the completion of the film, the PI oversaw the production of a film transcript containing still images of the film; images of residents are blurred to protect their identities. A copy of the film transcript is available on request from the PI. The film was made available for screening at each of the focus groups. An abbreviated version of the film of approximately 9 minutes duration is available for screening during academic presentations of this research.

4.4 Prototype Design – The 2017 DAS Collaborative Exercise

The Ryerson DAS runs the Collaborative Exercise (CEx) annually at the start of the winter term. All DAS undergraduate students participate for a pass-fail credit. DAS graduate students provide support to the CEx and DAS faculty members participate as advisors to the undergraduate student design teams. The PI was the Instructor for the DAS Collaborative Exercise in January 2017. The focus of CEx17, entitled Design approaches for outdoor Cooling Centres, was to address ways to mitigate excessive heat exposure for vulnerable populations in Toronto high-rise apartment buildings through on-site cooling centres.

CEx17 asked students to address the following questions:

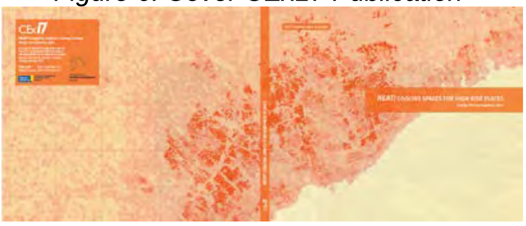
> “What effective passive design interventions can be created to provide outdoor Cooling Centres on sites adjacent to older inner-suburban high-rise buildings in Toronto?” and “How can architects contribute to the design of these outdoor Cooling Centres to provide places that provide comfort and relief in periods of extreme heat, and are well designed, safe, inviting to a wide variety of users, and have a low-energy impact?”

Approximately 425 DAS students participated in CEx17, under the guidance of 12 graduate students and an equal number of DAS faculty members. During the five days of CEx17, students followed a rigorous agenda and developed designs for outdoor cooling centres. Students completed final designs and produced posters of their designs that were displayed for a two-week period in January 2017 at the CEx17 conclusion in the Ryerson University

Paul H. Cocker Gallery located in the Architecture Building. The DAS CEx is seen as a way to start the winter term with a bang and energize students for the term ahead. For CEx17, each day was given a different name, to reflect the build-up of the week's work: Monday: "Heat Alert", Tuesday: "Heat Exchange", Wednesday: "Heat Wave", Thursday: "Making Cooling Outcomes" and Friday: "Show your stuff". Experts who were interviewed in the film spoke at a panel during Tuesday's "Heat Exchange". The filmmaker discussed his work on the same day. Six invited jurors drawn from health, design and the community, reviewed submissions and identified a number of noteworthy designs. The week ended with a celebration and all-school party on Friday evening.

The Instructor and PI oversaw a publication, *Heat!*, *Cooling spaces for highrise places* that documented CEx17 activities and design project outcomes. The publication was completed in 2018 and is available through the Ryerson University and Archives digital portal, https://library.ryerson.ca/. (Figure 6)

Figure 6: Cover CEx17 Publication



Cover, Heat! cooling spaces for highrise places, CEx17 Publication. George Thomas Kapelos, Editor. Credit: Sarah Lipsit

5. The Collaborative Exercise 2017 – Creating Cooling Centre Prototypes

Continuing in the tradition of past Collaborative Exercises, which addressed a number of important topics related to architectural issues and the public interest, including 'Civility' (2013), 'Identity' (2014), and 'Water' (2016), CEx17 addressed the topic of 'Heat'. The focus was the creation of prototypes for outdoor cooling centres. The PI, a professor in the Ryerson University DAS, was the Instructor for the CEx17, responsible for course conception, development and delivery. He developed the parameters for CEx17, which follow.

5.1 The sites

The design of outdoor cooling centres in CEx17 focused on three high-rise residential sites located in Toronto's inner suburbs (Sites A, B and C). The exact addresses and locations of these sites were not relevant to CEx17, as the three sites were chosen as typical of the approximately 2,000 high-rise sites where outdoor cooling centres may be located.

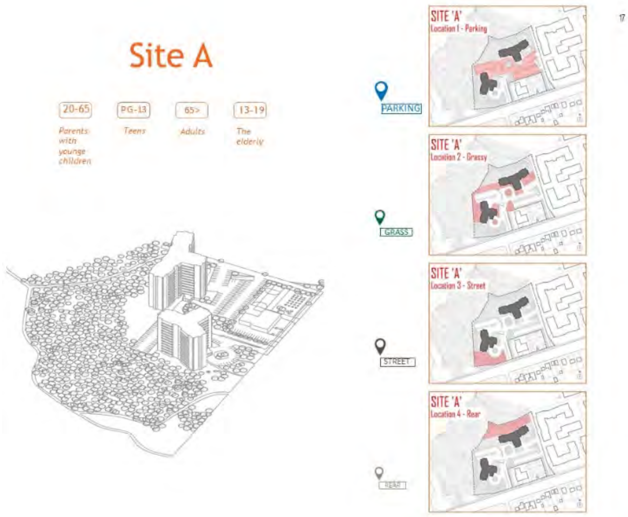
Table 1: Typical locations and location requirements and / or restrictions

	Name / location type	***Requirements / restrictions***
Typical location 1	**PARKING** Within an existing paved parking area	Must address the question of heat buildup on pavement and may require a raised platform. No excavation allowed into the pavement for plantings or water features. Must be accommodated within the existing flow of vehicular traffic and not block emergency routes. Plant and / or water features must be constructed on the platform and / or at grade. Must provide for a raised, well-drained area in the event of inclement weather.

Typical location 2	**GRASSY** On a grassy area which may have the potential to be enhanced with tree plantings	Some excavation of the site is allowed. Trees and other vegetation can be planted in the ground. Must provide for a raised, well-drained area in the event of inclement weather.
Typical location 3	**STREET** Adjacent to a major public thoroughfare and visible from the street	Some excavation of the site is allowed. Trees and other vegetation can be planted in the ground. Some form of enclosure is to be provided separating the cooling centre from the adjacent street / public walkway and providing privacy from the street. No obstruction of public pathways / emergency routes is allowed. Must provide for a raised, well-drained area in the event of inclement weather.
Typical location 4	**REAR** At the rear of the property, away from a major public street.	Some excavation of the site is allowed if this area is on grass or earth. Trees and other vegetation can be planted in the ground if the area is on grass or earth. Clear lines of sight into the cooling centre, ensuring surveillance of the facility from outside the cooling centre must be provided. Must provide for a raised, well-drained area in the event of inclement weather.

The sites display characteristics typical of older high-rise buildings located in the inner suburbs. The high-rise buildings contain from 200 – 300 residential units in a mix of bachelor, one-, two- and three-bedroom units. Typically these are rental buildings. The instructor secured the permission of the owners of these properties to utilize these sites for CEx17. However, as there were issues of privacy and respect for the residents, the instructor did not disclose the exact locations of these sites. Adequate information on each site was provided on D2L, the Ryerson University digital learning portal. Each of the high-rise building sites presented four typical locations where an outdoor cooling centre could be placed. Students were to assume that all locations at each site had access to power and water. The typical locations with requirements and / or restrictions are described in Table 1.

Figure 7: Site A

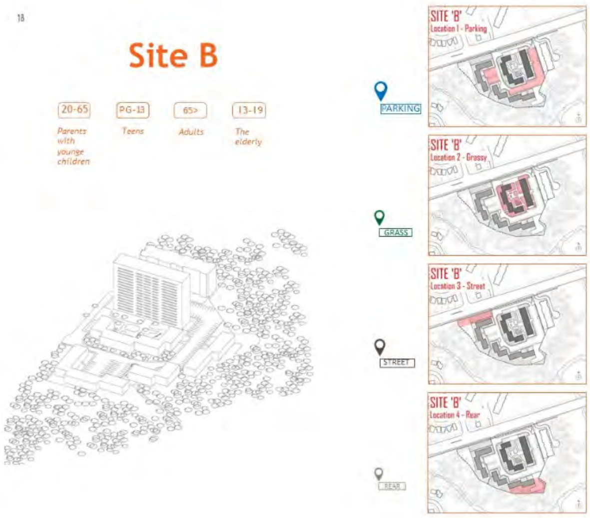


Site A, showing typical locations for outdoor cooling centres.
Credit: Saman Soleimani-Deilamani

Student teams were assigned one of the three sites (Site A, Site B or Site C). Within each site, teams were assigned one of the four location types (Type 1, Type 2, Type 3 or Type 4).

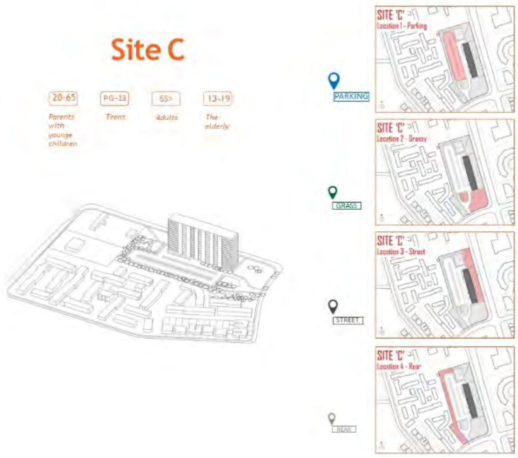
No changes were permitted. Typical locations for the cooling centre designs were identified on site materials posted on the D2L site. The sites and locations are indicated in Figures 7, 8 and 9.

Figure 8: Site B



Site B, showing typical locations for outdoor cooling centres.
Credit: Saman Soleimani-Deilamani

Figure 9: Site C



Site C, showing typical locations for outdoor cooling centres.
Credit: Saman Soleimani-Deilamani

5.2 Project Description – Heat: Creating Outdoor Cooling Centres

CEx17 took its cues from the growing concern about climate change and the ways in which episodes of extreme heat will impact Torontonians.

CEx17 invited students to design an outdoor cooling centre on a specific type of location on one of the three typical high-rise sites found in Toronto’s inner suburbs. The cooling centres were to be designed in such a way to provide a range of residents of high-rise buildings the opportunity to seek respite during periods of extreme heat in the summertime in Toronto.

The cooling centre was to provide basic amenities to users that would provide them comfort during a heat alert. It was recommended that the cooling centre be open 24 hours / day, 7 days / week, and be accessible to building residents on a priority basis. Other residents in the surrounding community might also access the cooling centre. Student design teams therefore were also to address questions of security, round-the-clock use and the implications of mixing user types in the centre's design.

The cooling centres were to cater to a wide range of individuals representing the spectrum of high-rise apartment dwellers in Toronto. Therefore and to focus the design, four specific user groups were identified. Each team was assigned one prime user group, but would have to consider at least two other user groups as secondary users. Students were asked to address the question of sensitivity between different types of users and potential conflicts that might arise when the site is programmed for a mix of users. In all cases, there might be a mix of ethnic groups and a range of abilities within these groups. Students were to be mindful of these issues as they developed their designs. Table 2 identifies the proposed user groups.

Table 2: Proposed user groups:

User Group 1	Parents with young children (i.e. children under 12 years of age)
User Group 2	Teenagers
User Group 3	Adults
User Group 4	The elderly

5.3 Project Drivers

A major thrust of this project was to seek ways in which to explore ideas of passive cooling and the use of water, plant materials and shade (either natural or constructed) as elements in the design of the cooling centres. Each cooling centre would have access to water and electricity but was not to be energy dependent for cooling. These were not to be designed as "air conditioned" rooms but rather as places that provided comfort and respite during periods of extreme heat through natural means.

Therefore, as a means for participants in CEx17 to explore the potential for passive cooling in these outdoor cooling centres, each team was asked to consider encapsulating passive cooling, which would provide thermal comfort to cooling centre users with low or nil energy consumption.

5.4 Design Considerations

Students were advised that these were to be unique facilities that would bring together a variety of people who might have common needs but not necessarily share similar values, beliefs, backgrounds or interests. Students therefore were to be mindful of providing privacy and a range of spaces within the cooling centre to address the diversity of the populations and their individual requirements.

The cooling centre might accommodate a cross-section of users, from individuals to small groups to large gatherings, of all ages and demographics. Therefore, the cooling centre might have within it a variety of zones from the intimate to the public. Therefore, the design was to be considered at three scales: the cooling centre, its immediate context (e.g. an area within 20 meters of its focus), and its larger context (e.g. extended vistas, views from within the site and from the larger urban context).

5.5 Design Objectives and Parameters

Each team was tasked to design an outdoor cooling centre that would provide comfort to a range of residents during periods of extreme heat. Different groups might have different needs and these needs were to be accommodated. For each cooling centre, students were to consider nine design issues. These are described in Table 3.

Table 3: Design issues

Access and welcome	For the cooling centres to be used by residents, the designs must demonstrate that they are accessible and welcoming places.
Comfort	Thermal comfort is important in these centres. As they are not to be “air conditioned” and are to use passive means of cooling, using low to no energy, students must demonstrate that comfort is achieved in their proposed design.
Security	Create a space where users may feel secure and welcome. If the decision is taken that the cooling centre may be in operation 24 hours per day, students must address the question of security of users around-the-clock.
Recreation	Create a space where users may engage in recreational activities, either individually or collectively. This may be in the form of quiet reading or group activities, including engaging with water recreationally, or other activities requiring more exertion. Different age groups may have different recreational needs and students should be mindful of this.
Culture and Ethnicity	Be capable of accommodating the needs of diverse cultural and ethnic groups and communities.
Function	Provide basic functional needs such as seating, resting/relaxing and toileting. Other activities may be incorporated, such as information functions, capacity to access internet, public telephone or charge individual portable computer devices or telephones. The facility may include a shower for individual bathing as appropriate.
Privacy	Provide the opportunity for individuals to find comfort and privacy, albeit in a public or quasi-public setting.
Sociability	Provide the opportunity for people to undertake sociable activities in small groups.
Information	Provide information to users on possible heat-related or public-service related issues.

5.6 Project Scope and Considerations

Table 4 identifies dimensional and area considerations each cooling centre design. Table 5 lists program considerations.

Table 4: Cooling centre dimensional and area considerations

- A space of approximately 100 m2 which will form the core of the cooling centre, capable of accommodating 15 – 20 people.
- If 24 hour use is proposed, present ways the space may be secured at night to permit possible overnight sleeping by residents during periods of extreme heat.
- It must be shaded and provide coverage in inclement weather.
- If students believe that this area is too small or too large, they may contract or expand the area and provide a rationale for their decision.
- If the area is enlarged, it must not exceed the area of 200 m^2 as discussed below.
- A larger space of approximately 200 m^2 which may extend the area of influence of the cooling centre into the larger location.
- The cooling centre may be a one- or two-storey structure. Be mindful of accessibility requirements. The maximum height of the built area is to be no more than 8 metres.

Table 5: Cooling centre program considerations

- The underlying premise of CEx17 is to create safe, comfortable, accessible and secure cooling centres that provide comfort to residents during periods of extreme heat.
- Each cooling centre will have common program elements.
- Specific program elements will be required for specific user groups and students may propose additional elements and incorporate these into their designs.
- Passive cooling is to be the main means of cooling. Energy consumption for cooling is to be low or nil.
- The tectonics of the cooling centre should be explored and clearly developed. The form and materiality of the cooling centre may seek to reinforce the idea of cooling. The tectonic, therefore, should consider both construction and how the choice of materials, assemblage and construction raises the architecture of the cooling centre to a higher meaning beyond the functional, allowing the design and object to have a significant presence.
- The cooling centre must have weather-protected / shaded and open / outdoor components.

- The cooling centre is to function from late spring through early fall. Its use, function and operation may change with time (daily or seasonally). - The cooling centre may be a permanent or temporary facility. If permanent, provision must be made for its enclosure / security in the season when it is not in use. If temporary, the design must demonstrate how it may be demounted and stored for reassembly and use in future summer seasons. - The cooling centre should accommodate a multiplicity of purposes and activities that may change over time.

5.7 Program elements and design requirements

Each cooling centre was to include common elements for any type of user and specific user-related elements. Table 6 lists common program elements and design requirements. Table 7 lists program elements and requirements for specific user groups.

Table 6: Common Program Elements and Common Design Requirements

Common Program Elements
− Water and electricity are provided
− Water: pools either need 24 hour surveillance (e.g. a lifeguard) or need to be drained when there is no surveillance
    - Must be wading pool or splash pad (wading pools are 0.75m or less in depth)
    - Misting station
    - Drinking water fountains
    - Two unisex bathrooms equipped with toilet / sink and a changing station; one may include a shower
− Shading: natural and constructed
− Area: 100m^2 secured area, 200m^2 maximum footprint
− An area for a person who will operate / supervise the cooling centre (including locked storage)
− Lighting: dependant on the program (sleeping, activities, etc.)
− Cooking space, including a barbeque, sink area
− Garbage disposal
− Assume even grading for the site
− Vending machine for cool drinks
− Ice machine
− Refrigerator for storage of cool/cold items
− Night activity permitted
    - Said activity to be determined by the group (active or passive)
− Students must address what happens to the site during the other seasons

Common Design Requirements − Barrier free design − Charging stations − Information panel − First aid station − Location for a Public Health worker or community volunteer to attend the Centre on an occasional basis − Digital component (audio, visual, etc.) − Storage space − A public address system − Possibility of public event area / public gathering area − Area for quiet relaxation, reading, listening to music (on earphones), lounging, resting − Picnic area − Universal activity tables

Table 7: Program Elements and Requirements for Specific User Groups

Parents with young children (i.e. children under 12 years of age)	− Easy visibility of children − Spaces must allow for adults to interact with their children − Park / play structure − + other uses as determined by student team
Teenagers	− Gathering space

	− Study space+ other uses as determined by student team
Adults	− No special uses other than those presented above − + other uses as determined by student team
The Elderly	− No special uses other than those presented above − + other uses as determined by student team

6. Design Prototypes

In CEx17, ten designs were prepared for each of the three sites, comprising a total of thirty different designs. Each design was the product of a team of students in the four-year Ryerson University DAS undergraduate B. Arch. Sci. program. Students in each group worked as a team in a four-day charrette.

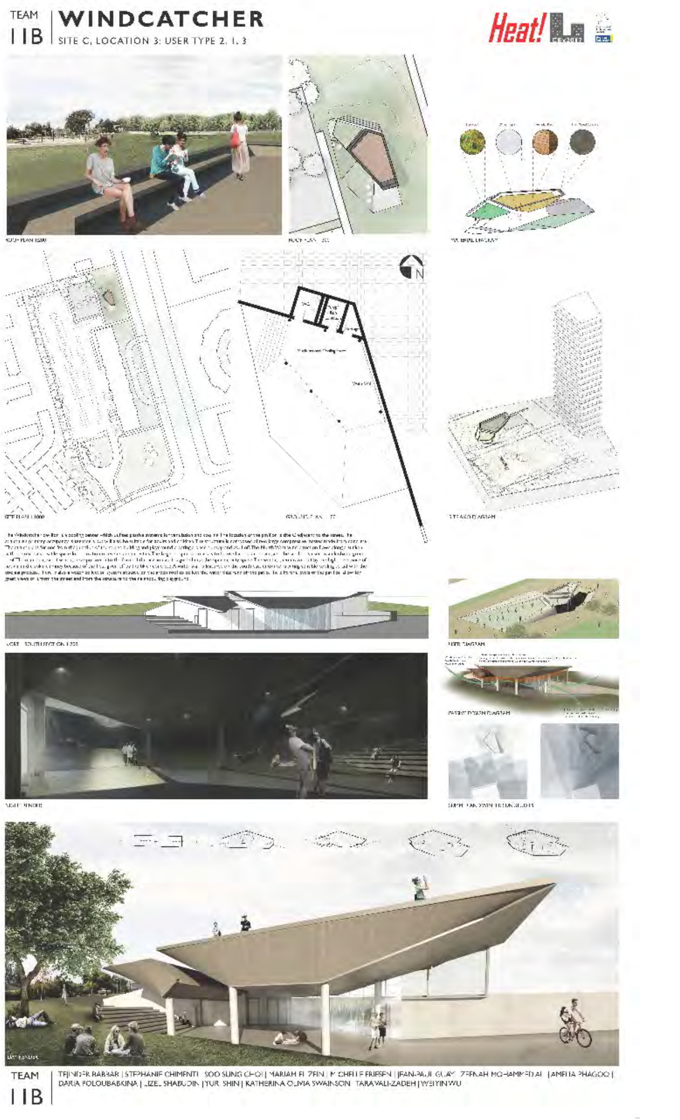
For the focus groups, four projects were selected for discussion and feed-back by focus group participants at Sites A and C. The projects were chosen to represent a range of design approaches for the four locational conditions and age-group focus of specific users. Table 8 lists design parameters for each prototype reviewed.

Table 8: Prototype names, on-site location and primary/secondary user

	Team number and Project Name	Location on site	Primary User	Secondary Users
Site C	11B Windcatcher	street	teenagers	adults parents with children under supervision
Site C	12B Heat: It's lit	rear	senior citizens	adults parents with children under supervision
Site C	13B Cool	parking	teenagers	adults parents with children under supervision
Site C	14B Cross Shade	grass	senior citizens	adults parents with children under supervision
Site A	6A Cool-Haus	grass	parents with children under supervision	adults teenagers
Site A	7A Sombra	street	adults	seniors parents with children under supervision
Site A	8B River and Chill	rear	teenagers	adults seniors
Site A	9A Chill Out	parking	adults	teenagers seniors

Each student team chose a name for their design and provided a brief description. The complete range of work is available through the Ryerson University Library and Archives digital portal, https://library.ryerson.ca/. The design prototypes present consistent themes of passive cooling, relaxation and sensitivity to the surrounding natural and built environment. Figures 10 – 17 present student designs and brief descriptions prepared as part of the student submission. These descriptions have been revised and edited for consistency and are provided as captions to each of the figures.

Figure 10: Site C – Team 11B, “Windcatcher”



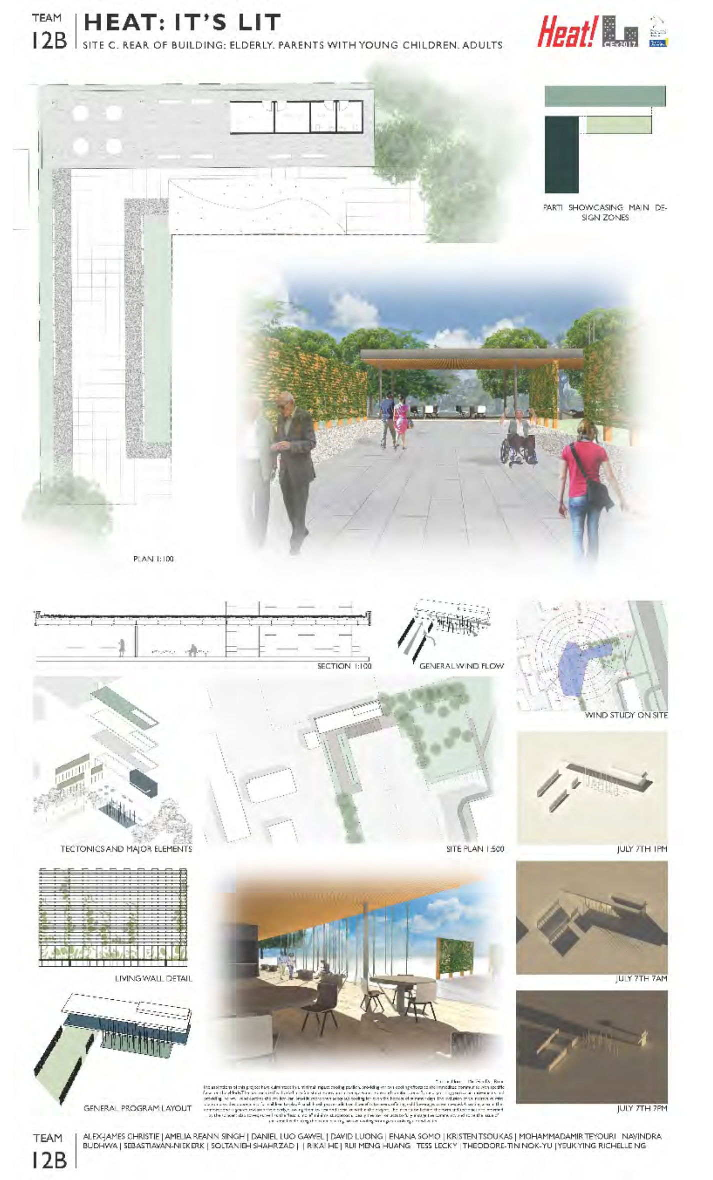
The Windcatcher pavilion is a cooling centre which utilizes passive systems for ventilation and cooling. The structure is composed of two large compressive masses and its form is derived from the intersection of the street, building and playground, creating a place to stop and cool off.

The north-west wind direction flows along a sunken path to create a versatile space for relaxation, events or activities. The larger suspended space is to be used as a patio space and the small, as a climbable green roof.

The manipulation of wind is incorporated into the pavilion form, as air is drawn into the open activity space. A water wall is featured on the south-east entrance, creating sensible cooling for pavilion users. The different levels of the pavilion allow for great views to adjacent playground.

Credit: T Babbar, S Chimenti, S Choi, M El Zein, M Friesen, JP Guay, Z M Ali, T Phagoo, D Poloubabkina, L Shabudin, Y Shin, K Swainson, T Vali-Azdeh, W Y Wu.

Figure 11: Site C – Team 12B, "Heat: It's Lit"



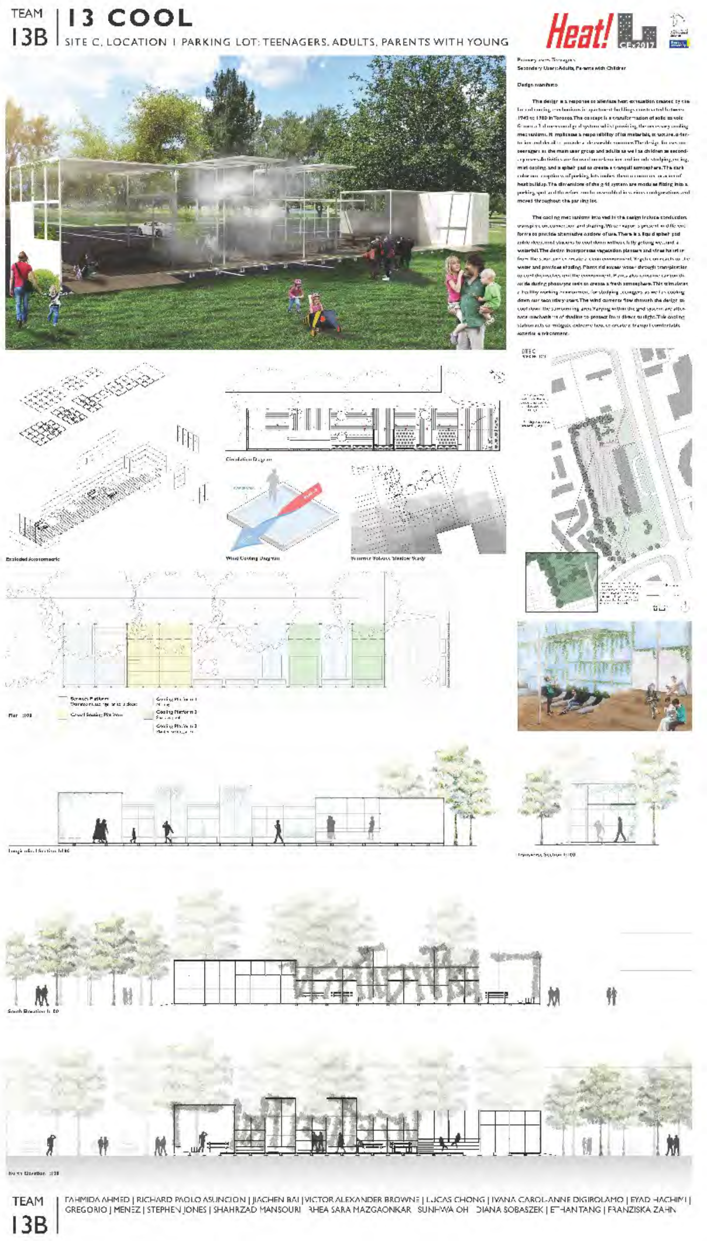
The aspirations of this project culminated in a minimal impact cooling pavilion, providing various cooling effects to the immediate community, with specific focus on the elderly.

The pavilion is divided into three distinct zones: an air zone, a water zone and a comfort zone. By incorporating passive air movement and providing a live wall that will catch the wind, the pavilion can provide more-than-adequate cooling on even the hottest of summer days. The inclusion of an interactive misting station provides opportunities for children to play. A small kiosk provides additional benefits to users, offering cold beverages when needed. A seating area in the comfort zone is geared towards the elderly, allowing places for rest and socializing.

The inspiration behind the form and tectonics is drawn from the adjacent apartment slab tower, as well as the less-is-more minimalist approach of Mies van der Rohe. Ideally, the pavilion acts to engage fully with the community and solve the issue of extreme heat during the summer by means of passive cooling strategies involving air and water.

Credit: A-J Christie, A R Singh, D L Gawel, D Luong, E Somo, K Tsoukas, M Teyouri, N Budhwa, S Niekerk, S Shahzad, R He, R Menh-Huang, T Lecky, T Tin-Nok-Yu, Y Ying, R Ng.

Figure 12: Site C – Team 13B, “Cool”



The design concept is the transformation of solid-to-void to fit into a three-dimensional grid while at the same time providing mechanisms for cooling. Materials, structure and orientation are brought together to provide a pleasurable summer experience for users. Teenagers are the prime user group with activities focused on relaxation, eating and studying. Mist cooling and a splash pad create a tranquil atmosphere. The lines demarcating parking spaces create the scheme’s modules, which can be assembled in various configurations and moved in a number of locations on the parking lot.

Cooling is brought about through conduction, transpiration, convection and shading. Water in various forms – vapor, mist or liquid – provide options for cooling. There is a splash pad for wading, misting stations for cooling, and a waterfall for visual pleasure. Hanging vines and planters emphasize the coolness of this place and provide shading and cooling through transpiration and carbon transfer. The presence of water and vegetation stimulates a healthy working environment for teenagers who wish to study. Winds moving through the pavilion cool the surrounding area. Shading devices protect users from harmful UV. The cooling station acts to mitigate extreme heat through the creation of a tranquil and comfortable exterior environment.

Credit: F Ahmed, R P Asuncion, J Bai, V A Browne, L Chong, I C-A Digirolamo, E Hachemi, G Jimenez, S Jones, S Mansouri, R S Mazgaonkar, S Oh, D Sobaszek, E Tang, F Zahn.

Figure 13: Site C – Team 14B, “Cross / Shade”

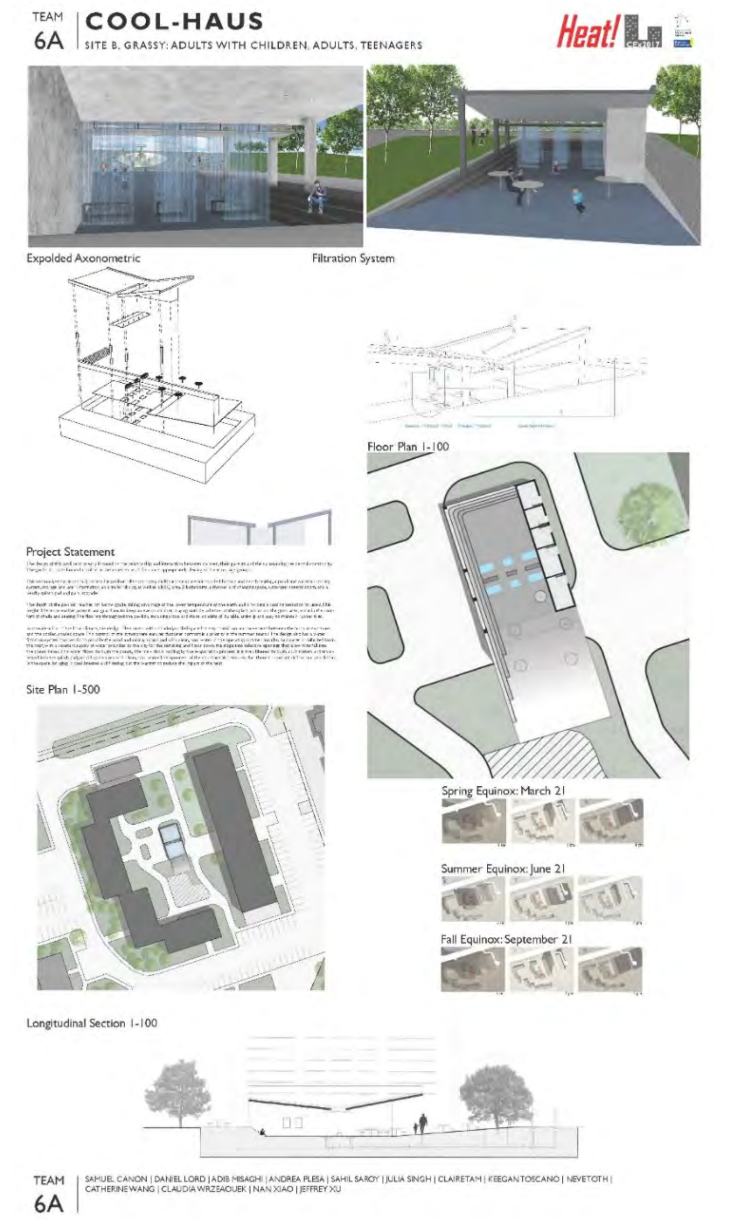
The goal of this project is to create a communal cooling system for elderly residents. The centre provides a refuge in heat wave and a lively recreation space. The design features four spaces, each with a specific purpose, all unified by an overhead lattice structure housing a misting station and branching from the central area to connect with other spaces.

A decked seating area is located in the centre of the site, furnished with patio tables and chairs and sitting over a narrow extension of the adjacent wading pool. Three existing trees shade the area and a small structure houses a small kitchen, washrooms and storage is located adjacent to the seating area. The wading pool (that can become a winter skating pond) is part of a larger water system across the site and provides a space for children to play.

Another seating area is designed, closer to the apartment building, intended for elderly users. Set off from the other areas, this is a quiet space, separated from the more active areas for users to enjoy board games, conversation or reading. The lattice structure extends to cover all areas of the site, unifying the composition.

Credit: S Adnan, D Ahmad, Y Arboleda, A Brenna, M Breteon-Honeyman, J Cavliere, G Chalabi, L Crichton, V Chow, E Doucette, B Esuan, S Elangko, J Hache, I Jeong, V Paningbatan-Cerez.

Figure 14: Site A – Team 6A, "Cool-Haus"



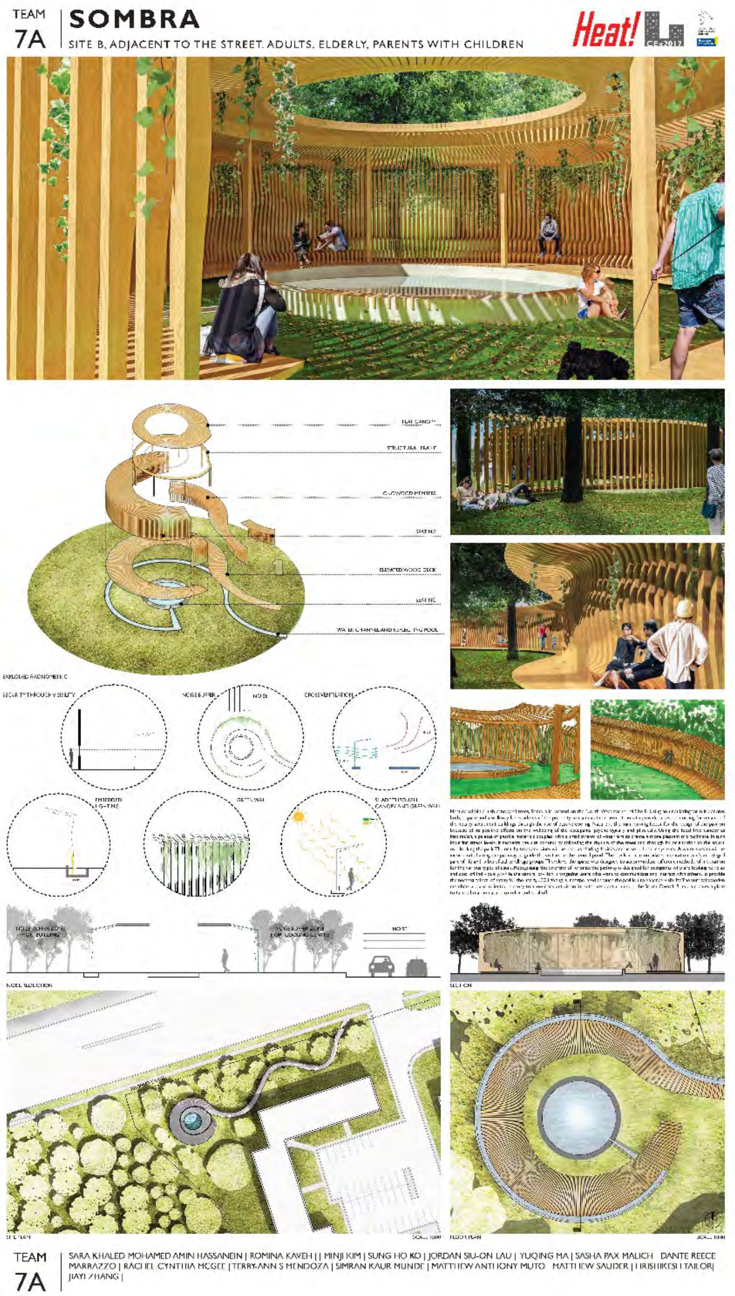
The design of the pavilion is focused on the interaction between children, their parents and their neighbourhood. The goal is to unite fun and comfort in the experience of the space. The versatile and fully accessible pavilion offers an open multipurpose space, seating, waterfall cooling, amenities, a BBQ cooking area, with a nearby splash pad and small park. The pavilion floor sits 1 m below grade, creating a cool environment. This grade differential allows for parent supervision beyond the enclosed area.

A shaded roofed space offers users a place for easy transition between hot exposes outdoor spaces and cooler, shaded spaces. A water filtration system and rainwater collection mechanism provides water to the pool and a constant flow of water, supplemented with municipal water, flows down the slope falling into the ponds below. A UV system filters water for use in the splash pad, all while cooling the overall area.

The openness of the structure ensures there is a constant airflow and through ventilation. Cool breezes reduce the impact of summer heat.

Credit: S Canon, D Lord, A Misaghi, A Plesa, S Saroy, J Singh, C Tam, K Toscano, N Toth, C Wang, C Wrzeouek, N Xiao, J Xu.

Figure 15: Site A – Team 7A, "Sombra"



Nestled within a lush canopy of trees, an undulating form denotes a space and a walkway for residents to call as their own. The design aims to provide respite to residents through passive cooling. Nature is the main driving factor of the pavilion because of its positive effects on the wellbeing of occupants, psychologically and physically.

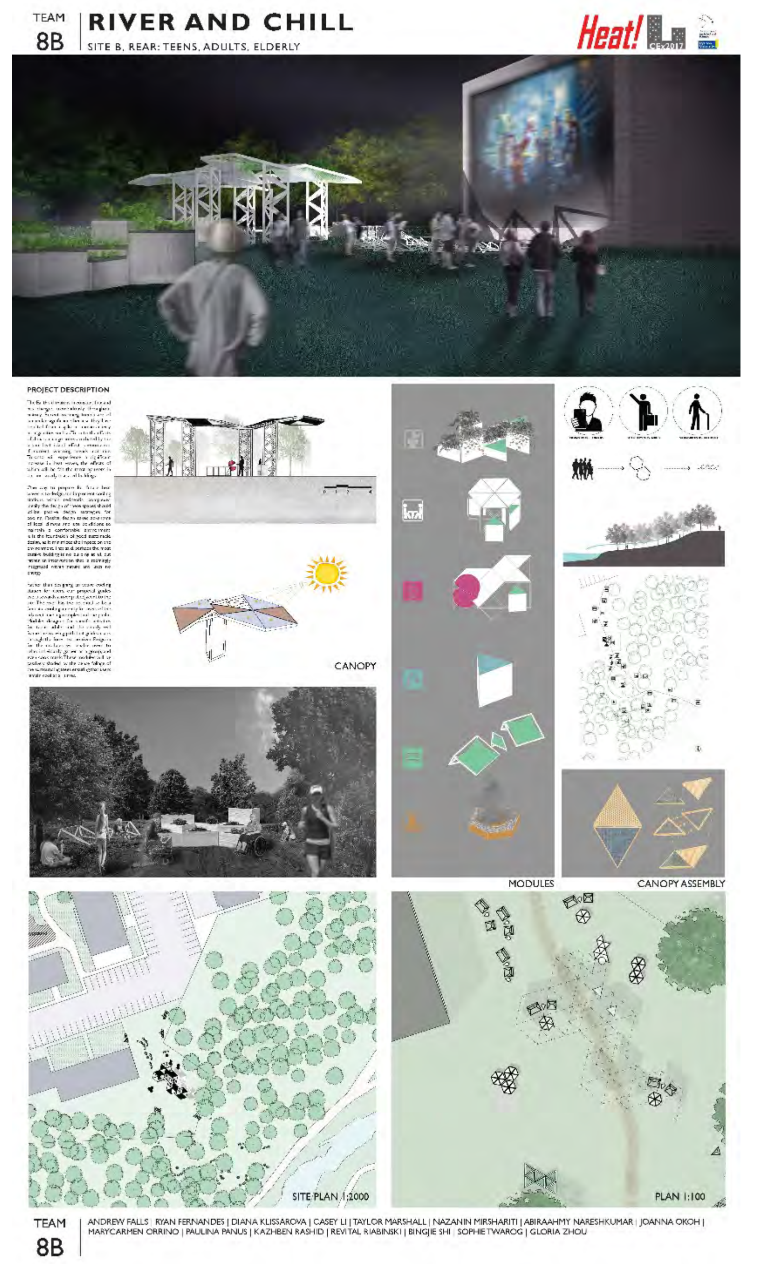
Using the local tree canopy as inspiration, a palette of natural materials together with a small stream of water aim to create a pleasant microclimate that helps lower a user's stress. The design that overlooks the park respects the site context, following the rhythm of the trees. Nearby, vegetation provide shade and noise reduction.

The pavilion accommodates meditation, as it is an integral part of the natural world and provides benefits to users of all ages. The pathway provides space for people who seek relaxation and cooling relief, while the central pavilion is larger for users to interact and engage with each other. To provide necessary levels of safety for users, LED lighting is incorporated in the design to enhance visibility. The vertical wooden members are oriented to allow constant views to the south.

Overall, Sombra creates a place to take a break in nature, to relax and cool off.

Credit: S K M A Hassanein, R Kaveh, M Kim, S H Ko, J S O Lau, Y Ma, S P Malich, D R Marrazzo, R C Mcgee, T A S Menoza, S K Munde, M A Muto, M Sauder, H Tailor, J Zhang.

Figure 16: Site A – Team 8B, “River and Chill”



The earth’s climate is changing. Recent warming trends are significant as they are the result of human activity. Toronto will experience the impact of climate change.

Cooling stations may help prepare us for future heat waves. Ideally these cooling stations should utilize passive cooling that takes advantage of local climate and site conditions to maintain a comfortable environment, minimizing the impact on the environment. A building built for passive cooling may be no building at all but rather an intervention that is integrated within nature and uses no energy.

Our proposal therefore guides users to a river adjacent to the site. This waterway has the potential to be fantastic cooling amenity for residents from the adjacent building. Modules designed for specific activities frame the path that brings users through the forest to the river. These spaces will allow users to relax on their own, gather in groups and enjoy activities together, such as an outdoor meal. The modules are passively shaded by the surrounding dense foliage, ensuring that users remain cool at all times.

Credit: A Falls, R Fernades, D Klissarova, C Li, T Marshall, N Mishariti, A Naeshkumar, J Okoh, M Crino, P Panus, K Rashid, R Riabinski, B Shi, s Twarog, G Zhou.

Figure 17: Site A – Team 9A, "Chill Out"

Chill Out is a proposal for a cost-effective modular cooling station. Designed to occupy the vast outdoor parking spaces surrounding apartment towers, the modular unit is derived from the size of a typical parking spot. Using a combination of semi-enclosed and open units, a variety of configurations are made possible, allowing for future expansion and use in other places.

Passive cooling is achieved by creating a module that is devoid of any solid walls, allowing for a constant breeze to pass through the space. In addition, shading is provided by the solid roof element and through vegetation and vines that grow around the cables and planers. Active cooling is achieved through a misting bar found at the entrance of every module that generates a mist when someone walks through the entrance. Electricity is generated through photovoltaic panels found on the roof or the modules. Additionally, the roof is designed to collect rainwater that provides a constant supply for misting.

To accommodate the activities of users, a variety of leisure, work and gathering spaces are provided. Each module is subdivided into three zones: intimate relaxation, circulation, and a multi-use active space.

The construction of the modules is made cost-efficient by using dimensioned lumber and steel cables as the main structural elements for the cooling stations.

Credit: A Al-Rashid, B Al-Waadeh, A Azia, J Bridglal, N Caccavella, A A Carere, N Chen, C S Chin, J S Cruxton, S Gurevich, E L Hamanova, R Ivanytskyy, S M Serrano, N Sokolov, J Tian, L Yang.

7. Community Focus Groups

The project anticipated three focus groups, one on each site. The protocol called for a random selection of up to 12 residents from each site to discuss the outdoor cooling centre prototype designs. The protocol anticipated focus groups would take no more than two hours.

In planning the focus groups, the PI recognized that it would be unlikely that focus group participants would have an in-depth knowledge of architecture. The PI also determined that presenting all the designs for each site could overwhelm participants and extend discussion beyond the focus-group's two-hour limit. Therefore, the PI in consultation with the focus group facilitator identified four designs per site to take to each focus group and posters were prepared. These are presented in Figures 9 – 16, above. The graphics contained architectural plans, descriptive texts and colour renderings of the spaces of the proposed cooling centres. An architecture student presented these design ideas at the start of each focus group, so participants could better comment on the architectural drawings presented to them.

In recruitment and organizing the focus groups, three issues arose.

First, due to delays in receiving REB approval for the focus groups (received in mid-February 2017), implementation of the focus groups was delayed to late winter / early spring of 2017.

Second, late in the process, a community group involved with one of the sites advised the PI that this group would not support Ryerson's engagement with that community, believing that the community had been "studied enough". This news came as a surprise to both the PI and TPH who had received permission from the property owners and community representatives for the focus groups. Consequently, the PI organized focus groups on the two remaining sites, B and C. Depending upon recruitment, the PI planned to hold up to three focus groups on the remaining two sites.

Third, agreed recruitment protocols – postering in the buildings and distributing flyers to building residents – yielded no participants, even after several attempts. Given constraints of budget, timing and availability of all personnel, the PI decided to approach recruitment with a more concerted effort and in a targeted manner. On the day that each focus group was scheduled, the RA and focus group assistants arrived early at each building. By going door to door and also waiting in the buildings' lobbies, they were able to recruit six participants at each site who met the participation criteria. In consultation with the PI, the facilitator proceeded to undertake the focus group utilizing each group as a convenience sample of users.

The first focus group was held on Saturday 22 April 2017 in a meeting room dedicated for community discussions, located in one of the low-rise buildings at Site B, the first of the two remaining sites. This focus group had three male and three female participants of various ages. One participant is active on the tenant council. All participants could communicate in English, as required, and also appeared able to follow the design presentations made. However, one participant seemed less comfortable participating than the others, and another participant made multiple efforts to divert the conversation to his personal interests about the housing complex. In general, the participants had great familiarity with their own site. When asked about personal cooling strategies, they all talked about going somewhere else: air-conditioned mall, park, or city beach. With respect to their own apartment building site, they gave detailed responses to their preferences about the best location on the property for an outdoor cooling centre. They were also very sensitive to issues of safety, security and vandalism of property, as well as the role of a property manager to support tenants' needs. Participants were not discerning about the specifics of design details other than the relationship of material choices and construction to property management and maintenance issues. The group was extremely interested in a design that would enable a wide range of residents to assemble and use a cooling centre, whether all at once or at varying times of the day.

The second focus group was held on Sunday 23 April 2017 in a meeting room in the high-rise building on Site C, the second of the two remaining sites. This focus group consisted of three male and three female participants. All participants could communicate in English, as required, and also appeared able to follow the design presentations made by one of the student focus group assistants. At this site, the participants all identified strategies of personal cooling in hot weather rather than going off-site. These included finding shade, wearing light-weight and light-coloured clothing, and staying hydrated. When assessing the student designs, these residents demonstrated a good knowledge of their own site. They indicated that the large open green space to the south is used from time to time for building-wide events but also that this area is both the hottest part of the site and the least convenient for assembling residents. Participants focused on the specific location of an outdoor cooling centre. They were mindful of the potential costs of constructing a centre. Participants expressed interest in modular designs that could be erected quickly, re-arranged and / or replicated to meet a variety of needs and conditions. When asked about property management issues, vandalism and security, the participants in the focus group described their building as well-managed and therefore had few concerns about these issues. The participants in the second focus group expressed interest in the social aspects of a cooling centre and offered support to those designs that would continue to facilitate wide use and social interaction of residents beyond periods of extreme heat.

8. Project Findings and Observations

This research project required the unfolding of a series of events and activities, with specific deliverables over a limited timeframe, in order to present to TPH and potential cooling centre users prototype designs for consideration and evaluation. The requirements of the multiple players added to the complexity of the project and led to delays in implementation of aspects of the project and a delay in project completion from early 2017 to late 2018. Nonetheless, the multiplicity of stakeholders reflects both the complexity of this issue and the necessity of a multi-valent approach to the question of addressing heat mitigation through outdoor cooling in apartment neighbourhoods. The following are presented as project findings and personal observations by the PI.

8.1 The development of design prototypes for outdoor cooling centres and the value of student engagement

This research project centred on architecture and the utilization of design-as-research as a means to explore an issue in the domains of public health, urban design and city planning. The use of actual sites, with real site constraints, obliged student designers to engage in creative and collaborative problem-solving. Specific locations within the given sites, further required consideration of both typical and unique conditions that would shape design decisions and outcomes for given sites and locations. The development of design objectives and parameters, the identification of potential user types and the articulation of design issues, and their application to the design problem, challenged students to meet all aspects of these real-world constraints, conditions and obligations in their design proposals.

The short time-frame for decision making and project execution in within a team of a dozen student called for all participants to negotiate decisions in a constructive and positive way, in order to achieve the objective of a coherent and considered design prototype. Foregrounding user comfort in extreme heat, sustainable design practices and passive cooling brought students into the contemporary exigencies of design praxis.

Engaging students with practitioners in multiple disciplines, exposed them to the complexities of design in the world beyond the academy. Presenting designs in focus group settings brought students into the reality of client engagement and feedback, necessary for effecting successful, engaging and useable design outcomes. Notwithstanding these multiple factors, constraints, issues and obligations, students produced a range of prototype designs that provide a spectrum of possibilities potential for the creation of outdoor cooling centres.

The outcomes of this pilot project demonstrates the potential of design to reveal possibilities and imagine different and otherwise unimagined futures

8.2 Utilization of focus groups for design feedback and community “buy-in”

Focus groups can be an effective way to elicit user feedback on a design proposal. In these particular focus groups, engaging architecture students in the development of designs, the presentation of design outcomes in focus group settings and hearing the community members’ response to discuss proposals, provide student assistants a one of a kind opportunity to experience user feedback to design work.

For reasons of time and cost, the material presented to the residents in the focus groups at the apartment sites was in the form of reduced scale reproductions of the students’ presentation panels, produced at the end of CEx17. These panels contained a lot of information and were presented in a variety of formats. The lack of uniformity and the relative lack of capacity among focus group participants to engage with architectural drawings and renderings may have made it more difficult for lay users to understand design concepts. A different process, such as providing more time or making designs available prior to focus groups, or more simplified and consistent presentation, may have made it easier for residents to quickly understand and then assess each proposal.

Focus groups depend upon participation. The absence of a significant financial incentive for participation (as a result of ethics considerations) and the timing and location of focus groups (and possibly the underlying issue of community residents believing that they had been “surveyed enough” without any long-term perceived benefits or outcomes) appears to have inhibited large-number participation in the focus groups. The low number of participants in the focus groups was disappointing. Although promised, community support for the project did not materialize that resulted in low turnout. Broadening recruitment to residents outside those on the subject sites may have yielded greater numbers. Nonetheless, the convenience sample of users at the two sites provides useful feedback on design proposals.

The positive response to cooling centres in both focus groups indicated a support for outdoor cooling as a potential to address one aspect of excessive heat for apartment dwellers in Toronto’s summer. Based on comments received, designing for such facilities must anticipate a wide range of users, extensive use over all times of day, and support for use of these facilities outside of periods of extreme heat.

Securing the buy-in of stakeholder groups is essential. Early in the process, the project anticipated engaging with building owners and managers, but this was not pursued, due to time constraints, changes in project personnel and limitations of resources. Sensitivity to community needs and closer work with community groups may facilitate broader participation and deepen project findings.

8.3 A complex issue takes time

As the research content and background information to this paper indicates, the issue of the impact of climate change on human health, in this case in relation to extreme heat for vulnerable populations living in highrise buildings without air-conditioning, has been developing over a long time. Evidence-based and conclusive research has provided considerable data for practitioners in health and planning.

The paucity of design-based research points to opportunities for architects, urban designers and physical planners to develop expand the field of knowledge and add their voices to those of the scientist, health promoter or policy maker. Continued investment in design-based research is called for in expanding this field of knowledge.

8.4 The power of film media to convey ideas and present issues in context

The production of a film on the impact of excessive summer heat, shown to architecture students in mid-winter, contributed positively to the CEx17. Capturing the voices and thoughts of residents in times of extreme heat (participants were filmed in the summer of 2016, Toronto’s hottest summer to that time) provided viewers with insights into the issue, that otherwise would have been difficult to convey. The Image Arts graduate student filmmaker is to be commended for his insightful development of this film and his work together with the RA to capture the essence of being in an overheated city in summertime.

The successful use of this medium to communicate a set of architectural issues is evident and worth continued pursuit. The showing of this film to a wider audience – perhaps through public libraries or community recreation centres or other community facilities – may prompt a broader discussion of this issue. The impact of film – and its current capacity to be easily accessible and user-friendly – may prompt architects, urban designers and city planners to engage in this aspect of research and documentation to support the advancement of their respective disciplines and professions.

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8.5 The creation of permanent record of the project and project dissemination

The publication of the CEx17 outcomes allows for a wider distribution of this material and provides opportunities for further focus group or other user feedback. The opportunity to present findings at academic conferences and public events further supports discussion of the seminal ideas of the project, feedback and knowledge transfer.

8.6 The complexity of inter-disciplinary and inter-sectoral research and the potential of positive synergies between multiple stakeholders

In the design and planning disciplines, engagement with multiple stakeholders, listening, responding and acting, are keys to successful practice.

This project originated with conversations between the PI and staff at TPH, who were interested in advancing ideas about outdoor cooling centres that were coming out of their research and stakeholder engagement on the issue of climate change. As the project developed and was implemented, others were drawn into the process, including a filmmaker, building science researchers, academics in many disciplines, health promoters, building owners and managers, landscape architects, tenant representatives and their associations, climate change experts, housing providers, municipal politicians, community leaders as well as collaborators in the Tower Renewal Partnership and others. In all this, the exigencies of time, the responsibilities and obligations of participants to their individual organizations created unforeseen challenges as well as unanticipated revelations. Nonetheless, common goals and shared aspirations for successful outcomes continued to propel the work of this project.

Addressing solutions to climate change is both time-consuming and challenging. As we all know, good things take time to develop and be realized. Inter-disciplinary and inter-sectoral work has the potential to yield fruitful outcomes for multiple benefits.

8.7 Further work

Funding from Ryerson’s CURLD provided for three focus groups, of which only two took place. Additional focus groups may provide further and more extensive feedback on the issue of cooling centre designs.

Seeking a broader audience for this issue, through showing the film then effecting a focus group, may prompt greater participation and elicit a broader range of opinion.

Since the conclusion of the project, staff at TPH has changed and priorities shifted. In light of a newly appointed Medical Officer of Health and new staff appointments, a full presentation of prototype proposals, a discussion of their designs and implications for future work to support concept of heat mitigation through outdoor cooling centres is warranted.

9. Conclusions

Vulnerable populations will face greater challenges to test their resilience in the face of climate change. Concerns about climate change, urbanization, heat island effects and concomitant impacts on the quality of life and the health and well-being of residents have been on the minds of planners, health promoters, designers and municipal leaders for decades. These concerns are not new. They echo the voices of early planners and putlic health practitioners that sought to ensure the health and well-being of all citizens through investment in urban infrastructures and attention to the design for health of urban places.

The push to re-valorize Toronto’s aging inner-suburb apartment neighbourhoods is a process of continual evolution. The new DAS zoning promises to promote the introduction of new uses, and the recreation of these monolithic neighbourhoods into vibrant and multi-faceted new places. The work of the Tower Renewal Partnership demonstrates leadership and vision. It is hoped the activities and findings of this pilot project may support their ongoing work.

Cooling centres and environmental awareness of design interventions promote a holistic view toward the design and renewal of buildings and their settings for the benefit of all residents, regardless of means, stage in life, backgrounds or abilities. The City of Toronto, through its agencies, boards, commissions and divisions is in a position to work collaboratively to address holistic issues of climate change, public health and resilience in order to mitigate effects of climate change, adapt to changing conditions and equitably seek solutions to address the diverse needs of Toronto residents.

Toronto’s comprehensive approach to “cool planning" (the theme of the 54th ISOCARP Congress 2018), reflects a responsible and considered approach to climate-proofing vulnerable citizens in Canada’s largest metropolitan region.

Project Participants
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For further information
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