

The “Building for Liveability” Framework

This building for liveability framework can be summarized in five overarching principles: **Comfort, Vibrancy, Diversity, Safety and Beauty**. These principles can be achieved by responding to the built form elements, identified in the following section. These are multifaceted and cannot be achieved in isolation, but instead require a comprehensive approach. Each of these principles can be addressed through built form and have been broken down further into a series of “elements of liveability” as outlined on the following pages. Chapters 01 - 10 of this report elaborate on each of the elements. Each chapter clarifies the objective, rationale, trends and best practices related to that element of liveability, followed by a summary of findings and potential recommendations that will contribute to greater liveability, as addressed through built form. Additional details are contained in the Appendix.

COMFORT

Buildings will be designed to create spaces that ensure comfortable micro-climatic conditions in the spaces around and within them, by protecting access to sunlight on the public realm, daylighting into buildings, reducing and mitigating wind, providing privacy, ensuring openness between buildings and creating human-scaled streetscapes.

VIBRANCY

The public realm will be interesting and attractive and contribute to a Downtown that is pleasant, walkable and provides opportunities for a variety of experiences. This will be achieved in large part by ensuring that buildings, in particular the base and lower floors of buildings, contribute to an enhanced, animated and expanded public realm designed to improve the pedestrian experience.

DIVERSITY

Diversity is a celebration of variety – in form, function, character, sense of place, community values, as well as gender, age, ability and ethnicity. The Downtown comprises of a range of built form types and scales that express the character of different neighbourhoods. Built form must respond to, respect, and reinforce these contexts. This diversity will be sustained through the design of buildings that have a variety of scales and form, and that respect and reinforce their existing and planned contexts.

SAFETY

The quality and character of the public realm is directly influenced by adjacent buildings. Buildings should contribute to a pedestrian experience that is clearly legible, welcoming and safe and can be addressed through the quality and character of the spaces between buildings and the connections between the private and public realm.

BEAUTY

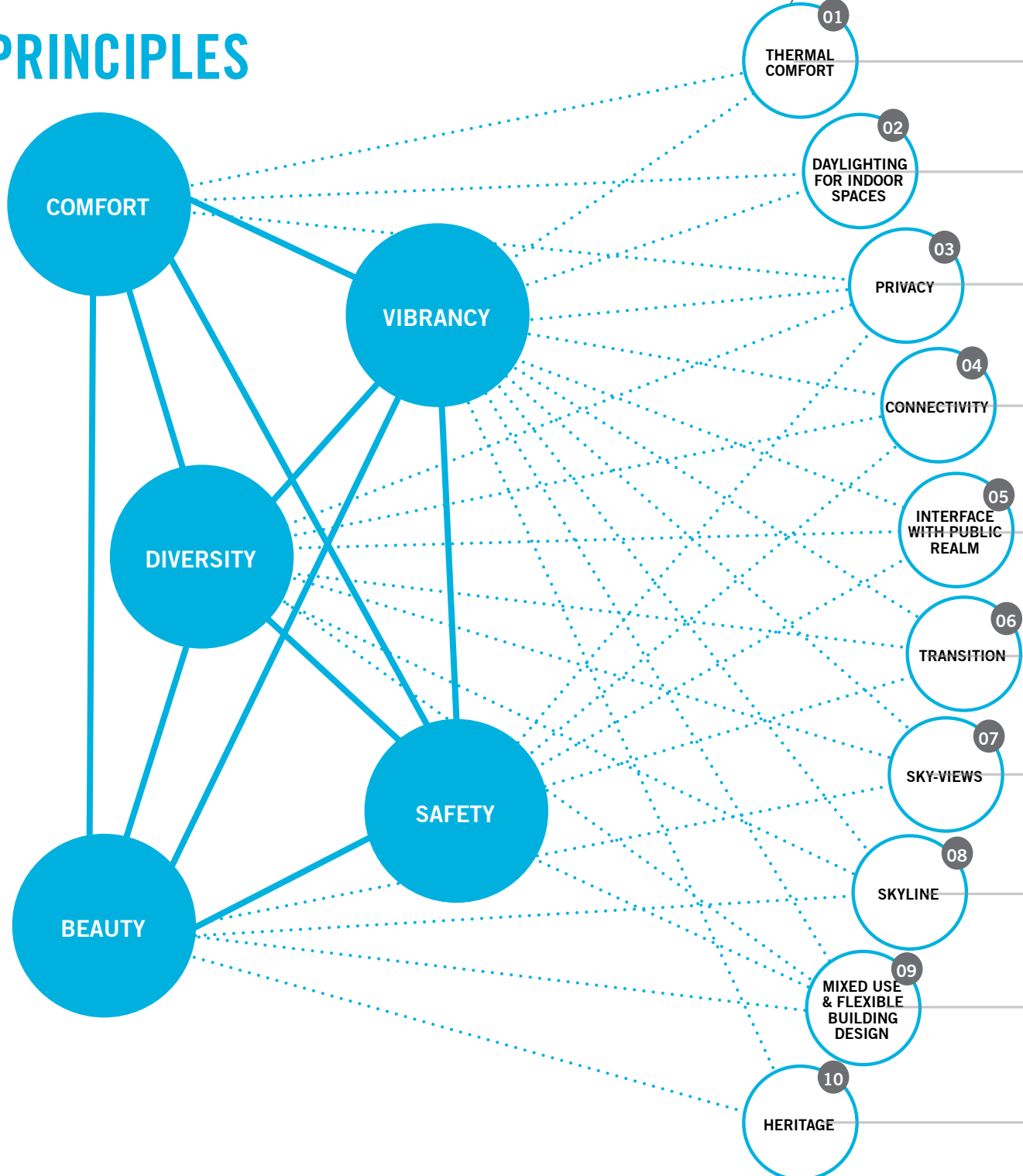
A city's beauty is much more than clean streets and stunning or unique architecture – it is a celebration of heritage, opportunities to engage and connect with nature, and reinforces for civic pride. The Official Plan identifies “Beauty” as one of the four principles of a successful Toronto - *“All successful cities astonish with their human-made and natural beauty. People choose to live and businesses choose to invest in beautiful cities”*⁹. Buildings Downtown should exhibit the highest standards of design excellence, materiality, heritage conservation and beauty.

9 Toronto Official Plan, Chapter 2, Page 1-4

PRINCIPLES

ELEMENTS OF LIVEABILITY

- A Access to Sunlight on Open Spaces
- B Access to Sunlight on Streets
- C Pedestrian Level Wind



01A / B / C.

OBJECTIVES

Buildings should be located, designed and massed to maximize pedestrian thermal comfort in all seasons. This includes maintaining sunlight onto the public realm, including parks and open spaces, streets and sidewalks, school yards, outdoor amenity spaces and privately owned publicly-accessible spaces (POPS).

02.

Buildings should be located, massed and designed to improve sunlight and daylight into buildings.

03.

Siting and orientation of buildings should provide access to natural light, minimize overlook and ensure privacy.

04.

Pedestrian comfort and safety should be prioritized on all streets Downtown, with buildings that support and enhance mobility and the pedestrian network.

05.

Base buildings, in particular the ground floor, should be designed to convey a sense of activity and liveliness, address the human scale, provide varied experiences, and facilitate the interface with pedestrian-oriented uses, such as transit, retail and other active uses.

06.

Appropriate transition to the existing and planned context should be provided, both in terms of scale and building type.

07.

Buildings should be located and designed to preserve and provide openness and sky-views.

08.

The composition of the overall Downtown skyline should be considered through the review of tall building location and design.

09.

New development should accommodate the wide range of services that foster a vibrant community, including schools, recreation, libraries, child care centres, human service organizations and other community service facilities.

10.

Buildings and landscapes with historic significance should be conserved and sensitively incorporated into new developments to enhance the character and liveability of the urban fabric.

HOW TO READ SECTIONS 01 – 10

LIVEABILITY
PRINCIPLE

##. ELEMENT OF LIVEABILITY

Each element of liveability is described in its own section, and can be read as follows:

OBJECTIVE

This statement is a combination of one or more of the principles of liveability: comfort, vibrancy, diversity, safety, and beauty; and describes how this specific element has an impact on the liveability of Downtown.

*How can buildings/
development address
liveability?*

RATIONALE

The elements of liveability have tangible and intangible impacts on the city's residents, workers and visitors. There can be physical, emotional, or mental responses to how we perceive liveability; this section explains the inclusion of the element in this study.

*Why should we care
about this element?*

TRENDS & TRAJECTORY OF CHANGE

Downtown is in a constant state of change, not only in its built form, but in demographics, economic and environmental stressors and development trends. Understanding what is happening here helps Toronto to adapt.

*How is Downtown
changing and why does
the element need to be
addressed?*

TORONTO PLANNING & REGULATORY CONTEXT

This study builds upon current plans, policies, practices and guidelines that already exist for Downtown (e.g. Official Plan, Secondary Plans, Tall Building Guidelines, etc.). This section lays out how and to what extent built form elements are currently regulated.

*How does the City's
planning framework
currently address this
element?*

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

There is benefit to looking to other urban areas to understand how they address these elements. This may include reports and studies that are not necessarily tied to a specific municipality.

*How do other cities
address this element?*

ANALYSIS / TESTING

Where applicable, this section outlines the purpose, methodology, and results of assessing the element of liveability under different scenarios to see how to achieve the objective.

*How can this element
be regulated or guided
to achieve our desired
outcomes?*

SUMMARY OF FINDINGS

A summary of what the research, analyses and testing presented, and what gaps or new issues it brings to light.

RECOMMENDATIONS

Although Toronto has a strong planning framework for built form, a list of recommendations are the result of the thought process and research involved in determining how to improve, enhance and protect liveability within Downtown. Areas of further research may also be identified.

01. THERMAL COMFORT

OBJECTIVE

The comfort and use of the public realm and other outdoor spaces where people gather is crucial to achieving liveability and utility of these spaces, and can be promoted by ensuring their thermal comfort. Buildings should be located, designed and massed to maximize pedestrian comfort in all seasons. This includes maintaining sunlight onto the public realm, including parks and open spaces, streets and sidewalks, school yards, outdoor amenity spaces and privately owned publicly-accessible spaces.

RATIONALE

Thermal comfort can be achieved in part by ensuring solar access. The City's policies for solar access are rooted in the analysis and recommendations from the *Sun, Wind and Pedestrian Comfort* study¹⁰, which placed a focus on the spring and fall equinox as the time of year when direct access to sunlight has the potential to extend the comfortable time for Torontonians to use its public spaces. This approach also considers the balance of sunlight access and development. With the low angle of the sun above the horizon in the winter (noon on December 21st), there would be limited potential for development if there was a requirement for solar access at this time of year. This approach prioritizes sunlight when it can have the greatest impact on thermal comfort. This has been explored further in this liveability study through three thermal comfort lenses:

“Cultures and climates differ all over the world, but people are the same. They’ll gather in public if you give them a good place to do it.”

Jan Gehl

01A. Access to Sunlight on Parks and Open Spaces

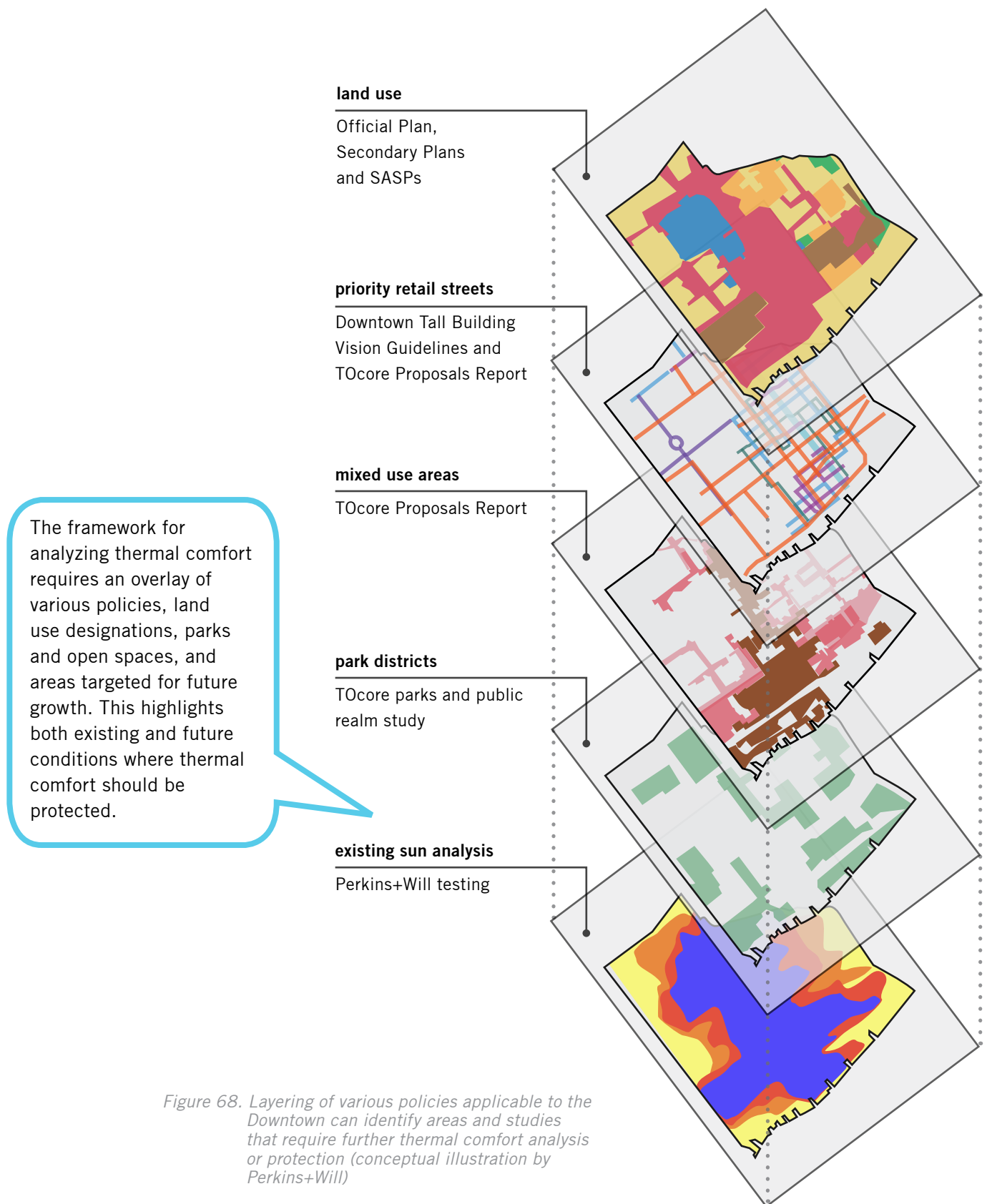
01B. Access to Sunlight on Sidewalks and Streets

01C. Pedestrian Level Winds



Figure 67. Extracts from the 1991 Bosselmann et al. study

10 Bosselmann, Peter et al. *Sun, Wind, and Pedestrian Comfort*. Prepared for the City of Toronto Planning and Development Department, 1991.



01A. ACCESS TO SUNLIGHT ON PARKS AND OPEN SPACES

OBJECTIVE

Locate, design and mass buildings to allow for sunlight onto parks and open spaces, including plazas, ravines, school yards, privately owned publicly-accessible spaces (POPs) and private outdoor amenity areas.

RATIONALE

Outdoor spaces provide vital pockets of both tranquility and activity, providing an escape from the daily busyness and intensity of the urban environment. Sunlight has many benefits – having the ability to engage in open, natural and restorative environments with access to the sun can boost mood, keep energies high, reduce stress and improve overall well-being. Varying in shape, size, and programming, public realm spaces should provide the opportunity to be connected to nature in some manner. In the Toronto climate, direct sunlight is especially important and can extend the period of comfortable conditions outdoors by several months.

Once an outdoor space is in shadow from a building, the impacts on these public amenities cannot be reversed. The result is that a new shadow can turn an activated open space into an underused or neglected space. Downtown will continue to develop with new buildings, but it is critical that existing outdoor spaces stay sunny and comfortable, allowing them to continue to be engaging, thriving and welcoming for year-round use.

TRENDS & TRAJECTORY OF CHANGE

Downtown's limited supply of parks and open spaces is a product of the city's finite land base, ownership patterns and its desirable location for both residential and non-residential development. Downtown has one of the lowest rates of parkland provision per person in the city, and ability to increase this supply is limited. As more of Downtown's population spends time in vertical communities, there is a need to provide high-quality, comfortable parks and open spaces within the urban environment.

In addition to the quantity of space, there is also the quality and character of these spaces to consider. This includes the design, maintenance and operation, and the environmental qualities of these spaces. As the number of tall buildings Downtown increases, the shadows cast are longer and collectively larger. This is especially true on infill sites that create the potential for more closely spaced tall buildings. This protection of sunlight in Downtown's parks and open spaces, as a means to preserve the utility of these spaces, must be balanced with growth.



Figure 69. Built form surrounding significant open spaces should be shaped to allow and enhance access to sunlight. Nathan Phillips Square (image credit: Toronto Life)

TORONTO PLANNING & REGULATORY CONTEXT

The Official Plan sets out guidance for all new developments to limit its impact on neighbouring streets, parks, open spaces and properties by providing for adequate light and privacy (3.1.2.3 d). This is emphasized in both Official Plan and City-Wide Tall Building Guidelines, new developments must “maintain access to sunlight” (Official Plan Chapter 4.2, City-Wide Tall Building Guidelines 1.3).

The Downtown Tall Buildings: Vision and Supplementary Design Guidelines provide additional direction and rationale for prioritizing the protection of open spaces Downtown. The guidelines protect *Signature Parks* for 6 hours and *all other parks* for 2 hours.

“Locate and design tall buildings to not cast new net shadows on:

- a) Parks and open spaces identified as “Signature Parks/Open Spaces” between 10:00 AM and 4:00 PM on September 21st. Signature Parks/Open Spaces include: Allan Gardens; Berczy Park; David Crombie Park; Grange Park; Moss Park; Nathan Phillips Square; St. James Park and Queen’s Park), and
- b) All other parks located within and adjacent to the Downtown Tall Buildings: Vision and Supplementary Design Guideline boundary area, between 12 Noon and 2:00 PM on September 21st”.

“Locate and design tall buildings to best mitigate all new net shadowing of:

- c) Jesse Ketchum Park, School Playground & Open Space and Ramsden Park in the Bloor-Yorkville/ North Midtown Area and St. James Cathedral’s park lawn & spire, throughout the entire day for all seasons of the year”.

There are several Site and Area Specific Policies (SASPs) that have policy direction for sunlight access such as North Downtown Yonge and the Garden District. The POPS guidelines primarily address the location of these privately owned publicly-accessible spaces, and how to maximize the amount of sunlight the spaces receive. **Refer to Appendix G for full Toronto planning and regulatory context excerpts.**



Figure 70. Excerpt from Tall Buildings Appendix 3 - Shadow Study of current (2013) conditions, from 10 am to 4 pm on September 21st

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

Other cities evaluate shadow analysis on parks and open spaces through a variety of methods. **Refer to Appendix G for full excerpts and additional graphics from the precedent city research.**

Mississauga, Ontario - Standards for Shadow Studies (2014)

The City of Mississauga has a very specific set of guidelines governing private and public streets and spaces to ensure adequate sunlight. The City uses a Sun Access Factor formula on specific date(s) to determine if the criteria are met. School yards are protected at a more restrictive level compared to other public realm spaces.

“3.2 Communal Outdoor Amenity Areas [...] include children’s play areas, school yards, tot lots, and park features such as sandboxes, wading pools etc., and outdoor amenity areas used by seniors and those associated with commercial and employment areas during spring, summer, fall and winter”.

“Shadows from proposed developments should allow for full sun on the above places at least half the time, or 50% sun coverage all the time, on each of the following dates: June 21, September 21, December 21”.

“Sun Access Factor = $As(ave) / AT$ = Average of the Areas in Sunshine for each of the test times from 1.5 hours after sunrise to 1.5 hours before sunset both inclusive / Total Area of the Space or Feature”.

Boston, USA - Shadow Laws (1990, 1993)

Boston has two shadow laws that protect two public spaces - the Common and the Public Garden, for the first hour after sunrise (or 7:00 am, whichever is later or the last hour before sunset).

Sydney, Australia - Local Environmental Plan (2012)

Based on set time frames, number of hours and date for shadow protection, the Local Environmental Plan outlines the exact extent of sun access planes for 8 specific parks, depending on their level and type of activity. To supplement this, a diagram shows the sun access plane height contours and resulting maximum building height allowable above ground.

New York City, USA - Interactive Shadow Map

The as-of-right building regulation in New York City presents a different approach to managing their shadow impacts on the public realm. Their zoning text does not have any direct direction for protecting shadow impacts.

The City has an interactive, publicly accessible map that presents all the shadows produced by buildings on December 21, June 21, and September 21, including annotations of address, height, and construction date. Hovering over any point in the map will present the percentage of the amount of day (in minutes) that is in shadow.

ANALYSIS

Ideally, all of Downtown's public realm, including parks and open spaces, would have optimal micro-climatic conditions for human comfort and utility as achieved, in part, by providing access to sunlight. The City's policies for solar access are rooted in the analysis and recommendations from the "Sun, Wind and Pedestrian Comfort: A Study of Toronto's Central Area"¹¹ (Bosselman et al), which placed a focus on the spring and fall equinoxes as the time of year when direct access to sunlight has the potential to extend the comfortable time for Torontonians to use its public spaces. This approach also took into consideration the balancing of sunlight access with growth and development. With the low angle of the sun above the horizon in the winter (noon on December 21st), sunlight access would greatly limit potential for development beyond low rise buildings. This approach of protecting for solar access between March 21st to September 21st from 10:18 a.m. – 4:18 p.m. prioritizes sunlight when it can have the greatest impact on thermal comfort and when it does not overly limit development potential.

Protecting for sunlight access on parks and open spaces has been an approach taken in many of the City's planning frameworks – the Official Plan, Secondary Plans and Site and Area Specific Policies (SASPs). In the Downtown context specifically, both CityPlan '91 and the Downtown Tall Buildings: Vision and Supplementary Design Guidelines (adopted by Council in 2012) identified a number of parks and open spaces to be protected from shadow. The Guidelines included a number of *Signature Parks* – which are spaces with special historic and/or cultural significance, that currently experience sunlight throughout most of the day. As the population of Downtown intensifies and the number of tall buildings increases, the spaces around them will experience more shadowing. The need to preserve sunlight becomes increasingly important to preserve the utility of these existing parks and open spaces and to protect any new parks and open spaces, as they are secured.

As part of this preliminary assessment, a cumulative hour analysis for existing Downtown-wide sunlight access was prepared based on the times and dates specified in the Sun/Shadow Study Terms of Reference from the City, and consistent with the Bosselman approach. The result is a colour gradient map that illustrates the hour by hour impact of shadows (Figure 711). Based on the analysis and referencing Bosselman's thresholds, the open spaces Downtown may be classified in three categories. **Refer to Appendix H for testing results.**

1. **Areas of high sunlight**, with 6 or more hours of sunlight on September 21st;
2. **Areas of medium sunlight**, with 3 to 5 hours of sunlight on September 21st; and
3. **Areas of low sunlight**, with less than 3 hours of sunlight on September 21st.

There are a number of areas with exceptional sunlight access within Downtown. These include many of the waterfront parks and open spaces, open space along the Don Valley and Rosedale Valley ravines, many of the parks within low-rise residential neighbourhoods, and some of the large parks and open spaces, such as Queen's Park, Alexandra Park or Riverdale Park West. This is due in part because of their location, orientation and surrounding prevailing land uses and form. For example, Jean Sibelius Square located in the Annex experiences almost full sun throughout the day because it is surrounded by streets and low-rise residential buildings. Similarly, many of the waterfront parks experience very good sunlight throughout the day because there is no development directly to the south. Many of the master planned areas within Downtown – Regent Park and West Don Lands – have been designed with relatively large parks and open spaces, with their location and orientation in mind to ensure good solar access. Interestingly, some of the older tall residential buildings in apartment neighbourhoods, such as St.

¹¹ Bosselmann, Peter. *Sun, Wind, and Pedestrian Comfort: A Study of Toronto's Central Area*, Toronto (Ont.). Planning and Development Department, 1991.

James Town and Moss Park that were built with slab type buildings with generous spacing have good sunlight access on their surrounding open spaces. The Financial District is unsurprisingly low in sunlight access, most of it receiving less than 3 hours of sunlight.

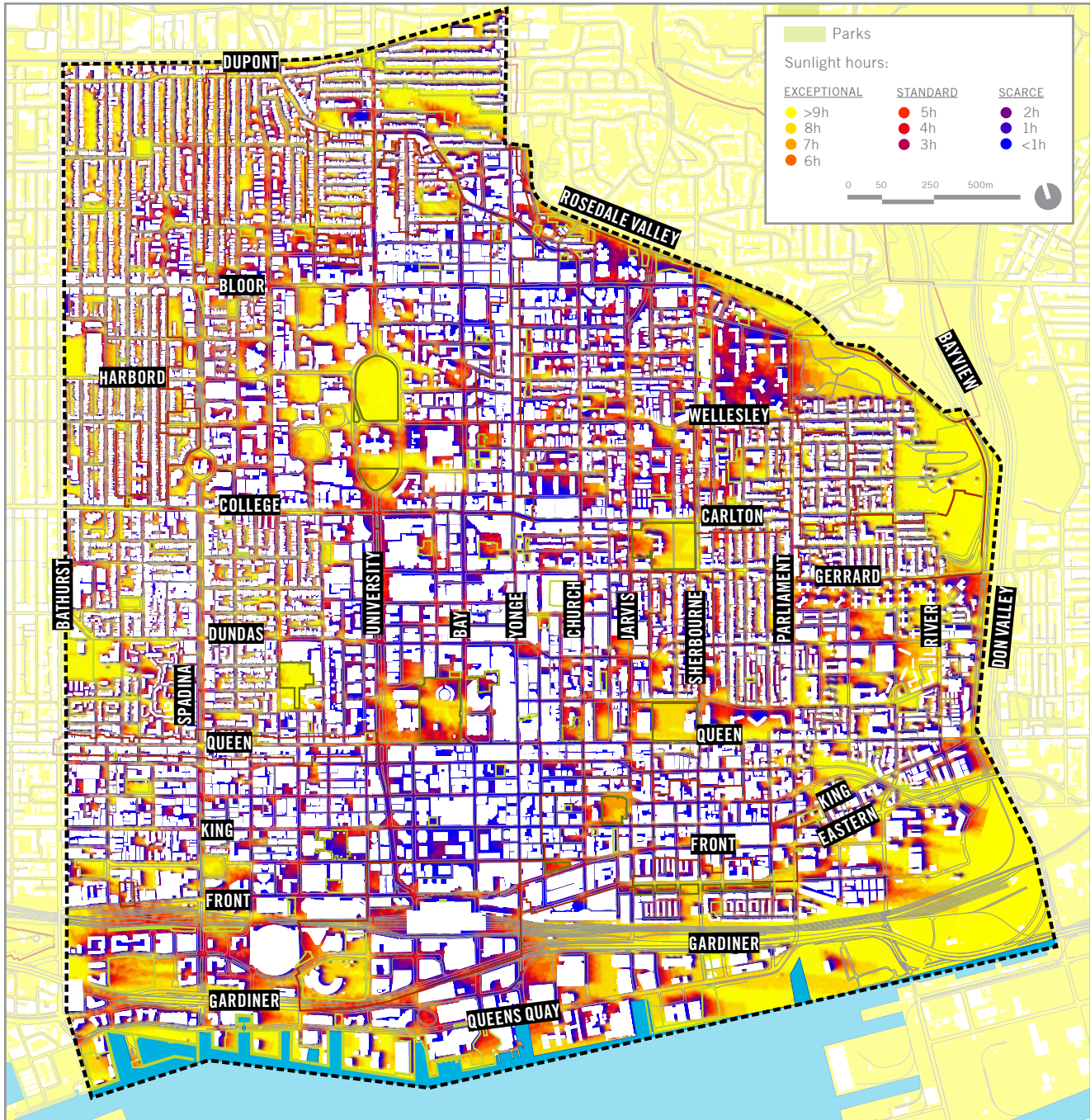


Figure 71. Sun/shadow analysis of current conditions on September 21st – cumulative hour analysis (Testing by Perkins+Will)

TESTING

A series of tests were designed to evaluate the impact that various sunlight protection policies would have on both thermal comfort and development potential. In order to design a comprehensive testing process, it was necessary to define the following assumptions in a way that is consistent with the intent of the vision for the Downtown, and that carefully considered matters of Methodology, Geography and Morphology:

Methodology:

The study of precedent cities proves that sunlight can be measured in different parameters, dates, sequences, etc. The methodology prescribed for the testing responded to the following questions:

- How is access to sunlight defined and measured?
- What units should be used?
- When should it be measured?
- What is a reasonable and satisfactory target for sunlight?
- Is the proposed methodology consistent with the existing planning framework and tools?
- Factors considered included no net-new shadow¹² versus number of hours in a defined period of time versus percentage of sun coverage all the time; equinox versus solstice measurements; one criterion only v.s. sun access factor (e.g. Mississauga example on Page 53).

Geography:

As part of the testing the type and amount of space that should be protected was determined. The geography prescribed for the testing responded to the following questions:

- Which spaces should be designed for protection?
- What is the criteria for protection?
- Which and how many spaces can be protected in the Downtown while still supporting other priorities in the TOcore vision?
- Factors tested included all open spaces v.s. selected open spaces; whether private open spaces should be considered for designation; whether criteria for protection should reflect on the land use designation of surrounding properties.

Morphology:

Boundaries were defined while sorting and processing the data. The morphology prescribed for the testing responded to the following questions:

- How are the spaces defined?
- What file source should be used for the data?
- Does the protection boundary extend to include adjacent open spaces, such as streets? For example: definition and source of legal boundaries for parks; whether sidewalks and/or streets in the perimeter of

¹² City's documents are not consistent on the use of no-net-new versus no-new-net, as evidenced in the precedents shown on previous pages and within the Appendix

an open space should be considered; approach to existing buildings within the protection boundary (e.g. pavilion within a park).

Full explanations of Methodology, Geography and Morphology employed during the testing can be found in Appendix H.

SOLAR PROTECTION TESTING STEPS:

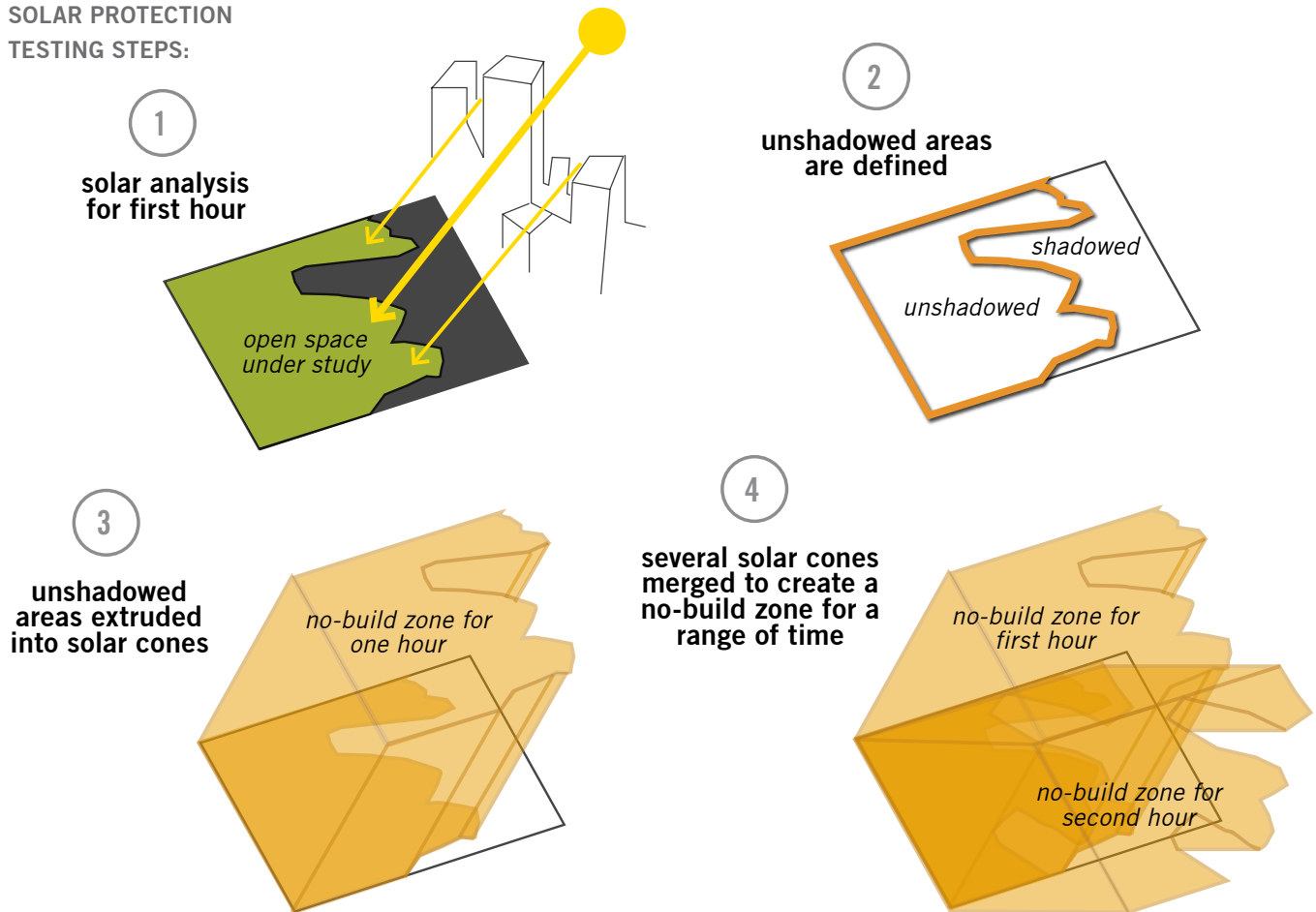


Figure 72. Demonstration of steps in the solar protection testing process (illustrations by Perkins+Will)



Figure 74. Maximum height for towers under the new City of Sydney strategy, based on sun access (image credit: the Sydney Morning Herald)

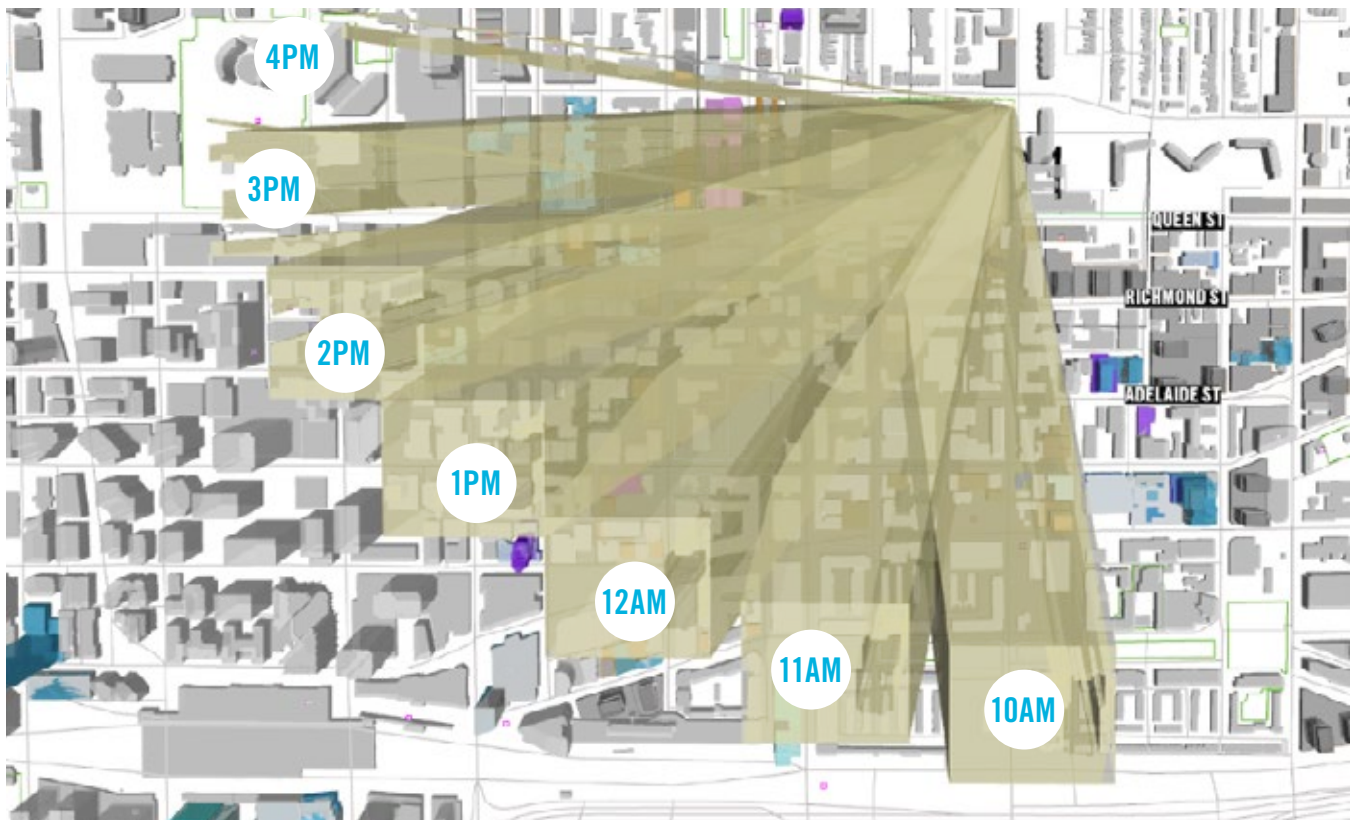


Figure 73. Demonstration of the generation of accumulative hourly no net-new no-built zones (in yellow) for Moss Park, for December 21st, depending on the number of hours to be protected, the range of the affected area varies

LEGEND



park
boundary



Sunlight hours:

>9h

5h

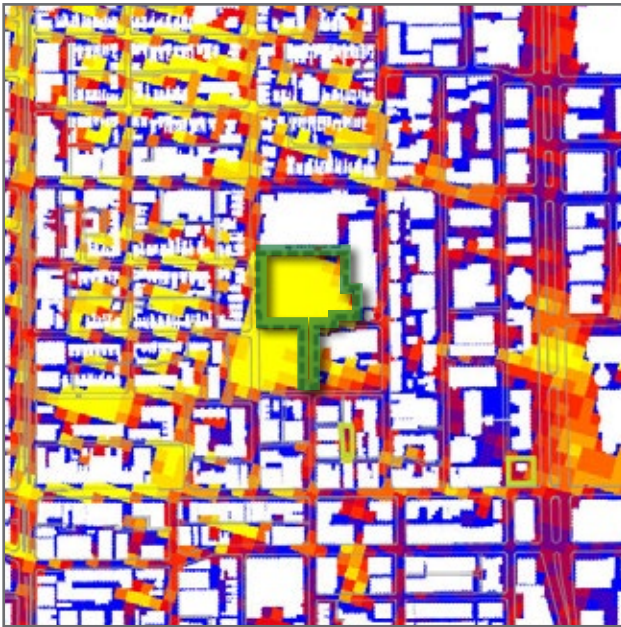
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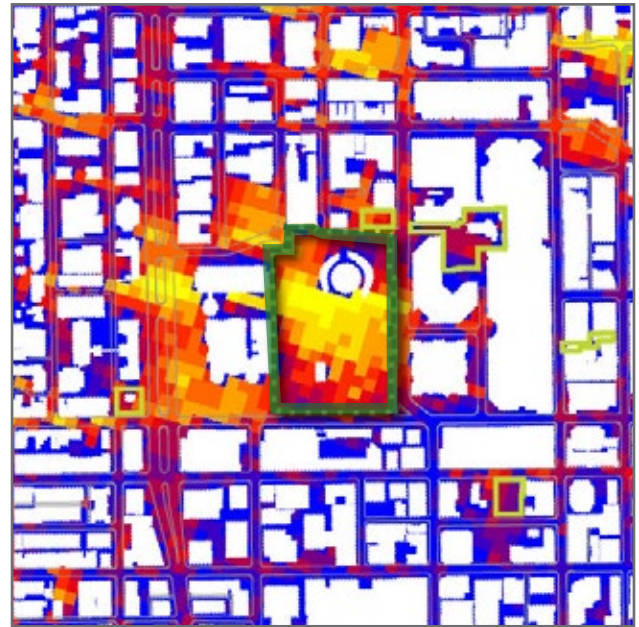
Individual Open Space Testing

Below are four of the test sites analyzed and selected for sun protection. For all 44 tested sites, **see Appendix H.**

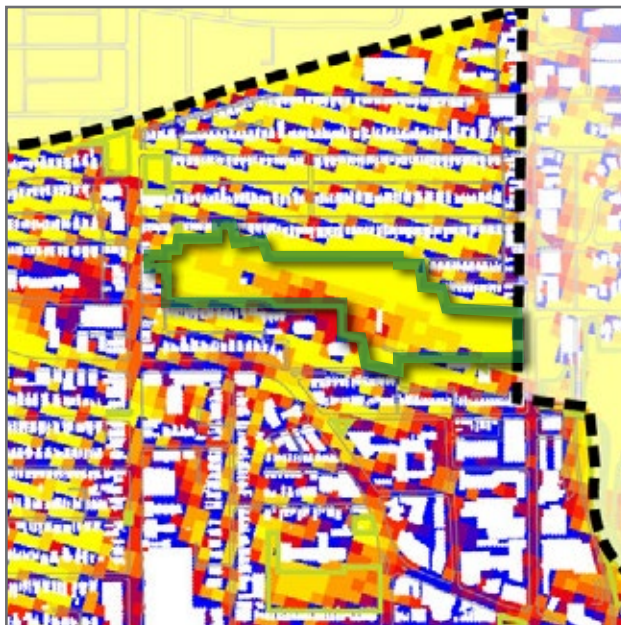
17. Grange Park



28. Nathan Phillips Square



33. Ramsden Park



38. St Andrew's Playground

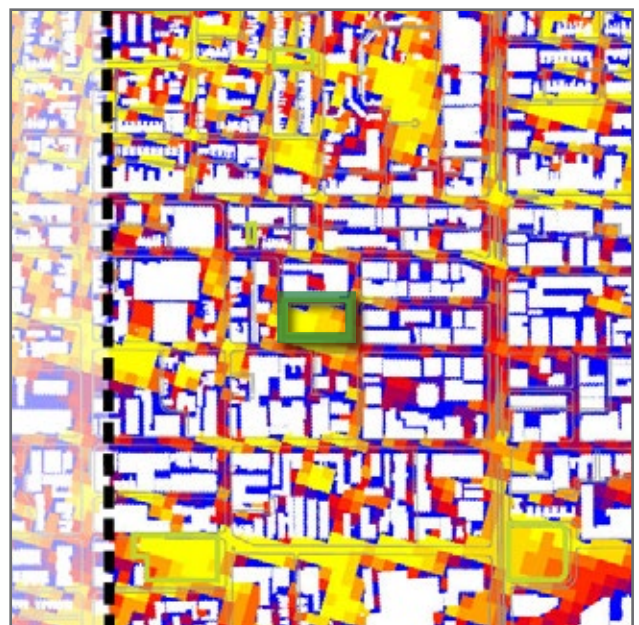


Figure 75. Sample of individual open spaces testing for existing solar conditions (testing by Perkins+Will)

FINDINGS

- As buildings get taller, and as more tall buildings are built in close proximity to one another, the shadows cast from these buildings become more pervasive. The shadows from tall buildings, depending on the time of day and year, can extend several blocks from its footprint.
- There are opportunities to expand the areas of shadow protection for parks and open spaces within Downtown beyond the Signature Parks, identified for the 6-hour shadow protection window found in the City's Downtown Tall Buildings: Vision & Supplementary Guidelines.
- Given Downtown's limited number of existing parks and open spaces, limited opportunities to create new parks and open spaces, and an increasing intensity of people using these parks and open spaces, it is important to protect spaces in the public realm that have sunlight, and create spaces that will have access to sunlight.
- In addition to general shadow guidance, other cities continue evaluate shadow analysis on a case-by-case basis.

RECOMMENDATIONS

1. Minimize shadows cast on the whole of the public realm to encourage its use, with a focus on prioritizing pedestrian activity and other active transportation modes.
2. Building on the City's existing policy frameworks, expand on the list of parks and open spaces to be protected from shadow, using and expanding on the criteria identified in this document.
3. Coordinate with the TOcore Parks and Public Realm Plan to identify other criteria for inclusion in the areas for no net-new shadow. Location within a "Park District" as identified in the Parks and Public Realm Plan should also be considered as part of the criteria as these parks and open spaces are important public realm amenities within their respective neighbourhoods.
4. Review the potential for additional parks and open spaces to be added to the Sun Protected Parks and Open Spaces map through local area studies by referring to the criteria identified in this study.
5. Include new parks and open spaces as they are planned and secured, on the list of Sun Protected Parks and Open Spaces where they align with the criteria and testing as identified in this study.
6. Protect school yards from shadow as part of the public realm and open space network Downtown.
7. Evaluate the location and design of new parks and open spaces by using the analysis, criteria, and testing as outlined in the study to determine their sunlight access.
8. Encourage the location of new outdoor amenity spaces, POPS and other private open spaces for good sunlight access.
9. Consider the impacts of new development on existing outdoor amenity spaces, POPS and other private open spaces.
10. Evaluate the acquisition of land for the creation of new public parks by considering the location and opportunity for sunlight access.

(CONTINUED)

RECOMMENDATIONS (CONTINUED)

11. Provide and maintain the City model, with frequent updates, currently available to applicants to ensure a standardized process for analyzing sun and shadow impacts of new proposed developments, including: detailed, accurate massing; and topographical information.
12. Update the Sun/Shadow Study Terms of Reference in the City's Development Guide to clarify the datasets and assumptions for the model.
13. Explore other architectural and massing techniques employed by other precedent cities as a strategy to ensure sunlight access on parks and open spaces.

01B. ACCESS TO SUNLIGHT ONTO STREETS

OBJECTIVE

Locate, design and mass buildings to allow for sunlight onto sidewalks and streets.

RATIONALE

Navigating Downtown's streets should be a comfortable, welcoming and animated experience. The pedestrian experience and desire to linger is largely dependent on the thermal conditions and buildings that frame the streets. Streets are outdoor rooms for active and passive forms of movement, connecting to public transit or gathering spaces, providing opportunities for people to experience, engage with and explore the city. Pedestrians are more likely to walk more, and for longer, when their consistent exposure to sunlight is higher¹³. By ensuring sidewalks and streets are comfortable, walkability Downtown can be improved.

Sidewalks and streets are more than just places of movement – in many instances, especially Downtown, they should be destinations unto themselves and places where pedestrians are encouraged to linger. The link between climate conditions and physical activity suggests that it is critical for these spaces to remain sunny, light, airy and bright. Ultimately, there should be opportunities for sunlight access within the public realm.

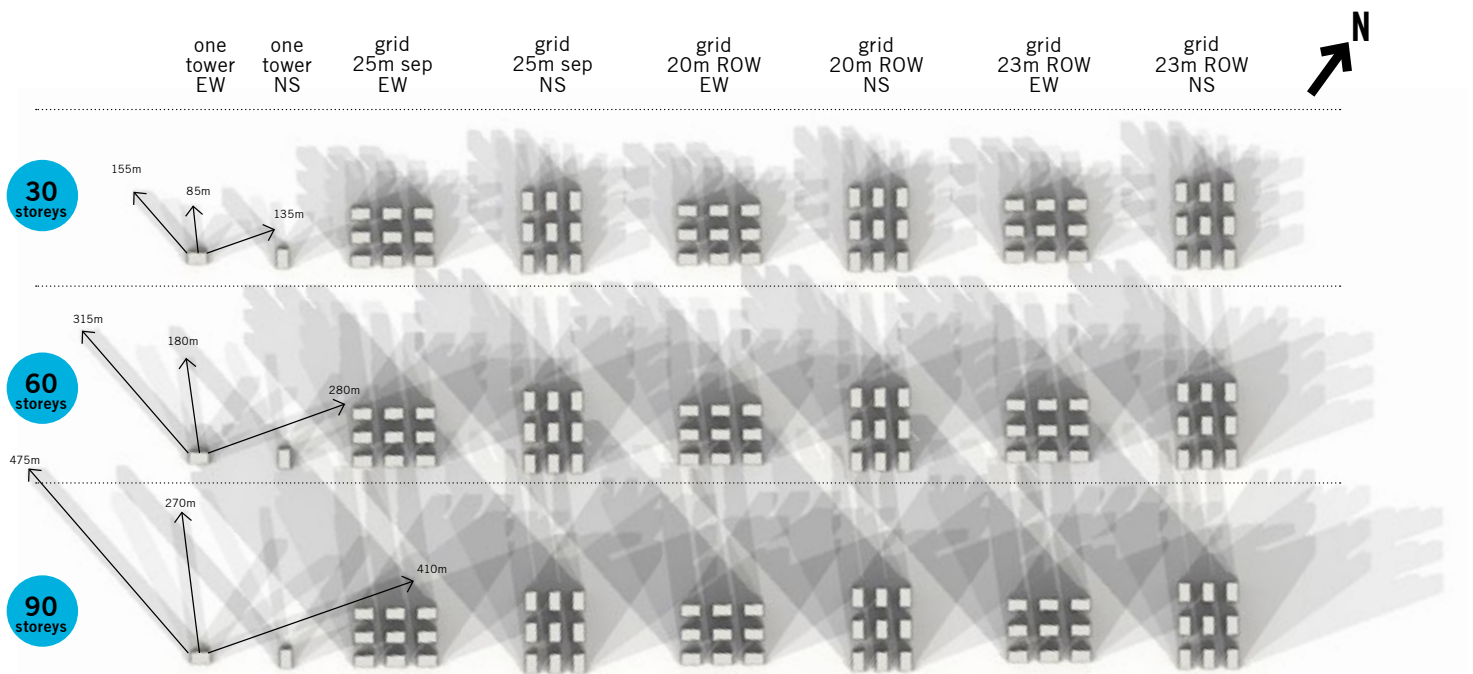


Figure 76. Reach of shadows of tall buildings depending on height, orientation of towers and tower separation associated with either City of Toronto By-law 1106-2016 where described or the right-of-way of the street (illustration by Perkins+Will)

¹³ Klenk, J et al. *Walking on Sunshine: Effect of Weather Conditions on Physical Activity in Older People*. Journal of Epidemiology & Community Health, 2012.