APPENDIX . 01B. ACCESS TO SUNLIGHT ONTO STREETS - RESEARCH

TORONTO PLANNING & REGULATORY CONTEXT

Official Plan (2015)

3.1.2 BUILT FORM

"3. New development will be massed and its exterior façade will be designed to fit harmoniously into its existing and/or planned context, and will limit its impact on neighbouring streets, parks, open spaces and properties by: d) providing for adequate light and privacy".

3.1.3 BUILT FORM - TALL BUILDINGS

"When poorly located and designed tall buildings can physically and visually overwhelm adjacent streets, parks and neighbourhoods. They can block sunlight, views of the sky and create uncomfortable wind conditions...".

"Most of the proposed intensification in this Plan is anticipated to be achieved with street oriented, grade related or mid-rise building types that define and support sunny, comfortable and vital streets, parks and open spaces...".

4.2 APARTMENT NEIGHBOURHOODS

"2. Development in Apartment Neighbourhoods will contribute to the quality of life by:

• c) locating and massing new buildings to frame the edge of streets and parks with good proportion and maintain sunlight and comfortable wind conditions for pedestrians on adjacent streets, parks and open spaces...".

Avenues & Mid-Rise Buildings Study (2010)

This document recommends that sidewalks on the Avenues enjoy at least 5 hours of sunlight on the opposite sidewalk from the spring through to the fall¹. The built form tools to enforce it are:

- Front angular planes, side property step-backs at upper storeys, breaks at upper storeys between new and existing mid-rise buildings, and maximum building width

1.2 MID RISE URBANISM

"The Avenues vision calls for beautiful tree-lined streets and sun-lit sidewalks".

Sun, Wind, and Pedestrian Comfort: A Study of Toronto's Central Area (1991)

This study of micro-climatic conditions particular to Toronto selected representative streets and open spaces, developed a modelling methodology to test different scenarios, and concluded with recommendations and implementation tools.

It describes how sun access standards have been created, and what purposes they are designed for. For example, some streets with a high density of office uses will require a shorter frame of sunlight, ideally for a 30 to 60-minute lunch break. On the other hand, a more extensive time window for commercial streets and residential streets will be required to serve shoppers and residents who would desire sunny sidewalks for longer, from mid-morning to mid-afternoon.

¹ Supported by evidence from "Sun, Wind, and Pedestrian Comfort: A Study of Toronto's Central Area" by Bosselman et al., 1990, which recommends maintaining a minimum of 5-hours of sunlight on Toronto's commercial streets between the spring equinox and fall equinox.

The study selected a number of representative streets to analyze their sunlight and shadow conditions. From this, they were able to use solar fans to design a 'mitigated' development form that would accommodate for protecting existing sun conditions within its time frame.

It includes a few relevant recommendations:

A street classification standard for all streets of the Central Area, with 3, 5 and 7-hour categories on September 21st:

- "Three-hour Time Window: Business Streets".
- "Five-hour Time Window: Promenades, Historic Streets, Medium-density residential streets and mixeduse streets".
- "Seven-hour Time Window: Low-density residential streets".

"Restrict the allowable height of future development to guarantee three or more hours of sunlight during a period encompassing midday along sidewalks of streets in the Central Area".

"Three-Hour Windows of Sunlight for East-West Streets: the height of properties on the north side are exempted".

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

Mississauga, Ontario - Standards for Shadow Studies (2014)

The City of Mississauga includes a hierarchy of streets (opposite boulevard including full width of sidewalk) with different protection time frames, and checkpoints, as well as angular planes depending on street type and right of way dimensions.

Low and Medium Density Residential Streets:

"Developments should be designed to allow full sunlight on the opposite boulevard including the full width of the sidewalk on September 21...

- for a total of at least 4 hours between 9:12 a.m. and 11:12 a.m.
- and between 3.12 p.m. and 5:12 p.m.".

"This criterion is met if there is no incremental shade from the proposed development at:

- 9:12 a.m., 10:12 a.m. and 11:12 a.m.
- and at 3:12 p.m., 4:12 p.m. and 5:12 p.m.".

Mixed Use, Commercial, Employment and High Density Residential Streets

"Developments should be designed to allow full sunlight on the opposite boulevard including the full width of the sidewalk on September 21...

- for a total of at least 5 hours that must include the 2 hour period between 12:12 p.m. and 2:12 p.m.
- and an additional 2 hour period from either 9:12 a.m. to 11:12 a.m. or from 3:12 p.m. to 5:12 p.m.".

"This criterion is met if there is no incremental shade from the proposed development at:

• 12:12 p.m., 1:12 p.m. and 2:12 p.m.

• and three consecutive times either: 9:12 a.m., 10:12 a.m. and 11:12 a.m. or 3:12 p.m., 4:12 p.m. and 5:12 p.m.".

London, Ontario - The London Plan

BUILDINGS

"292. High-rise buildings should incorporate a podium at the building base, to reduce the apparent height and mass of tall buildings on the pedestrian environment, allow sunlight to penetrate into the right-of-way, and reduce the wind tunnel effect".

"293. High-rise buildings should be designed with slender towers that reduce shadow impact, minimize the obstruction of views, and are less massive to neighbouring properties. A typical floor plate of approximately 1,000m² is a reasonable target to achieve this goal. Commercial towers may have larger floor plates, but should still have effective separations between towers to allow access to sunlight and views".

URBAN DESIGN POLICES: DESIGN PRINCIPLES

"Access to Sunlight: ix) The design and positioning of new buildings should have regard for the impact of the proposed development on year-round sunlight conditions on adjacent properties and streets. In reviewing proposed developments, access to sunlight for adjacent properties should be maximized to enhance the potential for energy conservation and the amenity of residential areas and open space areas, such as parkettes and outdoor plazas" (amended by OPA No. 88 – OMB Order No. 2314 – approved 99/12/23).

Victoria, Australia - Guidelines for Higher Density Residential Development

OBJECTIVE 2.3

"To protect sunlight access to public spaces. Shadows cast by a new development should not be considered in isolation, but as part of the cumulative shadowing effect of surrounding buildings, structures and trees. Each new building will add to this overshadowing and should be considered as an additional impact to the existing situation".

"A key decision about overshadowing is the appropriate time of the year to measure when additional overshadowing might occur – there are two choices: equinox (22 September) or winter solstice (22 June). The appropriate measure for private open space is typically accepted as equinox, but local policy can identify public spaces that should be protected at the winter solstice. These spaces will typically include local open spaces and plazas. Where a shopping street currently enjoys sun at mid winter there will usually be a reasonable presumption that the sun access will be preserved".

APPENDIX J. 01B. ACCESS TO SUNLIGHT ONTO STREETS - TESTING

TESTING

Since existing policies currently treat open spaces and streets very differently, the process of testing sunlight onto streets was fundamentally different than for testing sunlight onto open spaces. In order to design a coherent testing process, the *Methodology, Geography* and *Morphology* had to be defined.

Methodology

Unlike parks and open spaces, existing policies for the protection of sunlight onto streets in Toronto frame the evaluation based on the number of hours of sun per day received onto the street during the equinoxes. While the no net-new shadow approach was binary in nature (build zone/no-build zone), the key challenge of the hourly approach is that there may be more than one possible result which renders the production of final no-build zones unviable.

To demonstrate this idea, consider a hypothetical area of a street which, for a given day, is sunlit between 12pm and 6pm under existing conditions, to a total of 6 hours of light in such given day. If the target for the day were 5 hours of light, then the area could take one hour less of sunlight and still meet the target. This hour of light could be taken away either from 12 to 1pm by a new building A south of the site, or from 5 to 6pm by a new building B west of the site. Either building A or building B are possible, but not both; therefore, two different results may develop while still meeting the 5-hour target. If the proposed target was 3 hours, the number of possible results is higher.

Because the purpose of testing was to develop a reasonable assessment of the impacts of a certain sunlight requirement on the development potential of the area surrounding the street, the test was simplified to render only one of the possible results, the one that would allow for the maximum flexibility for development build-out while meeting the target. Any other results would be inferred from this test. Generally, the moment of the day when the sun reaches the street with less impact in development is when the sun is at its highest altitude in the sky, at solar noon. Therefore, the test was designed to calculate a no net-new shadow solar cone for the targeted hours symmetrical around noon: if the target was 2 hours, the study time was between 11am and 1pm; if the the target was 4 hours then the study time was between 10am and 2pm.

It is important to highlight that the test described above was not intended to represent an exclusive scenario of how a certain sunlight target could be met, and to acknowledge that it was inconclusive in regards to the future of areas that did not meet the minimum target. Instead, the test was used as a tool to visualize the changing consequences of diverse variables. During the process, additional auxiliary tests were run to confirm various hypotheses.

Generally, the targets used for the testing aligned with the threshold values set by the Bosselman study and notably used by any subsequent policy (i.e. 3, 5, and 7 hours).

Geography

Early testing indicated that it was unfeasible to protect all streets because of the restrictions it would place on the potential for growth Downtown. Therefore, the analysis focused on identifying streets that would benefit from additional protection. The Downtown Plan, as well as other components of the TOcore work, in particular the Downtown Parks and Public Realm Plan and Mobility Strategy, provide a framework to rationalize the importance of certain streets Downtown. The network of Priority Retail Streets capture the patterns of pedestrian activity and the Great Streets speaks to the cultural and historical significance of certain corridors. The testing process focused on both retail streets¹ and Great Streets². However, the analysis revealed that both retail streets and Great Streets extend across areas of different planned contexts, and thus varying height and densities. It was concluded that any additional requirement to protect for sunlight onto streets should be aligned with the planned context as expressed by the land uses designations, in particular for the four new *Mixed Use Areas* resulting from the Downtown Plan.

Morphology

The matter of defining the geography of the street to be protected was not simple. Existing City policies refer to the street in different terms. The Avenues and Mid-rise Buildings study protects for sunlight onto the sidewalks on both sides accumulative; the Tall Building Guidelines protects the opposite side of the street only, regardless of orientation.

In addition to the discrepancy in methodology between the different policies, there is the matter of the lack of definition of the sidewalk boundary itself. Firstly, it is unclear whether a sidewalk includes extensions into private areas by means of setbacks. Secondly, the use of the curb as the limit of a sidewalk may be unreliable because it may be relocated through road redesign, as illustrated by examples of road re-alignment within Downtown, such as along Queens Quay, or where the right-of-way includes areas for active transportation (i.e. bike lanes) that would benefit from access to sunlight.

An additional issue is the impact of the asymmetry of streets in terms of access to sunlight. Any testing should acknowledge the difficulties of ensuring any level of sunlight on the south side of the street. Similarly, if specific periods of time were dictated, the west side of the street generally benefits from morning sun, while the east side depends on the afternoon hours. The preferred definition of a sidewalk for the purpose of sunlight protection is captured in the Recommendations.

¹ TOcore Proposals Report 2 As identified in the Downtown Plan Strategy

Queen Street



	PARKS BAR	S
MEDIUM		
		POTENTIAL GROWTH

King Street



	PARKS BAR		
MEDIUN	1		LOW
		POTE	ENTIAL GROWTH

Queens Quay





Figure A14. Sun analysis for some of the east-west Great Streets under existing conditions (testing by Perkins+Will)















Spadina Street



University Avenue



Yonge Street



Figure A15. Sun Analysis for some of the north-south Great Streets under existing conditions (testing by Perkins+Will)









APPENDIX K. 01C. PEDESTRIAN-LEVEL WINDS -RESEARCH

TORONTO PLANNING & REGULATORY CONTEXT

Official Plan (2015)

The Official Plan contains few details about the creation of a comfortable microclimate; there is a need to update and expand these requirements.

3.1.2 BUILT FORM

"3. New development will be massed and its exterior façade will be designed to fit harmoniously into its existing and/or planned context, and will limit its impact on neighbouring streets, parks, open spaces and properties by:

- e) adequately limiting any resulting shadowing of, and uncomfortable wind conditions on, neighbouring streets, properties and open spaces, having regard for the varied nature of such areas; and
- f) minimizing any additional shadowing and uncomfortable wind conditions on neighbouring parks as necessary to preserve their utility".

3.1.3 BUILT FORM - TALL BUILDINGS

"When poorly located and designed, tall buildings can [...] block sunlight, views of the sky and create uncomfortable wind conditions in adjacent streets, parks and open space...".

City-Wide Tall Building Guidelines (2013)

GUIDING PRINCIPLES

"[...] minimize shadowing and wind impacts, and protect sunlight and sky view, for streets, parks, public and private open space, and neighbouring properties".

3.2.1 FLOOR PLATE SIZE AND SHAPE

"a. Organize, locate, and articulate the tower floor plate to minimize shadow impacts and negative wind conditions on surrounding streets, parks, open space, and properties".

"b. Provide greater tower separation, setbacks, and stepbacks proportionate to increases in tower floor plate size or height to mitigate resultant wind, shadow, and sky view impacts".

3.2.2 TOWER PLACEMENT

"d. As an option within the stepback, up to one third of a point tower frontage along a street or open space may extend straight down to the ground. At these locations, provide permanent building features, such as canopies and overhangs, to help mitigate pedestrian-level wind".

4.3 PEDESTRIAN LEVEL WIND EFFECTS

"Locate, orient, and design tall buildings to promote air circulation and natural ventilation, yet minimize adverse wind conditions on adjacent streets, parks and open space, at building entrances, and in public and private outdoor amenity".

Toronto Development Guide: Site Plan Control Applications (2011)

For large sites, waterfront sites and/or sites where a substantial increase in height is requested, a Preliminary Wind Study may be required in addition to the Final Wind Study, which:

- May require quantitative wind testing by a certified wind tunnel specialist;
- Evaluates pedestrian comfort based on wind force, thermal comfort and wind chill to evaluate the comfortable use of sidewalks and open spaces for appropriate uses including sitting, standing and walking.
- Mitigation solutions must be provided for areas found to be uncomfortable or severe.

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

Mississauga, Ontario - Urban Design Terms of Reference: Wind Comfort and Safety Studies (2014)

- This Terms of Reference includes methodology to be used by microclimate specialists providing wind comfort studies.
- A Qualitative Wind Assessment is required for any building 20 m in height or more as a minimum.
- A Quantitative Wind Tunnel Study is required for:
 - any building over 40 m in height;
 - any building over 20 m in height, and up to two times the height of surrounding buildings;
 - any development proposal with two or more buildings that are 20 m in height or more;
 - any building that is 20 m in height or more, and is located south of the Queen Elizabeth Way;
 - any development proposal with a site area of 3 hectares or more, and a building that is 20 m in height or more; or
 - any building over 20 m in height at the discretion of the Planning and Building Department.
- Metric used: Gust Equivalent Mean (GEM) wind speed¹
- While the evaluation framework is similar to the standard Lawson Comfort Criteria (which quantifies the speed of wind and relates it to the activity an individual can 'comfortably' do), the target values are more restrictive:

Comfort Category	Lawson Comfort Criteria (GEM)	Mississauga's Terms of Reference (GEM)			
Sitting	<4 m/s (14.4 km/s)	≤ 10 km/h (2.78 m/s)			
Pedestrian Standing	4-6 m/s (14.4-21.6 km/s)	\leq 15 km/h (4.17 m/s)			
Pedestrian Walking	6-8 m/s (21.6-28.8 km/s)				
Business Walking	≤ 20 km/h (5.56 r 8-10 m/s (28.8-36 km/s)				
Uncomfortable	>10 m/s (36 km/s)	≥ 20 km/h (5.56 m/s)			

¹ Gust Equivalent Mean (GEM) speed considers both mean and gust wind speeds; The GEM is defined as the maximum mean wind speed or the gust wind speed divided by 1.85.

Auckland, New Zealand - Unitary Plan (2013)

The wind policies within the Unitary Plan are applied to buildings exceeding 25 metres, using Mean wind speed as their metric. The public realm is organized in 5 performance categories with prescribed maximum gust speeds. These categories are analogous to Lawson's categories:

Category A	Areas of pedestrian use or adjacent dwellings containing significant formal elements and features intended to encourage longer term recreational or relaxation use i.e. public open space and adjacent outdoor living space
Category B	Areas of pedestrian use or adjacent dwellings containing minor elements and features intended to encourage short term recreation or relaxation, including adjacent private residential properties.
Category C	Areas of formed footpath or open space pedestrian linkages, used primarily for pedestrian transit and devoid of significant or repeated recreational or relaxational features such as footpaths not covered in Categories A or B above
Category D	Areas of road, carriage way, or vehicular routes, used primarily for vehicular transit and open storage, such as roads generally where devoid of any features or form which would include the spaces in Categories A-C above
Category E	Category E represents conditions which are dangerous to the elderly and infants and of considerable cumulative discomfort to others, including residents in adjacent sites. Category E conditions are unacceptable and are not allocated to any physically defined areas of the city

The curves on the graph delineate the boundaries between the acceptable categories (A-D) and unacceptable (E) categories of wind performance.



Figure A16. Mean wind speed table from Auckland's Unitary Plan



Figure A17. Sunlight locations map, City of Auckland



Figure A18. The LaSalle Canyon, Chicago's Financial District: urban canyons create constricted spaces where the wind becomes funneled between buildings, dramatically increasing wind speeds and pressure (image credit: JoeyBLS)

Chicago, USA - Development Manual (2012)

Neither the Chicago Zoning and Land Use Ordinance, nor community plans include any mention of wind speed control.

DEVELOPMENT MANUAL FOR CHICAGO PLAN COMMISSION PROJECTS

"Wind Impact Analysis: A quantitative wind impact analysis of pedestrian levels showing the impact of the project on surrounding areas with particular attention to nearby public spaces may be requested of buildings in excess of 600 feet in height and/or adjacent to existing or proposed publicly accessible parks, plazas, playgrounds, beaches, or inland waterways. In addition, buildings significantly taller than surrounding buildings may be requested to submit a study. The results of the wind study analysis should be consistently presented in miles per hour and velocity should be measured at a scale equivalent to 4.5 to 5 feet above ground level. The study should include the potential effects of wind, the expected one percent (1%) and two percent (2%) occurrence of hourly average effective gusts and peak gust velocities and anticipated wind velocities in every direction. In addition, the study should describe how the design of the structure and pedestrian level design features will mitigate the effects of wind".

The manual, which provides guidance for Planned Development (PD) applications, Lake Michigan and Chicago Lakefront Protection applications, proposed zoning map amendments within designated industrial corridors, and interagency referral items, includes a brief description of how to analyze wind impact:

- A quantitative wind impact analysis of pedestrian levels showing the impact of the project on surrounding areas with particular attention to nearby public spaces may be requested of buildings in excess of 600 feet in height and/or adjacent to existing or proposed publicly accessible parks, plazas, playgrounds, beaches, or inland waterways.
- Metric used is miles per hour. Velocity should be measured at a scale equivalent to 4.5 to 5 feet above ground level.
- The study should include the potential effects of wind, the expected one percent (1%) and two percent (2%) occurrence of hourly average effective gusts and peak gust velocities and anticipated wind velocities in every direction. In addition, the study should describe how the design of the structure and pedestrian level design features will mitigate the effects of wind. It does not include evaluation criteria.

Ottawa, Ontario - Terms of Reference: Wind Analysis

For the City of Ottawa, it is required for all planning submissions to include a wind analysis, which provides a visual model and written evaluation to demonstrate how a proposed development will impact the wind conditions at the pedestrian level. This is particularly important for when new developments are adjacent to existing or planned low rise development, open spaces, water bodies, and large public amenity areas. There are two types of wind studies:

"Type 1: Applications seeking an increase in height and/or massing which is either: a tall building(s), 10 storeys or more or a proposed building that is more than twice the height of adjacent existing buildings and is equal to or greater than 20 meters in height".

"Type 2: Tall building applications which have not sought an increase in height or massing".

Ottawa uses Gust Equivalent Mean (GEM) speed to measure the comfort and safety of the wind on pedestrian level uses as well as for amenity areas: "GEM is defined as the maximum mean speed (kilometres/hour) or the guest speed divided by 1.85". The City uses four measuring points to evaluate the comfort of the wind speed.

There are four measuring points to evaluate the comfort of the wind speed: sitting, standing, strolling and walking. These measuring points are to be evaluated at different locations/areas on the development site and immediate adjacent area to ensure that they meet the criteria. Should a proposed development not be able to meet the comfort evaluation criteria, mitigation measures (e.g. building and / or site design measures) are suggested to be included into the design of the building and/or site.

Category	GEM Speed	Where Applicable			
Sitting	<u>≤</u> 10	Outdoor public and private amenity space (e.g. restaurant patios and seating areas)			
Standing	<u>≤</u> 14	Major building entrances and bus stops			
Strolling	≤ 17	Sidewalks association with a mainstreet, plazas, and parks			
Walking	<u>≤</u> 20	Sidewalks other than those associated with a mainstreet, bicycle paths and parking lots			
Uncomfortable	≥ 20	Winds of this magnitude are considered a nuisance for most activities and wind mitigation measures are recommended.			

A Wind Safety Criteria is also used to measure what mitigation strategies are required to eliminate the safety issue:

Category	GEM Speed	Where Applicable
Exceeded	≥ 90	At any test location, wind speeds of this magnitude are considered a safety hazard and wind mitigation is required.

APPENDIX L. 02. DAYLIGHTING FOR INDOOR SPACES - RESEARCH

TORONTO PLANNING & REGULATORY CONTEXT

Official Plan (2015)

3.1.2 BUILT FORM

"3. New development will be massed and its exterior façade will be designed to fit harmoniously into its existing and/or planned context, and will limit its impact on neighbouring streets, parks, open spaces and properties by: d) providing for adequate light and privacy".

5.1.3 SITE PLAN CONTROL

"3. To help achieve environmentally sustainable development, the City may use subsection 114(5)(2)(iv) and (v) of the City of Toronto Act, 2006 to secure the following sustainable design features in development that address exterior building and site matters in Tier 1 of the Toronto Green Standard ...

• c) building orientation to take advantage of passive solar heating, shading for cooling and natural light; and every efficient exterior cladding and window treatments".

Zoning By-Law 1107-2016 and Official Plan Amendment 352

Official Plan Amendment and Zoning By-Law Amendment with respect to tall building setbacks in Downtown.

"(A) every tower must be set back at least 3.0 metres from a lot line that abuts a street and 12.5 metres from the centre line of that abutting street; 12.5 metres from the centre line of an abutting lane; and 12.5 metres from a lot line having no abutting street or lane".

"(B) each tower must be separated by at least 25.0 metres from each other tower on the same lot".

Ontario Building Code (2012)

The Ontario Building Code (OBC) includes requirements for minimum glass area for rooms of residential occupancy:

"(1) Except as required in Article 9.9.10.1. and Sentence (3), the minimum window glass area for rooms in buildings of residential occupancy or rooms that are used for sleeping shall conform to Table 9.7.2.3.".

Key requirements are:

- Minimum unobstructed glass area of 10% of area served for living rooms and dining rooms; and
- Minimum unobstructed glass area of 10% of area served for bedrooms and other finished rooms not mentioned above.

The OBC is a performative code, therefore the requirements in table 9.7.2.3 may be omitted if an alternative solution is provided that complies with the following Compliance Alternative:

"(a) Where windows are not used as means of egress and where they do not conflict with ventilation requirements, the minimum glass areas as shown in Table 9.7.2.3. may be reduced by 50%".

"(b) an existing room converted to an interior room, created by an addition, shall not require a window, provided there is an opening in a dividing wall occupying not less than 30% of the separating plane to an adjoining room, where the adjoining room has a minimum of 5% window area of the combined floor areas, and provided the required ventilation for the combined room is maintained".

TOCORE BUILDING FOR LIVEABILITY Appendix 233

City-Wide Tall Building Guidelines (2013)

The Tall Building Design Guidelines respect and highlight the importance of providing natural light to the building interiors, but do not set specific guidelines for regulating it. The protection of indoor daylighting exists within the 25 metre tower separation and angular planes. The guidelines also understand that interior daylighting will be more restricted if many towers are clustered. The design of balconies is another main restraint on allowing daylight to flow into indoor spaces.

"Access to natural light in the building interior is an important component of residential liveability, workplace productivity, and sustainable building practice. An adequate level of daylighting is achieved for residential buildings when natural light reaches the main living space for part of the day. Tall buildings with small floor plates and adequate separation provide enhanced opportunity for daylighting".

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

United Kingdom - British Standards and Daylighting guidelines

- Daylighting is guided by British Standard BS 8206 'Lighting for buildings: Part 2: Code of practice for daylighting', which is primarily concerned with the psychological well-being of people, not with the level of illumination.
- Daylight factor (DF)¹ has been used in the standard as the parameter. For rooms daylighting, the criteria are:
 - 5% average DF for rooms without supplementary electric lighting;
 - 2% for rooms with supplementary electric lighting.

For rooms in dwellings. the criteria are:

- 1% average DF in bedrooms;
- 1.5% average DF in living rooms; and
- 2% average DF in kitchens².

SKYLIGHT AND OPTIMUM WINDOW SIZE (DETR Guidelines)

"Achieving very high levels of daylight usually means large windows and tall rooms; these are associated with excessive heat gain and loss, and a high building cost. Conversely, with very small windows, little use is made of daylight as a source of energy; in addition, occupant satisfaction tends to be lower".

- A publication by the Building Research Establishment, 'Site layout planning for daylight and sunlight' (BR209) outlines how one can assess the obstruction of daylight to existing buildings, though mostly in a low/medium density context.
- In terms of sunlight, BS 8206 gives the following guidance: 'Interiors in which the occupants have a reasonable expectation of direct sunlight should receive at least 25% of probable sunlight hours³; at least 5% should be received during the winter months (23 September to 21 March).'

Daylight factor is the ratio of the light level inside a structure to the light level outside the structure. It is defined as: DF = (Ei / Eo) x 100%, where, Ei = illuminance due to daylight at a point on the indoors working plane, Eo = simultaneous outdoor illuminance on a horizontal plane from an unobstructed hemisphere of overcast sky.

Department of the Environment Transport Regions (DETR). Desktop guide to daylighting - for architects. Good Practice Guide 245, 1998. Probable sunlight hours is the long-term average of the number of hours during the year in which direct sunlight would fall on unobstructed ground at that location. In London, for example, this is about 1500 hours per year (see BR209)



Figure A19. Design "rule of thumb" guidelines from DETR guidelines

Southwark, UK - Residential Design Standards (2011)

2.7 DAYLIGHT AND SUNLIGHT

"DAYLIGHT TESTS:

This test should be used where the proposed development faces the affected window of the neighbouring property:

- 1. Draw a line at 25 degrees upwards from the centre of the affected window;
- 2. If the proposed development is higher than this 25 degree line, there may be an unacceptable loss of daylight to the affected window.

This test should be used where the proposed development is at rightangles to the affected window of the neighbouring property:

- 1. Draw a line at 45 degrees upwards from the centre of the affected window;
- 2. Draw a line at 45 degrees sideways from the centre of the affected window.

If the proposed development is both higher and wider than these 45 degree lines, there may be an unacceptable loss of daylight to the affected window".

"Designing High-Density Cities: For Social and Environmental Sustainability" (2009)

Part of this comparative study by Edward Ng includes an analysis of vertical obstruction angle restrictions in different cities⁴, including angular planes as another common way of controlling the sky component (SC). Based on the Downtown Tall Buildings: Vision and Supplementary Guidelines, the current di facto vertical restriction angle in Toronto is approximately 83 degrees.

⁴ Ng, Edward. Designing High-Density Cities: For Social and Environmental Sustainability. Earthscan, 2009.

Hong Kong - Lighting and Ventilation Requirements (2015)

In Hong Kong, "the provision of natural light has been controlled by the Building (Planning) Regulations B(P)Reg. 30, 31, and 32 [...which] controls the minimum window glazing area and the distance between buildings"⁵. Some of the tools to ensure daylighting used in Hong Kong include:

- 10 per cent window area to floor area ratio;
- maximum room depth of 9m:
- minimum window height of 2m; and
- an unobstructed open space known as the rectangular horizontal plane (RHP) outside of the window.
- the RHP directly outside that has a plan size not less than 203 m multiplied by one third of the height of the building above the window. This controls the sustaining vertical unobstructed angle {no sky line} of the window.





Figure A22. The effect of window height on Daylight factor (image credit: City University of Hong Kong)

Figure A21. The Effect of Window Shape on Daylight factor

Auckland, New Zealand - "Unitary Plan 101" (2017) and Design Manual (2017)

OUTLOOK SPACE / DAYLIGHT

By establishing dimensions of outlook spaces, it provides an area of protection for the indoor uses, ensuring they receive adequate sunlight while maintaining privacy. It uses these outlook controls and building separation to allow for daylighting. Street views, front yard setbacks, and daylight for indoor spaces all go hand in hand.

⁵ Hamzah, Baharuddin and Lau, Stephen S.Y. The development of visible sky area as an alternative daylight assessment method for high-rise buildings in high-density urban environments. Informa UK Limited, 2014.



"'Passive solar design' means orienting and designing buildings to receive heat from the sun during winter months, and shade and natural ventilation during warmer months".

"All private open spaces should receive at least five hours of sunlight across at least half of the garden, courtyard, balcony or roof terrace, as measured on the equinox (22 March / September)".

• "Design and orientate all principal living spaces, which are directly accessible from private open spaces, to receive maximum sunlight admission, as measured at the equinox on 22 March / September".

"Using skylights, clerestory windows and fanlights to supplement daylight access".

London, UK - Housing Design Guide (2010)

5.4 FLOOR TO CEILING HEIGHTS

"In ground floor dwellings where daylight may be limited, higher ceilings can provide better light levels, a better urban scale to the base of larger buildings, the potential for homes to be used more flexibly, and can make ground floor dwellings more suitable for conversion to non-residential uses".

5.5 DAYLIGHT AND SUNLIGHT

- "The quality and quantity of natural light in an interior depends on both the surrounding environment and the design of a building the size and position of windows, the depth and shape of rooms, and the colours of internal surfaces:
 - 5.5.2 All homes must provide for direct sunlight to enter at least one habitable room for part of the day".



Figure A24. Designating outlook spaces and regulating building separation to cater to solar orientation (image credit: Auckland Guide to the Unitary Plan)



Figure A25. Building cutouts (forecourts, courtyards) can allow for more daylighting opportunities. 500 Queens Quay, Toronto (image credit: Google Maps)

New York City, USA - "Laying the Groundwork" Retail Design Guidelines (2015)

"A transparent storefront welcomes customers...reduces energy consumption by letting in natural light...".

"1.1.1 Provide continuous ground-to-ceiling glazing, with internal doors. Where ground-to-ceiling glazing is not possible, meet a target ot 70% transparency between 2 feet and 10 feet above the sidewalk".

New York City, USA - Active Design: Shaping the Sidewalk Experience (2013)

"Suggest that transparent or translucent materials be incorporated in 'minimum transparency percentage requirements' and provide guidelines for incorporating other architectural features to give glazing variety...".

Other Daylighting Metrics

Beyond angle restrictions, a series of more complex daylighting metrics are used to quantify daylighting in highdensity contexts, which generally require intensive calculations or computational tools. These include:

- Rectangular Horizontal Plane (RHP), as used in Hong Kong
- Vertical Day Factor (VDF), calculated by the Unobstructed Vision Area (UVA) method
- Visible Sky Area (VSA) is defined as the ratio of projected area of sky (PAS)
- Vertical Sky Component (VSC)

City University of Hong Kong - "BST2522 Building Environmental Science 2: Daylighting"

This lecture outlines the importance of daylighting, and its relationship with a number of environmental factors (e.g. solar gain), and building design⁶.

9. DESIGN CONSIDERATION

"9.1 Environmental factors: Daylight design is closely related to a number of environmental factors because the use of glass windows to let in light also allows the penetration of solar heat and noise and increases the rate of heat gain or loss of the building fabric".

"9.2 Fenestration: The lighting conditions in a room depend primarily on the fenestration [...] the DF [Daylight Factor] and consequently the illumination near the window decreases as the height of the window above the floor is increased. However, the illumination increases away from the window, giving greater uniformity to the lighting".

DF varies across a room using two types of windows, both having the s[a]me total area".

"The following points should be considered in the design of fenestration:

- The window head should be as high as possible, say at least 2 m above floor level, to enable one can see out when standing;
- The window sill should not be higher than 1 m from floor level to enable one can see out when sitting;
- The window surface area should be evenly distributed over the outside wall and the window heights and widths should not be too small in relating to the window wall because this reduces the uniformity of lighting and produces undesirable shadows".

⁶ Chan, Apple L.S. *BST2522 Building Environmental Science 2: Daylighting - 9. Design Consideration.* City University of Hong Kong.

APPENDIX M. 03. PRIVACY - RESEARCH

TORONTO PLANNING & REGULATORY CONTEXT

Official Plan (2015)

3.1.2 BUILT FORM

"3. New development will be massed and its exterior façade will be designed to fit harmoniously into its existing and/or planned context, and will limit its impact on neighbouring streets, parks, open spaces and properties by: d) providing for adequate light and privacy".

City-Wide Tall Building Guidelines (2013)

3.2.3 SEPARATION DISTANCES

"Setback tall building towers 12.5 metres or greater from the side and rear property lines or centre line of an abutting lane. Provide separation distance between towers on the same site of 25 metres or greater, measured from the exterior wall of the buildings, excluding balconies".

City of Toronto By-law 1105-2016 / 1106-2016 & OPA 352 (under appeal)

These Zoning By-law and Official Plan Amendments update the separation requirements for Tall Buildings for the Downtown boundary.

"B. ii) The Zoning By-law will contain minimum numerical standards for tower setbacks from property lines and separation distances between towers in the area governed by this SASP. Zoning By-law amendments may be considered through rezoning or minor variance providing that adequate space between towers within the block will:

 d) provide appropriate access to natural light and a reasonable level of privacy for occupants of tall buildings;"

"iii) Not every site in the area governed by this SASP can accommodate a tall building. Proposed tall buildings that do not meet the intent of Policies B(i) and B(ii) present significant concern for building strong healthy communities in the area governed by this SASP and as such those sites are not considered suitable for tall building development."

Section 12(2)380 is amended so that it reads: "380. No person shall erect or use a building or structure on the lands shown delineated by heavy lines and identified by the label "Toronto Downtown" on the map appearing at the end of this Section 12(2)380. that does not comply with the following:

- (2) Every tower must be no closer than 25 metres to another tower on the same lot.
- (3) If a line projected at a right angle from a main wall of a tower intercepts another main wall of the same tower, those main walls must be separated by a minimum of 25.0 metres".

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

London, Ontario - The London Plan (2016)

"B.d. Buildings and structures should: not cause any unacceptable harm to the amenity of surrounding land and buildings, particularly residential buildings, in relation to privacy, overshadowing, wind and microclimate. This is particularly important for tall buildings".

London, UK - Housing Design Guide (2010)

"When housing is developed to the upper limit of its density range, privacy and amenity space can be lost".

"Balconies should be designed to provide some shelter and privacy from neighbouring properties".

"Surrounded by the noise and activity of daily life in London, it can be difficult to make homes that offer people a place to withdraw and retreat from the city. Even in the suburbs, traffic noise and adjacent uses can be hostile to the quiet repose we want from our homes. To address this, the guidance in this section proposes standards around privacy and noise mitigation, but also recognises the importance of generous ceiling heights and natural light to the sense of wellbeing we take from our homes. We are determined to encourage the kind of housing that provides comfortable and enjoyable places of retreat and privacy".

5.1 PRIVACY

"Homes in the city should provide the opportunity to look out on and enjoy surrounding public and shared open spaces... People value highly the opportunity to relax outdoors without being seen by neighbours or passersby".

"...avoid windows that directly face each other where privacy distances are tight. It will often be beneficial to provide a set-back or buffer where habitable rooms directly face a public thoroughfare, street, lane or access deck".

"5.1.1 Design proposals should demonstrate how habitable rooms within each dwelling are provided with an adequate level of privacy in relation to neighbouring property and the street and other public spaces".

5.2 DUAL ASPECT

"5.2.2 Where single aspect dwellings are proposed, the designer should demonstrate how good levels of ventilation, daylight and privacy will be provided to each habitable room and the kitchen".

London Borough of Camden, UK - Planning Guidance (2015)

CPG1: DESIGN - BALCONIES AND TERRACES

"5.23 Balconies and terraces can provide valuable amenity space for flats that would otherwise have little or no private exterior space. However, they can also cause nuisance to neighbours. Potential problems include overlooking and privacy, daylight, noise, light spillage and security".

"5.24 Balconies and terraces should form an integral element in the design of elevations. The key to whether a design is acceptable is the degree to which the balcony or terrace complements the elevation upon which it is to be located".

"Consideration should therefore be given to the following:

- · detailed design to reduce the impact on the existing elevation;
- · careful choice of materials and colour to match the existing elevation;
- possible use of setbacks to minimise overlooking...;
- possible use of screens or planting to prevent overlooking of habitable rooms or nearby gardens, without reducing daylight and sunlight or outlook; and
- need to avoid creating climbing opportunities for burglars".

"To ensure privacy, there should normally be a minimum distance of 18m between the windows of habitable rooms of different units that directly face each other. This minimum requirement will be the distance between the two closest points on each building (including balconies)".

"Building Positioning (Privacy):

- xi) Where a proposed development consists of a grouping of buildings, the buildings should be positioned to define usable and secure open space areas on the site and to afford a reasonable measure of privacy to individual dwelling units.
- xiv) To the extent feasible, the design and positioning of new buildings should minimize the loss of privacy for adjacent residential properties".

CPG6: AMENITY - OVERLOOKING AND PRIVACY

"7.4 Development should be designed to protect the privacy of both new and existing dwellings to a reasonable degree. Spaces that are overlooked lack privacy. Therefore, new buildings, extensions, roof terraces, balconies, and the location of new windows should be carefully designed to avoid overlooking. The degree of overlooking depends on the distance and the horizontal and vertical angles of view".

Auckland, New Zealand - Design Manual (2017)

DESIGNING FOR PRIVACY

"1. All habitable rooms have a good level of privacy in relation to the street, public spaces and neighbouring properties".

"2. The building arrangement enhances privacy for the residents and neighbours".

"3. The views from prinicipal rooms and private open space are maximised without compromising visual privacy".

"Screening balconies and ground level private open spaces. Screen devices and fences are effective on the first floor. Onsite planting will screen up to three stories on most sites, but higher planting will be required in a park or large communal area".

"Introducing a change in level between ground floor private space (both indoor and outdoor) and the public domain or communal open space".

"Orienting and angling adjacent blocks so that they do not directly face each other".

"Use detailed site and building design elements to increase privacy without compromising access to light and air".

RESIDENTIAL SAFETY GUIDELINES

"Depending on the nature of the development and the resource consent requirements, it may be necessary to provide the Auckland Council with a landscaping plan showing:

- plant species, location, sizes at the time of planting, maximum sizes of plants and trees at maturity, height of any tree canopy at maturity."

"Residential open spaces that face the street should have fencing that does not obscure visibility. This will give residents privacy, while still allowing them to overlook what is going on beyond their section and keeping the public space safe."

"To strike a balance between privacy and passive surveillance, a level change between the ground floor and the footpath can be helpful. This will limit visibility into the dwelling while still letting residents look out. Make sure that the entrance to the building remains accessible."

Los Angeles, USA - Downtown Design Guide (2009)

C: SPACING

"Tower Spacing: Towers should be spaced to provide privacy, natural light and air, as well as to contribute to an attractive skyline".

"Residential Unit Spacing: Provide privacy and natural light and air for all residential units. The shortest horizontal distance between the specified window of one residential unit and the specified window or wall or another residential unit in the same project shall have, at a minimum, the "line-of-sight" distances from the middle of the windows specified in Table 6-2".

"Exceptions. Towers over 150' in height may vary from the minimums shown [...] 1) offset towers, 2) adjacent towers, or 3) curved or angled towers".

APPENDIX N. 04. CONNECTIVITY - RESEARCH

TORONTO PLANNING & REGULATORY CONTEXT

Official Plan (2015)

1. MAKING CHOICES

"This Official Plan rests on strong foundations that can weather the test of time. It builds on the vision of those who have helped us travel from our early roots as a settlement on the shores of Lake Ontario to a vibrant and modern city. It is grounded in principles of: [...] connectivity"

2. PRINCIPLES FOR A SUCCESSFUL TORONTO

"A City of Connections: A connected city recognizes that all aspects of our daily lives are linked and that we have to understand relationships and interdependencies to ensure future success".

2.2 STRUCTURING GROWTH IN THE CITY: INTEGRATING LAND USE AND TRANSPORTATION

"The integration of transportation and land use planning is critical to achieving the overall aim of increasing accessibility [...] Accessibility has two components: mobility (transportation) and proximity (land use)".

2.2.1 DOWNTOWN: THE HEART OF TORONTO

"Well designed connections between the core of the City and the Central Waterfront are important to the vitality of Downtown as a great place to live and as an attractive and competitive business location".

"Downtown streets, sidewalks and the connecting system of public spaces are not just links between activities but are also spaces to be enjoyed in their own right. The quality of the design, construction and maintenance of these parts of the public realm are vital to the image of Downtown...

• Without compromising the role of the street as the main place for pedestrian activity, expansion & re development of the PATH network will be supported by encouraging new development to connect to the system".

City-Wide Tall Building Guidelines (2013)

2.2 BUILDING ADDRESS AND ENTRANCES

"Organize tall buildings to use existing or new public streets for address and building entrances. Ensure primary building entrances front onto public streets, are well defined, clearly visible, and universally accessible from the adjacent public sidewalk".

2.6 PEDESTRIAN AND CYCLING CONNECTIONS

"Provide comfortable, safe, and accessible pedestrian and cycling routes through and around the tall building site to connect with adjacent routes, streets, parks, open space, and other priority destinations, such as transit and underground concourses".

4.2 SIDEWALK ZONE

"a. Along the primary street frontages of a tall building site, secure a sidewalk zone at least 6 metres wide or greater where larger setbacks are established by the existing context or required by the Zoning By-law".

Avenues and Mid-Rise Buildings Study (2010)

PERFORMANCE STANDARD #7A: Minimum Sidewalk Zones

"Right-of-ways greater than 30 metres should provide a minimum sidewalk dimension of 6.0 metres".

Design Guidelines for Privately-Owned Publicly-Accessible Spaces (POPS) (2014)

2.1 CREATING A NETWORK OF OPEN SPACES

"b) Ensure access and visibility to POPS from adjacent public streets, parks or other public spaces. This legibility of the public nature of POPS will enhance usability."

"e) Utilize mid-block pedestrian walkways to connect POPS with nearby public open spaces."

Complete Street Guidelines (2014)

1.4 VISION FOR COMPLETE STREETS

"Toronto's vision for complete streets is built on the vision for streets in the City's Official Plan. There is a deep interdependence between how we design our streets and the people of the city, the health of our communities and the strength of our economy. Toronto's streets must serve a multitude of roles, functions and users."

1.5.1 STREETS FOR PEOPLE

Goals: Improve Safety & Accessibility, Give People Choices & Connected Networks, and Promote Healthy and Active Living

1.5.2 STREETS FOR PLACEMAKING

Goals: Respect Local Context, Create Vibrant & Attractive Public Spaces, and Improve Environmental Sustainability



Figure A28. Illustration from POPs Guidelines showing potential relationships between open spaces



Figure A27. 6 metre wide sidewalk guideline to provide frontage and marketing zone, pedestrian clearway, and area for furniture and planting, as per the Tall Building Design Guidelines



Figure A26. 4.8 - 6.0 metre wide curb to building face distance as per the Avenues & Mid-Rise Buildings Study

2.3.4 DOWNTOWN & CENTRES RESIDENTIAL STREET

"Accommodate a high level of pedestrian activity with wide sidewalks. New buildings should be set back to create sidewalk and amenity space.

"Prioritize the safe movement of pedestrians and cyclists and design for modest motor vehicle volumes and speeds."

"Provide ample bicycle parking for visitors and residents to encourage cycling."

"Plant street trees in the frontage zone if boulevard space is limited."

"Manage speed by rightsizing lanes and corners, and providing chicanes, mid-block crossings and on-street parking."

"Provide driveways and servicing through shared access lanes and on side streets to minimize conflicts on busy residential streets.

"On-street vehicle parking may sometimes be provided on at least one side of the street."

Toronto Streetscape Manual

The Streetscape Manual is an urban design reference tool that focuses on the design quality in the public right-of-way, using a hierarchy of streetscape types: "Main Streets (Special Streets, Major Streets, Existing Main Streets, Emerging Main Streets), Green Streets (Scenic Streets, Intermediate Streets), and Special Areas.

The manual also prescribes five Streetscape Elements that are necessary to create high quality streetscapes with distinct characters: Paving, Street Trees, Medians, Lighting, and Street Furniture.



Figure A29. Visualization of a Downtown and Centres Residential street type in the Toronto Complete Street Guidelines, with taller buildings and higher levels of pedestrian activity than the other residential streets



Figure A30. Visualization of the Apartment Neighbourhood Residential street type in the Toronto Complete Street Guidelines, which are typically lined with a range of residential buildings

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

London, Ontario - The London Plan (2016)

6.1 INTEGRATING TRANSPORT AND DEVELOPMENT

"[...] supporting development that generates high levels of trips at locations with high levels of public transport accessibility and/or capacity".

"[...] seeking to ensure that all parts of the public transport network can be used safely, easily, and with dignity by all Londoners".

New York City, USA - Active Design Guidelines (2010)

"Researchers have identified five 'D' variables that are key to analyzing the relationship between urban design and travel patterns: Density, diversity, design [...] destination accessibility and distance to transit [...] developing and maintaining these five qualities is therefore essential to promoting active living through urban design and planning".

2.7 STREET CONNECTIVITY

"Encourage walking by maintaining a network of interconnected streets and sidewalks".

"Minimize addition of mid-block vehicular curb cuts on streets with heavy foot traffic".

"Where current connectivity of the sidewalks and streets on a building site is poor, provide pedestrian paths through existing blocks to increase the area's walkability".

2.9 DESIGNING PEDESTRIAN PATHWAYS

"Giving streets a human scale and sense of enclosure can encourage physical activity".

"Create a buffer to separate pedestrians from moving vehicles...".



Figure A31. Pedestrian seating area as extension of sidewalk - New School, Manhattan (image credit: NYC. GOV)



Figure A32. The High Line, NYC (image credit: thehighline. org)

2.11 BICYCLE NETWORKS AND CONNECTIVITY

"Design interconnected bikeways and establish a backbone network of unbroken through routes...".

"Make links between bicycling and transit...".

"On bikeways, include signposts providing bicyclists with directions, distances, and times to various destinations".

New York City, USA - Zoning Regulation

37-52. TYPES OF PEDESTRIAN CIRCULATION SPACE

"The pedestrian circulation space provided shall be of one or more of the following types: an arcade, building entrance recess area, corner arcade, corner circulation space, relocation or renovation of a subway stair, sidewalk widening, subway station improvement, through block connection or public plaza."

"Each zoning lot shall be categorized as either a corner lot, through lot, or interior lot, and pedestrian circulation space shall be provided on each zoning lot in at least one of the applicable types, or combination of types, specified in the following table:



Figure A33. Table excerpt from New York City zoning text, section 37-52

New York City, USA - Active Design: Shaping the Sidewalk Experience (2013)

HUMAN SCALE AND COMPLEXITY

"The lower one to two floors of a building wall are most important in relation to the factor of 'human scale and complexity'. The lower portion of the building façade, the street, and the treatment of the closest lane of the roadbed become extensions of the sidewalk room and are the elements that the pedestrian experiences most intimately".

BREAKING DOWN THE VERTICAL DIMENSION

"The human eye typically perceives the space within the angles of 50-55° above and 70-80° below a horizontal line [...] the vertical height most intensely experienced by the pedestrian is the lower one-two floors of a building. This lower portion of the wall plane is most successful when it contains a sufficient level of detail and articulation [...] more closely readable to the human eye, and renders the sidewalk experience interesting and engaging for the walker".

BREAKING DOWN THE HORIZONTAL DIMENSION

"I. The scale of the Street: 100 metres is the farthest distance that the human eye can see people/objects in motion".

"II. The scale of the Building: roughly 25 metres is the distance at which the human eye can begin to read facial expression. It is the mid-scale of the rhythm often demonstrated when there are a series of different buildings, and therefore vertical distinctions between them, on the same block".

"III. The scale of the Establishment/Unit: 0 to 7 metres is the scale at which the senses are most engaged with the complexities of façade articulation, active entries, transparency, textures, awnings, signage, architectural details".



Figure A34. Frequent breaks in frontage can allow for new experiences every few steps - Queen Street West, Toronto (image credit: Narcity)



Figure A35. New buildings should match the existing frontage length pattern and architectural style to create consistent rhythm - Queen Street West, Toronto (image credit: hullmark)

Melbourne - Places for People (2015)

PUBLIC SPACE: LANEWAYS

"As individual places, laneways offer a welcome juxtaposition to the central city's uniform street grid. Their smaller scale intensifies sensory interaction, with the physical space positioning aesthetic details, sights and smells at a range more easily discernible to humans: this is known as the 'human scale'".

"Most laneways are open to the public during the day and night, whereas arcades are generally closed at night. This impacts on not only the permeability of the pedestrian network [...] but also changes the nature of the immediate area".

BUILT FORM: STREET LEVEL FAÇADES

"[...] there are redevelopment projects that diminish rather than contribute to a more vibrant and animated city, by demolishing small scaled tenancies with large scaled and internalized buildings".

"[...] the fact that so many towers have a limited interface with the street, creates not only a dormant urban form, but a place with little passive surveillance that is critical to people's sense of safety and security".

Melbourne - Planning Scheme (updated 2017)

CLAUSE 22.20 LANES POLICY

"Lanes provide some of the most important and unique public spaces within the Central City. They provide a setting for people, buildings and activities, and more importantly the exchange between these elements".

San Francisco - Urban Design Guidelines (2017)

"A building that relates to city fabric, to its immediate context, and adjacent human activity helps unify neighborhood experience and character. The relationship between areas of low, finescaled buildings and areas of high, largescaled buildings can be more harmonious if the transition in building height and mass between such areas is managed in an intentional and sensitive manner."



Figure A36. Left and right: Degraves Street, Melbourne (image credit: Harcourts, NYMAG)

S2. HARMONIZE RELATIONSHIPS BETWEEN BUILDINGS, STREETS, AND OPEN SPACES

"Develop site and building design to establish, respect, or enhance the mid-block open space and minimize their impacts to privacy and access to light. Different configurations for rear yards may be acceptable due to site conditions".

Florida, USA - Envisioning Florida's Future: Transportation and Land Use in an Automated Vehicle World Final Report (2016)

"Based upon this work, the following built environment impacts were identified.

- Smaller and More Efficient ROWs: AVs' unique navigation capabilities are expected to enable narrower traffic lanes, reduce the number of lanes needed to accommodate traffic demand, and remove the need for medians.
- A Drop-off Revolution: AVs are expected to create demand for drop-off areas that are as close as possible to the entrances of destinations. These drop-off areas will impact site-level design and affect access management in the form, location, and design of curb cuts and drop-off/loading areas.
- Signage & Signalization: The future lies not in large numbers of traffic signs and signals, as traffic information can be transmitted to AVs wirelessly in real time, yielding far fewer traffic signs and signals and less cluttered urban spaces.
- Bicycle & Pedestrian Infrastructure: AVs are expected to improve the safety of bicyclists and pedestrians, but they may also make non-motorized travel more difficult by fragmenting or slowing down bike/pedestrian networks.
- Parking: AVs will bring massive changes to the location, form, and amount of parking, as AVs can park themselves or remain in the transportation network while awaiting their next rider.
- Redevelopment Opportunities: Reducing parking and narrowed right-of-ways will yield substantial redevelopment opportunities in urban areas dominated by surface parking and wide roadways"¹.





Figure A37. Illustration from San Francisco Urban Design Guidelines, showing how new open spaces should lead to existing ones



Figure A38. Illustration from the envisioning Florida's future study of the potential transformation of the Right-of-way allocation caused by AV technologies, from "Envisioning Florida's Future" report

"Transit-Supportive Densities and Land Use" - Puget Sound Regional Council (2015)

"The academic literature highlights strong evidence that transit can achieve greater ridership and costeffectiveness by serving areas with higher densities and other complementary elements, such as mixed uses, pedestrian connectivity, and supportive parking management".

Transit type goes hand-in-hand with land use and built form outcomes. Figure A36 shows the two way relationship between land use decisions and transit decisions; density should be allocated in areas of high transit usage and availability and vice versa.

GUIDING PRINCIPLES TO ACHIEVE TRANSIT-SUPPORTIVE LAND USES

"Several key guiding principles stand out for the region and its constituent jurisdictions to follow as they plan for transit and transit-supportive communities. These principles are grounded in the research on the relationship between land use, density, and transit, and also reflect best practices among regional governments and transit agencies".

1. Increase Densities around Transit Stations and Stops to Increase Ridership

"Dense mixed use development can achieve a critical mass for transit use through means such as joint development over and around transit stations, infill on underutilized sites such as surface parking lots, and horizontal mixed uses with housing, office, and retail".



Figure A39. Efficient and productive transit systems should support urban design and planning decisions and vice versa (image credit: PSRC)

	Light Rail	Commuter Rail / Ferry / Express Bus	Bus Rapid Transit / All- day Frequent Bus		
Walk distance	1/2 mile	1/2 mile	1/4 mile		
Residential density	16 – 67+ residents per gross acre	n/a*	7 – 8+ housing units per gross acre		
Employment	100,000 - 150,000+ jobs in CBD	CBD employment key	n/a*		
Activity Units	56 – 116+ residents and jobs per gross acre	n/a*	17 +/- residents and jobs per gross acre		

*"na" indicates that these metrics were not addressed in the literature reviewed

Figure A40. Density benchmarks by transit mode, showing the relationship between order of transit and residential/employment density, from the "Transit-Supportive Densities and Land Use" study

- 2. Establish Transit-Supportive Density Goals based on Locally Relevant Data and Policies
- 3. Maximize Land Use Potential within Transit Walksheds
- 4. Promote Employment Growth at Station Areas in Transit Corridors
- 5. Plan for and Encourage Mixed Uses and Transit-Supportive Design
- 6. Incentivize Alternatives to Automobile Travel in Station Areas²

² Puget Sound Regional Council. Transit Supportive Densities and Land Uses: A PSRC Guidance paper. PRSC.org, 2015.

"How Do Different Modes Compare?" - PlanItMetro Blog (2014)

This article analyzes the pros and cons of different transit modes and the various purposes they serve³. The study compares different jurisdictions to see what external factors and trade-offs also influence mode selection in different municipalities. The main driver of mode choice is typically driven by existing transit and land use measures; a chart (Figure A38) was developed to compare commuter rail, commuter bus, heavy rail, light rail, streetcar, bus rapid transit, and enhanced bus modes to land use intensity (household density and employment density), vehicle capacity, stop spacing, trip length, and overall capital/operating costs.

This study demonstrates how different densities, and therefore different building types, can be more appropriate than others, depending on the transit service provided. While higher densities are appropriate for transit hubs, midrise buildings are most suitable along linear transit systems where they provide a continuous framing and animation of the adjacent public realm.

			Corridor/Station Area Land Use Intensity 1			Capacity ²		Distance		Cost ³			
Mode Local Examples	Right-of-	Hou	seholds per /	kcre	Empl	loyees per Aci	re		Consider				Operation
	Way	Local Min-Max Examples		Central Juriudictions/ Core	Local Min-Max Examples	Suburbs	Central Junisdictions/ Core	Passengers per Vehicle	(passengers per hour per direction)	Station/Stop Spacing (average)	Passenger Trip Length (average)	Capital Cost	Cost (per passenger mile)
Commuter Ral	0	<1 - Stafford County 13 - Silver	6	**	<1 - Stafford County 140 - L'Enlant	N/A (Typically residential or Park-and-	N/A (Varies by corridor and terminal	<u>en ::::::::::::::::::::::::::::::::::::</u>	††††	H	• • •	\$ - \$\$\$ • \$5-\$100 million per mile	¢ \$0.30 - \$0.50
	Dedicated	Spring	24	>4	Plaza	Ride)	stational	90-190 seated	2,500 - 40,000	2 · 10 miles	24 miles	 SS3 million per 8-car train with locomotive 	00000000000
Hensy Ital Metroral	Deduced	1 - Branch Ave Metro 27 - Columbia Heights Metro	12-18	A A A >18	1 - Addison Rd Metro 350 - Famagut West Metro	13-35	>35	65-75 seated 100-120 total (Metocraf)	25,000 (Metroval)	0.5 · 1 mile	s miles	\$\$ - \$\$\$ - \$100-\$600 million per mile - \$80-\$100 million per station - \$22 million per 8-car train	¢ \$0.30-\$0.50
Light Roll Purple Line (Pl	nned)	6 - Purple Line Corridor	37	**	12 - Purple Line Corridor	1111 1111 8-18	1001 1001 1001 >18	40-60 seated 180 total	† † 3.600	0.75 - 1.5 miles	ee S miles	\$\$ - \$\$\$ • \$50-\$150 million per mile (includes vehicles)	¢ \$0.40-\$0.80
Columbia Pike Streetcar (plan DC Streetcar Junder constru	er ed; Son) Codested Series	13 - Columbia Plie 19 - H St NE	A 36	**	30 - Columbia Pike 50 - H St NE	5-15	100 (0) 100 >15	30-50 seated 129 total	† † 1,200	0.5 mile	4miles	\$\$ - \$32-\$80 million per mile (includes vehicles)	¢ \$0.50-\$0.85
Commuter Bus MTA Commuter PRIC OmniRid Leudoum Coun Transit Private Operat	Burs y n Contraded Stars	NVA (Lung distance point-to-point service)					45 - 65 seated	1 00 - 1,000	Varied; Stops Clustered at Route Start and End	20-60 miles	\$ - \$500K-\$600K per vehicle	Ç Dependenton operator	
Bus Repid Tran Comidor Cities Transitiany (plu CCPY Transitive Junder constru	e wedi / tion) Deduced	2 - Corridor Cities Transitway 11 - CCPY Transitway	36	**	8 - Corridor Cities Transitway 44 - CCPY Transitway	100 100 6-10	(Å) (Å) (Å) >18	60 seated 95-105 total	1,905-2,100	0.5 mie	e	\$ \$ • \$5 - \$30 million per mile • \$500K - \$800K per vehicle	C \$0.40-\$0.60
Enhanced Bus Metrobus Metro Priority Control Network (plane	Extra edj Shared	3 - various suburban PCN lines 25 - 16th St NW line	36	*	3 - various suburban PCN lines 108 - 16th St NW line	100) 100) 8-18	1001 (1001 1001) >18	40-45 seated 60-70 total	1,200-1,400	0.25-0.5 mile	ee Amáes	\$ - \$250K-52 million per mile - \$400K-\$750K per vehicle	¢ 50.40 - 50.65

Figure A41. Comparison of various transit modes (based on Washington Region local examples) and their relationship to land use intensity (residential and employment), capacity, distance, and cost (image credit: planitmetro blog)

3 Allison. How do different modes compare? PlanitMetro: Metro's Planning Blog, 2014

APPENDIX 0. 05. INTERFACE WITH PUBLIC REALM - RESEARCH

TORONTO PLANNING & REGULATORY CONTEXT

Official Plan (2015)

3.1.2 BUILT FORM

"The exterior design of a façade at grade, closest to the pedestrian environment, is an important design consideration to help new development support the public realm and fit with the existing and/or planned context. In particular, the nature, scale and placement of doors as well as the placement, type and treatment of windows on the façade, taking into account the character and functions of interior uses, play an important role in supporting a safe, accessible and vibrant public realm".

"Our personal enjoyment of our streets and open spaces depends largely on the visual quality, activity, comfortable environment, and perception of safety in those spaces. Most of the qualities are influenced directly by the built form of adjacent buildings".

"3.1.2.1 - New development will be located and organized to fit with its existing and/or planned context. It will frame and support adjacent streets, parks and open spaces to improve the safety, pedestrian interest and casual views to these spaces from the development...

• c) Providing ground floor uses that have views into and, where possible, access to, adjacent streets, parks and open spaces"

"3.1.2.3 - New development will be massed and its exterior façade will be designed to fit harmoniously into its existing and/or planned context, and will limit its impact on neighbouring streets, parks, open spaces and properties by...

• b) Incorporating exterior design elements, their form, scale, proportion, pattern and materials, and their sustainable design, to influence their character, scale and appearance of the development".

City-Wide Tall Building Guidelines (2013)

2.1 BUILDING PLACEMENT

"Locate the base of tall buildings to frame the edges of streets, parks, and open space, to fit harmoniously with the existing context, and to provide opportunities for high-quality landscaped open space on-site".

4.1 STREETSCAPE AND LANDSCAPE DESIGN

"Provide high-quality, sustainable streetscape and landscape design between the tall building and adjacent streets, parks, and open space".

4.2 SIDEWALK ZONE

"Provide adequate space between the front of the building and adjacent street curbs to safely and comfortably accommodate pedestrian movement, streetscape elements, and activities related to the uses at grade".

Avenues and Mid-Rise Buildings Study (2010)

3.2 PERFORMANCE STANDARDS

"4B. "Pedestrian Perception" step-backs on buildings taller than 23 metres should be required to mitigate the perception of height and create buildings at the street that are of a comfortable scale for pedestrians".
"9. When mid-rise building frontages are more than 60 metres in width, building façades should be articulated or "broken up" to ensure that façades are not overly long".

"15. Mid-rise buildings will be designed to support the public and commercial function of the Avenue through well-articulated and appropriately scaled façades".

- "The street wall of buildings on the Avenues should be designed to create a comfortable, yet highly animated, pedestrian environment through a rhythm of multiple retail frontages, architectural articulation, numerous entrances, display windows, canopies and signage".
- "The ground floor of all buildings should be articulated and highly transparent, with a minimum of 60% of this frontage to be glazed and transparent".
- "Building materials will be high quality and contribute to a human-scaled public realm".

Design Guidelines for Privately Owned Publicly-Accessible Spaces (POPS) (2014)

2.0 ROLE OF POPS IN THE OPEN SPACE NETWORK

"The location, scale, character and programming of open space is an iterative process that will achieve a balance of building and open space opportunities and requirements on a site, as well as extending and enhancing the local and city-wide open space network".

2.2 ENHANCING BUILDING & SITE PROGRAM

"a. Connect with and expand other parks and open spaces such as parks, trails and other pedestrian connections".

"b. Avoid fragmentation of open spaces where possible. Larger areas provide more flexibility to accommodate a range of social functions as well as more usable space".

"e. Enhance prominent building entrances with open spaces, such as a forecourt, plaza or garden".

"f. Animate the street with active uses and allow for sufficient setbacks for these to function. Examples may include patios, retail display areas or community markets".

3.4 WALKWAYS / MID-BLOCK PEDESTRIAN CONNECTIONS

"An exterior public pedestrian route at street level, usually providing a connection through the block. Improves pedestrian access and ease of movement".

3.5 FORECOURTS

"A landscaped open space between the public sidewalk and main entrance of a building, generally enclosed on three sides by building façades".

4.4 ACTIVE EDGES

"The edges of POPS should be designed to seamlessly connect with the city's existing public realm. In particular, active uses, such as retail, cafes and restaurants in mixed use and commercial areas, and grade-related individual residential entrances and playground spaces in residential areas, can be used to animate the edges of the space and deter underutilized space that may otherwise appear dull or unsafe".

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

San Francisco, USA - Urban Design Guidelines (draft 2017)

S5. CREATE A DEFINED AND ACTIVE STREETWALL

"Design all public building frontages to allow active and direct engagement with the street to support pedestrian-oriented activity. Consider the width of the sidewalk in establishing the articulation of the streetwall".

"Absolute consistency in streetwall presence is not always necessary. In some settings, designing a street front with a variety of forecourts, setbacks, loggias, and recesses that act as a lively counterpoint to a streetwall may be appropriate, but not to such an extent that the overall sense of urban room enclosure is eroded".

"Where a project offers a forecourt or front setback, design it as an inviting spatial transitional element between the building wall and the street environment".

Ottawa, Ontario - Urban Design Guidelines for High-Rise Housing (2009)

"3. Use built form to define a human-scaled street space. Different ratios of building base / podium heights to street width create different perceptions of space. Depending on the context, a 1:1 ratio is appropriate for dense downtown locations, and a ratio of 1:2 and 1:3 may be appropriate for other intensification areas such as Traditional Mainstreets, Arterial Mainstreets, and Mixed-Use Centres".

"13. Design the lower portion of the buildings to support human-scaled streetscapes, open spaces and quality pedestrian environments. This can be achieved with fine-grain architectural design and detailing, quality materials, and through the use of human-scaled elements such as landscaping, site furnishings, awnings and canopies".

New York City, USA - Retail Design Guidelines (2015)

1.0 FAÇADE AND SIGNAGE

"A well designed ground-floor façade contributes to an active street life by engaging passersby and connecting interiors to the street. Façades that clearly and distinctly define retail and residential uses attract customers from many locations on the block and beyond".

1.1 GLAZING / FENESTRATION

"Making the façade as transparent as possible allows for a two-way visual exchange between the exterior and interior. Occupants in the retail space see what is happening on the street and pedestrians outside see the activity and offerings in the retail spaces. This symbiotic relationship benefits both patrons and retailers"

"1.1.1 Provide continuous ground-to-ceiling glazing, with integral doors. Where ground-to-ceiling glazing is not possible, meet a target of 70% transparency between 2 feet and 10 feet above the sidewalk".

Seattle, USA - Design Guidelines (2013)

PL3: Street-Level Interaction 1. Design objectives: Design primary entries to be obvious, identifiable, and distinctive with clear lines of sights and lobbies visually connected to the street. Scale and detail them to function well for their anticipated use and also to fit with the building of which they are a part...".

APPENDIX P. 06. TRANSITION - RESEARCH

TORONTO PLANNING & REGULATORY CONTEXT

Official Plan (2015)

The Official Plan includes policies that direct new development to be located and massed to provide a transition between areas of different intensities and scales. These policies have been repeated for multiple areas (e.g. Apartment Neighbourhoods, Mixed-Use Areas), typically through setbacks and/or stepbacks.

3.1.2 BUILT FORM

(Sidebar) "Appropriate transition in scale can be achieved with many geometric relationships and design methods in different combinations including angular planes, stepping height limits, appropriate location and orientation of the building, the use of setbacks and stepbacks of building mass. The larger the difference in scale of development the greater the need for transition".

"3. New development will be massed and its exterior façade will be designed to fit harmoniously into its existing and/or planned context, and will limit its impact on neighbouring streets, parks, open spaces and properties by: c) creating appropriate transitions in scale to neighbouring existing and/or planned buildings for the purpose of achieving the objectives of this Plan".

4.2 APARTMENT NEIGHBOURHOODS

"2. Development in Apartment Neighbourhoods will contribute to the quality of life by: a) locating and massing new buildings to provide a transition between areas of different development intensity and scale [...] through means such as providing setbacks from, and/or stepping down of heights towards, lower-scale Neighbourhoods".

City-Wide Tall Building Guidelines (2013)

1.3 FIT AND TRANSITION IN SCALE

"Ensure tall buildings fit within the existing or planned context and provide an appropriate transition in scale down to lower-scaled buildings, parks, and open space".

"a. Apply angular planes, minimum horizontal separation distances, and other building envelope controls (such as stepping height limits, building setbacks and stepbacks), to transition from tall buildings down to lower scale buildings and to maintain access to sunlight and sky view for surrounding streets, parks, public or private open space, and neighbouring properties".

"b. [...] encourage fit and transition in scale in the following ways:

- when a tall building or group of tall buildings is proposed within an identified growth area, design towers nearer to the edge of the growth area to be progressively lower in height than those in the "centre" the location of greatest intensity and highest order transit;
- when a tall building or group of tall buildings is proposed on a site surrounded by other tall buildings of consistent height, relate the height and scale of the proposed tower to the existing context".

"c. At the site scale, promote fit and transition in scale between tall buildings and lower-scaled buildings, parks and open spaces on the block or across the street by:

• accommodating all aspects of fit and transition within the tall building development site;

- including base buildings that relate directly to the height and typology of the existing or planned streetwall context;
- on larger sites, providing lower-scale buildings or open space to achieve horizontal separation distance".

"d. Appropriate fit and transition in scale may mean that not all sites are suitable for tall buildings, or that the existing or approved massing and scale of a tall building on one site can be applied or used as a reference point for redeveloping a neighbouring site".

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

Sydney - Central Planning Strategy (2016)

Central Sydney acknowledges a number of areas that have special and distinctive character (Special Character Areas). To ensure that development in each special character area can respond to both existing and planned contexts, provisions respecting Street Frontage Height and Street Setback designations are included. Since this method is prescriptive and restrictive, new developments must adhere to site-specific requirements.

Auckland - Design Manual (2017)

This design manual understands that new development must 'blend' into the neighbourhood, by understanding character, form, and scale of the surrounding urban environment.

GUIDANCE FOR MIXED USE DEVELOPMENT: 2.1 MASSING, HEIGHT AND PLACEMENT

"Relate to the mass, scale and setbacks of adjacent buildings. New buildings should reflect the existing or intended character (where major changes are anticipated) of the surrounding area. This means referencing the setbacks, heights, massing and architectural features of adjacent buildings. Where buildings are intended to be of a greater height or mass than existing developments they should be designed to blend into the neighbourhood".

"Pay careful attention to the design of the rear of the building and its relationship to any adjacent accessways or buildings. Rather than being an afterthought, these areas need careful consideration to ensure they are functional, safe and provide good levels of amenity and privacy for occupants and neighbours. The rear of new buildings should, where possible, face the rear of existing buildings".

Ottawa, Ontario - Urban Design Guidelines for High-Rise Housing (2009)

Specific design guidelines for tall residential buildings acknowledge many of the same tools as Toronto - setbacks, stepbacks, scale and massing. However, they also apply buffers (landscaped open spaces, parking, circulation, etc.) as a strong transition technique. The City of Ottawa guidelines also outline the sensitivity of heritage buildings and the need to understand the area's planned function.

"Guideline 4: Locate and orient other building components, such as the base and tower, and various site elements, to create a sense of transition between high-rise buildings and existing, adjacent lower profile areas. Choose transition techniques appropriate to the context including:

- Stepping down incrementally changing the building height, often using 45 degree angular planes to adjacent lower development;
- · Setbacks & Buffers separating adjacent development with landscaped open space, parking, site

circulation or service areas;

- Scale / Massing placing the tall building components strategically on the site to reduce visibility; wrapping the higher rise building with low rise development or with a building base that defines the street scale;
- Design & Character establishing the design qualities and treatment of the lower component or building base based on a human scale and ensuring that the ground floor is active, relevant and a well-designed pedestrian experience".

"Guideline 5: Create a sense of transition between high-rise buildings and existing adjacent lower-profile areas through the location and orientation of the building base or podium and the tower. Create buffers with landscaped open space, parking, site circulation, and lower profile buildings and the building base".

"Guideline 6: Distribute the building form and massing in a manner appropriate to the scale and proportion of the built surroundings. Be sensitive to historic built form and land use patterns of the existing neighbourhood and the area's planned function".

New York City - Zoning Regulation

As a city built strictly to the zoning provisions, transition is encouraged in special districts. Due to the development nature of New York City, it is very detailed. For example:

For the 'Special Harlem River Waterfront District', under 87-30 Spacial Height and Setback Regulations, c) Transition heights outlines: "all street walls, except for parcels 5 and 6, may rise to a maximum transition height of 115 feet, provided that, except on parcel 7, not more than 60 percent of the aggregate width of street walls facing a shore public walkway exceeds a height of 85 feet".

Mississauga, Ontario - Downtown Core Built Form Standards (2013)

Similar to Toronto, Mississauga standards note that where a significant difference in scale exists between building heights, "development will be required to deploy transition strategies through massing and built form, to achieve a harmonious relationship between proposed and existing development, and/or adjacent open spaces". The City of Mississauga outlines different contexts and scenarios, and how built form should appropriately respond.

It also encourages a variety of heights, or a layering of built form masses to "articulate and define the highest and most intense use of land, to the least intensive of uses".

"T28. Consider the size of the development area and the planned intensity of the use".

"T29. Consider the context of adjacent low scale development and other aspects such as the street width or adjacent open space".

"T30. Where a proposed development incorporates multiple buildings, design the buildings to step down in height from high to low, and where it abuts lower scale development".

"T31. For large properties, use an angular plane of 45 degrees from the closest property line of lower scaled residential development, or open space, to determine the minimum setback and height of a building within a development".

"T32. For single properties, deploy a stepping down of the building height and mass to achieve a transition to adjacent lower scale development or open space."

"T33. Design the development to address the impacts of shadow, sky-views and how sunlight can be maximized on the private and public realm".

"T34. Where a group of buildings and/or spaces act collectively to create a special architectural context (i.e. related by similar scale, heights, materials, colours, architectural character, landscaping and open space patterns or qualities) ensure that proposed infill development respects the context by deploying a strategy for building height that is compatible, and which positively contributes to the existing and/or anticipated pattern of development".

APPENDIX Q. 07. SKY-VIEWS - RESEARCH

TORONTO PLANNING & REGULATORY CONTEXT

The Official Plan refers to the importance of sky view in relation to both street and building design. This is emphasized in the Tall Building Design Guidelines, which encourages all new developments to be evaluated on the ability to "secure the greatest amount of sunlight and sky view in the surrounding context. Official Plan Amendment 352 and Zoning By-law 1107-2016 provides for a minimum separation between tall buildings (12.5m from the centre line of the abutting street and 25 metres between tall buildings) as well as minimum tower setback requirements for tall buildings from the lot line (3 metres) which help to maintain sky-view and openness.

Official Plan (2015)

3.1.1 THE PUBLIC REALM

"5. New and existing City streets will incorporate a Complete Streets approach and be designed to perform their diverse roles by: d) providing building access and address, as well as amenities such as view corridors, sky view and sunlight".

City-Wide Tall Building Guidelines (2013)

1.4 SUNLIGHT AND SKY VIEW

"a. Evaluate alternative placement and massing concepts for individual tall building sites at the scale of the block to secure the greatest amount of sunlight and sky view in the surrounding context".

"Sky view is the measurable amount of sky seen from a street, park, or other open space above and in between building masses. Loss of sky view reduces access to light, which affects the comfort, quality, and use of the public realm".



Figure A42. Excerpt from Tall Building Design Guidelines - stepbacks of tower floorplate

3.2.1 FLOOR PLATE SIZE AND SHAPE

"Limit the tower floor plate to 750 square metres or less per floor, including all built area within the building, but excluding balconies".

"b. Provide greater tower separation, setbacks, and stepbacks proportionate to increases in tower floor plate size or height to mitigate resultant wind, shadow, and sky view impacts".

3.2.2 TOWER PLACEMENT

"a. Coordinate tower placement with other towers on the same block and adjacent blocks to maximize access to sunlight and sky view for surrounding streets, parks, open space, and properties".

Lower Yonge Urban Design Report: Principles and Recommendations (2014)

The built form recommendations for the Lower Yonge Precinct Plan included percentages for Tower Area Ratios (TAR). The Lower Yonge urban design report tested that a "wall of condos" had a TAR of at least 27%; thus in order to protect for open sky views and access to sunlight, the TAR for tall residential developments should be below 20%. These recommendations advocate for using additional tower separation (greater than the 25 metres in the Tall Building Design Guidelines) as a tool to limit negative impacts on the public realm and protect loss of sunlight and views.

6.9 TALL BUILDINGS: TOWER AREA RATIO & SEPARATION

"1. TAR North of Harbour Street: For towers north of Harbour Street, a maximum of 20% of the total site area may project above the base building".

"2. TAR South of Harbour Street: For towers South of Harbour Street, a maximum of 35% of the total site area may project above the base building".

"3. Minimum Separation Distances: Towers should be separated by 30m or if more than 80m high, a length consistent with the longest edge of the tower, whichever is greater".

Downtown Tall Buildings: Vision and Supplementary Guidelines (2012)

The three tall building typologies identified for Downtown High Streets are Tower-Base Form, Canyon Form, and Landscaped Setback. The document identified areas where towers should be setback even further from the street, namely along Yonge Street.

3.7 TOWER PLACEMENT

"Step back the tower portion of tall buildings a minimum of 10 to 20 metres from the Yonge Street property line..."

"a. Twenty metre tower stepbacks for tall building proposal sites that contain heritage properties; and b. Ten metre tower stepbacks for tall building proposal sites that do not contain heritage properties".



Figure A43. South view down Yonge Street (image credit: Google Maps)

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

Ottawa, Ontario - Urban Design Guidelines for High-Rise Housing (2009)

"Guideline 2b: Determine if a high-rise should be designed as a "background" building that integrates and blends in with the fabric of the surrounding context by assessing its context and purpose. A "background" building usually:

• creates view corridors and frames the views to neighbouring significant places, as well as sky views".

"Guideline 21: Design the high-rise towers with compact floor plates to maximise views, light and ventilation for the interior spaces, to facilitate breezes and light reaching outdoor spaces...and to allow opportunities for sky views".

London, Ontario - Official Plan (2016)

POLICY 11.1.1 URBAN DESIGN POLICIES: DESIGN PRINCIPLES

"Council shall promote the use of the following urban design principles in the preparation and review of development proposals and community improvement plans and programs".

"Open Views: iii) To the extent feasible, new development should minimize the obstruction of views of natural features and landmarks".

"Pedestrian Traffic Areas : viii) In pedestrian traffic areas, new development should include street oriented features that provide for the enhancement of the pedestrian environment, such as canopies, awnings, landscaped setbacks and sitting areas".

New York City, USA - Zoning Regulation

"New York was the first city in the country to adopt a citywide zoning code, and since the beginning of its zoning history, the city has been struggling to create rules that balance growth with livability. In the early 1900s, buildings were going up fast and going up tall. Just south of Wall Street, for instance, there are two towers to the north of Trinity Church, built in 1905 and 1907, that stretch 21 stories up (skyscraping, for their time) and flank the tiny, dark corridor of Thames Street. To keep New York from becoming a dark nest of brick and stone, by 1915, the city had convened a commission to consider how to control the shape and height of buildings. In 1916, the city's first zoning ordinance required that developers keep at least a minimum level of natural light and air reaching the street."

¹ Laskow, Sarah. Do Taller Buildings Have to Mean Darker Streets? Next City, 2015.

APPENDIX R. 08. SKYLINE - RESEARCH

TORONTO PLANNING & REGULATORY CONTEXT

Official Plan (2015)

3.1.1 THE PUBLIC REALM

"11. Public works and private development will maintain views from the public realm to the skylines of the Downtown and the Central Waterfront, North York Centre, and Scarborough Centre shown on Maps 7a and 7b. These views are dynamic and are expected to evolve over time to include new buildings constructed within the Downtown and Central Waterfront, the North York Centre and the Scarborough Centre" (as amended by OPA 199, 2013).

The Official plan recognizes Downtown's 'dramatic skyline' as "Toronto's image to the world and to itself: comfortable, cosmopolitan, civil, urbane and diverse. It is the oldest, most dense and most complex part of the urban landscape, with a rich variety of building forms and activities." It also states that fthe Financial District is the prime location for "landmark buildings that shape the skyline", and to "design the top of tall buildings to contribute to the skyline character".

City-Wide Tall Building Guidelines (2013)

DEFINING TALL BUILDINGS

"Regardless of stylistic approach, the design and placement of all tall buildings should make a positive contribution to the public realm, fit harmoniously within the surrounding context and skyline...".

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

New York City, USA

Design requirements for development are contained in the New York City Zoning Resolution. New York City is an "as-of-right" city, meaning the Planning Department does not review most development proposals unless there is a need to change the underlying zoning controls. Most development, including tall skyscrapers, are built through additional provisions that allow you to exceed zoning permission (e.g. transfer of development rights or bonusing).

An exhibition and study, titled the "Accidental Skyline" by the Municipal Art Society of New York City, examined the new "hyper-tall, super-slender towers that are, for the most part, as-of-right"¹. This study focused on the shadowing impacts of new skyscrapers on Central Park, raising awareness of the outdated zoning process that is permitting these buildings. It is clear that New York City is struggling because of, but are subsequently allowing, taller and taller skyscrapers.

A big driver of these buildings is the goal to make wealth visible, which has existed since the post-war economic boom. This results in an increase of luxury housing that caters to the global elite, as developers continue to pursue hyper dense, slender, towers that protrude out of the existing context (Figure A41). These towers, like 217 West 57th, which will be America's Tallest Residential Building at between 1,400 and 1,500 feet, are built as-of-right, without public review, by way of a zoning lot merger and purchase of neighbouring development rights.

New York City, USA - Zoning Resolution

"81-641 (3) Building Design: ...any development or enlargement proposed under the provisions of this

¹ The Municipal Art Society of New York. The Accidental Skyline. MASNYC, 2013.

Section shall demonstrate particular attention to the building design, including, but not limited to, the proposed uses, massing, articulation and relationship to buildings in close proximity and within the Midtown Manhattan skyline".

"91-00 General Purposes (b): facilitate maximum design flexibility of buildings and enhance the distinctive skyline and streetscape of Lower Manhattan".



Figure A44. Top: new developments proposed as of 2013 that have shadow impacts on Central Park. (image credit: Municipal Art Society of New York City).

Montreal, Canada - Plan D'urbanisme de Montreal

The borough of Ville-Marie requires all buildings to fit within the silhouette of the Downtown Area. "Even if they surpass the height of their neighbours...the goal is to maintain the importance of Mount Royal within the urban landscape"².

5.1.2 The Centre's skyline: By-laws established by the Borough of Ville-Marie must ensure that a building that exceeds the street height in an area as specified on the attached Map entitled "Areas of Tall Buildings" is set with respect to the skyline.

Paris, France

In light of the absence of a height restriction, the Tour Montparnasse was built at a height of 689 feet, emerging out of the skyline³. Subsequently, in 1977, Paris set a height limit of 121 feet on all new buildings. However, in 2010, in acknowledgement of a new vision for the city, Paris City Council voted to raise the maximum height limit from 121 feet to 590 feet (approximately 60 storeys).

Soon after the revised height limits were approved, the Tour Triangle, or Projet Triangle, was proposed as a tall glass pyramid at a height of 590 feet, with completion planned for 2020. The Tour Triangle serves as an example of what may occur when a city-wide height regulation is revised.

London, United Kingdom

Beginning in the 1930s, London has created a rigid series of policies that allocate where taller buildings can be located in the city. From policies that protected views of St. Paul's Cathedral and the Monument to the Great Fire to areas of historical or architectural conservation, these layers of protection limited where taller and higher density structures are permitted within the skyline. What remains is a small restricted area where you can build the taller towers required to accommodate London's downtown growth. Today, a cluster of towers are constructed or are proposed up to 305 metres, which is the Civil Aviation Authority height limit for flight paths. The Guardian

Heffez, Alanah. Skyline Planning. Spacing Montreal, 2008. Davies, Alex. Newly Freed from Height Limits, Paris Skyline Ready to Rise. Tree Hugger, 2010.

comments that "as soon as you define what the biggest possible development could be, developers will come and build it"⁴.





Vancouver, Canada - View Protection Guidelines

In order to protect Vancouver's spectacular ocean and mountain views, density is promoted in the downtown area. The backdrop of the mountains behind Vancouver's skyline signifies the city's connection to nature and aligns with its goals around sustainability.⁵

The downtown peninsula has limited land available for development because of its geographic boundaries. In order to reduce urban sprawl, the City considers higher buildings that don't impact the protected view corridors. Vancouver has 27 protected view corridors, established by the City to protect the view of the North Shore mountains, the Downtown skyline, and the surrounding water.

The location maps within the View Protection Guidelines⁶ only show the location of the view cones and do not give the maximum building heights within them. Staff will calculate the maximum building height for each site falling within a view cone. Within the West End Community Plan⁷, one of the seven built form guiding principles include: "Reinforce the Dome-Shaped Skyline: New development opportunity should reinforce the legibility of the downtown's recognized dome-shaped skyline when viewed from longer distances. Appropriate form and scale to "fill the gaps" can strengthen the image of the city."

Doha, Qatar

As the capital city of Qatar, Doha been experiencing a rapid increase in corporate and commercial activity⁸. However, each new tower is as tall, or even taller than the last, competing in profile, material, style, and roofline to stand out amongst the rest. In contrast to Toronto, which has a fairly legible shape despite the infill nature of recent developments, there is a lack of composition to the skyline.

⁴ Wainwright, Oliver & Ulmanu, Monica. 'A tortured heap of towers': The London skyline of tomorrow. The Guardian, 2015.

⁵ Final Report: Implementation of "Vancouver Views" and Opportunities for Higher Buildings in the Downtown. January 20,2011

City of Vancouver. View Protection Guidelines. Community Services, amended 2011.
 City of Vancouver. West End Community Plan. Planning and Development, 2013.

Willet, Megan. (2014). Incredible photos show how Qatar has transformed over 40 years. *Business Insider.*

APPENDIX S. 09. MIXED-USE AND FLEXIBLE BASE BUILDINGS - RESEARCH

TORONTO PLANNING & REGULATORY CONTEXT

Official Plan (2015)

2.3.1 HEALTHY NEIGHBOURHOODS

"6. Community and neighbourhood amenities will be enhanced where needed by:

- a) Improving and expanding existing parks, recreation facilities, libraries, local institutions, local bus and streetcar services and other community services; and
- b) Creating new community facilities and local institutions, and adapting existing services to changes in the social, health and recreational needs of the neighbourhood".

3.1.3 BUILT FORM - TALL BUILDINGS

"By concentrating development on a small part of the site, they can also provide high quality publicly accessible open spaces and areas for community services and amenity".

3.2.2 COMMUNITY SERVICES AND FACILITIES

"Strategic investment in social infrastructure encourages greater levels of equity, equality, access, participation and social cohesion across the City and within communities".

"1. Adequate and equitable access to community services and local institutions will be encouraged by:

- a) Providing and preserving local community service facilities and local institutions across the City dedicated to this purpose;
- b) Improving and expanding local community service facilities and local institutions in established neighbourhoods that are under or poorly served; and
- c) Ensuring that an appropriate range of community services and facilities and local institutions are provided in areas of major or incremental physical growth".

3.3 BUILDING NEW NEIGHBOURHOODS

"2. New neighbourhoods will be viable as communities, with : d) High quality parks, community recreation centres, open space and public buildings; e) Services and facilities that meet the needs of residents, workers and visitors".

4.2 APARTMENT NEIGHBOURHOODS

"2. Development in Apartment Neighbourhoods will contribute to the quality of life by: g) Providing ground floor uses that enhance the safety, amenity and animation of adjacent streets and open spaces".

Section 37 Implementation Guidelines for Section 37 of the Planning Act (adopted 2007)

5.3 COMMUNITY SERVICES AND FACILITIES SPACE

"Where community services and facilities space is secured as a community benefit, the following conditions shall generally apply and be secured in the Section 37 agreement. It is intended that there be flexibility in these conditions to allow for consideration of the specific circumstances:

• Generally, the City will conduct a selection process to identify a non-profit service provider to operate in the space. Where deemed appropriate by the City, and the developer agrees, the developer shall

issue a request for proposals for the space, and the Chief Planner must approve the developer's choice; and

• The size, location, materials and design are to the satisfaction of the City and meet all licensing and Ontario Building Code requirements".

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

This research component analyzed both existing policies and case studies in different municipalities to compare the impact of policies on built form - however, in most cases, it is observed that policies are geared towards facilitation of process rather than built form direction.

Seattle, USA - Downtown Amenity Standards (2014)

"In some Downtown zones, increases in floor area above the base Floor Area Ratio (FAR) limit or base height limit of the zone may be allowed, subject to specified conditions".

SECTION I: GENERAL ELIGIBILITY CONDITIONS FOR AMENITY FEATURES

The following eligibility conditions apply to all amenity features for which a floor area bonus is sought under SMC Sections 23.49.013 and 23.58A.016 and to specific amenity features for which a floor area exemption is allowed as described in these Standards. The categories of general eligibility conditions are:

- A. Installation Timeframes
- B. Public Access and Hours of Operation
- C. Maintenance
- D. Combination of Amenity Features
- E. Art in Bonused Public Spaces
- F. Use of Bonused Public Spaces
- G. Landscaping and Furnishings
- H. Safety
- I. Identification
- J. Required Street Level Uses
- K. Information in Permit Application and Recording Conditions

Figure A46. Excerpt from Seattle Downtown Amenity Standards

Vancouver - Downtown Official Development Plan By-laws

SECTION 7 - SOCIAL, CULTURAL AND RECREATIONAL AMENITIES AND FACILITIES

Where a need for any public, social, cultural or recreational facility has demonstrated to the satisfaction of the Development Permit Board, the Board may authorize, for any building which includes one or more of such facilities, an increase in the permitted floor space ration of density of a building, subject to prior approval by City Council.

Vancouver - Community Amenity Contributions - Through Rezonings

"1. Community Amenity Contributions (CAC) policies apply to private rezoning applications. Community amenities may be provided through rezonings, to help address growth costs, area deficiencies, and/or other community needs and impacts. CACs may be a cash contribution, or an amenity provided in-kind by the development. CACs are generally for capital facilities."

"It is difficult to make a direct comparison between Vancouver and Toronto regarding the process of obtaining community benefits through rezonings and the value of the benefits secured...On the surface it appears that Vancouver is able to obtain more benefits for community amenities than Toronto through rezonings,

Vancouver, British Columbia

Woodward's Redevelopment

Coined as perhaps the 'most significant mixed-use development project to be undertaken in Vancouver'¹, this site in Gastown, once home to a major department store, now consists of approximately one million square footage of community uses. This urban redevelopment project includes both market-rate and non-market housing choices (multi-family, condominium, affordable and social housing), educational space for Simon Fraser University, daycare facility, public atrium, plaza, ground-floor retail, grocery store, parking, cultural and office spaces over 2.32 acres.

The land was purchased by the City from the Province, and invited proposals for redevelopment. A two-stage competition between three development teams explored different ideas. Westbank Projects and the Peterson Investment Group were selected for its heritage restoration and intensification proposal.

The zoning process in Vancouver allows the city to add density in return for their preferred design concept². This triggered a collaboration, from both public and private sectors, to bring the site back to life and serve the city. This development and its amenities are successful due to its high mix of uses, large floorplate, high ceilings, large windows for daylighting, and the framing of public space that creates activated public spaces.

Westbank. Woodward's, 2017.
 ULI Case Studies. Woodward's, 2014.



Figure A47. Vancouver example of a successful mixed-use development initiated by the city, as a result from a collaborative zoning process (image credit: Westbank corp, ULI case studies, Archdaily)

but even for this calculation there are important nuances that make this observation inconclusive. One important difference is that Toronto, for the most part, has not included in-kind benefits in its summary of valuations..." - *City of Toronto 'Improvements to the Section 37 Implementation Process Interim Study Findings', 2013*

New York City - Incentive Zoning

"Incentive zoning provides inducements to developers for development projects that provide some type of a community benefit, such as a public square, streetscape, park, senior housing, or affordable housing. Often, the incentive will take the form of a density bonus". - Liveable New York Resource Manual

- The idea of incentive zoning was pioneered by New York City in its 1961 zoning, where extra floor area was given to office buildings if developers created public plazas around building bases.
- Although this approach is primarily used for creating privately-owned public spaces rather than public amenities, community facilities such as hospitals, universities, and churches can take advantage of it to bump up their site density.

New York City - Inclusionary Housing

- Since 1987, New York City's zoning has included an Inclusionary Housing program, which offers a floor area ratio bonus for developments that provide affordable housing. This housing may be offered on or off site, be a part of new construction, redevelopment, or preservation of existing affordable housing.
- There are two types of Inclusionary Housing: "the R10 and the Designated Area programs offer an optional floor area bonus in exchange for creation or preservation of affordable housing. Mandatory Inclusionary Housing, or MIH, requires affordable housing as part of all residential development above a certain size in applicable areas."¹
 - Voluntary Inclusionary Housing: enacted in 1987, enables a development to receive a density bonus in return for the new construction, substantial rehabilitation, or preservation of permanently affordable housing.
 - Mandatory Inclusionary Housing: enacted in March 2016, requires a share of new housing in mediumand high-density areas that are rezoned to promote new housing production - whether rezoned as part of a city neighbourhood plan or a private rezoning application - to be permanently affordable.

Chicago - Neighborhood Opportunity Bonus (updated 2017)

"Zoning bonuses to increase the size of individual downtown construction projects are allocated through a higher floor area ratio (FAR). FAR bonuses are available through a single voluntary payment into a Neighborhood Opportunity Bonus system. The equation for determining the bonus payment under the simplified system is as follows:

• Cost of 1 square foot of floor area = 80% x median cost of land per buildable square foot"

"Neighborhood Opportunity Fund: Receives and allocates 80% of all bonus contributions to support development projects within under-served West, Southwest and South side commercial corridors, including grocery stores, restaurants and cultural facilities".

¹ New York City Planning. Inclusionary Housing. Department of City Planning, 2017.

New York City, USA

Long Island City Waterfront

Economic development is a driver of this revitalization project on two City-owned sites on the Long Island City waterfront. Over 1.5 million square feet, it is projected that 1,500 permanent and more than 2,500 construction jobs will be created¹.

As one of the fastest growing centres of the city's economy, modern industrial and innovation jobs are supported with incubator space, workforce training programs, a 600-seat school, start-up office spaces, and light industrial spaces.

Furthermore, 400,000 square feet of commercial space, 19,000 square feet of retail space, and a total of 1,000 residential units will be provided, with 25% of that being affordable housing. Over an acre of open space will also be provided.

1 NYCEDC. New York Works: NYCEDC Announces Plan to Bring First of its Kind Industrial-Commercial-Residential Project to Long Island City Waterfront. 2017. New York City Economic Development Corporation issued a request for proposals, eventually selecting a joint submission by TF Cornerstone, Greenpoint Manufacturing and Design Centre, C4Q, and BJH Advisors to build this dynamic new development.



Figure A48. New York City example of how mixed-use, revitilization, and economic development initiatives can come together. Industrial and residential can be compatible (image credit: NYCEDC)

New York City, USA

Mortimer B. Zuckerman Research Center

Located in the heart of Manhattan, this new 23-storey research building by Memorial Sloan Kettering Cancer Centre is composed of laboratories, auditorium, conference centres, office space, library, biology and graduate school programs¹.

The vertical research center is situated on an L-shaped, 45,500 square foot parcel, using space efficiently to fit all laboratory uses, research support rooms, and shared work spaces in a productive way within a linear, urban form.

The Cancer Centre establishes goals that the building embraces: the need for flexibility, efficient use of space, and phasing of construction in a way that does not disrupt ongoing work.

1 Memorial Sloan Kettering Cancer Centre. Design and Construction Fact Sheet, 2017.





The School at Columbia University

Partially built over an existing bank, this 170,000 square foot, 12 storey building is primarily a K-8 private school administered by Columbia University, with flexible clustered teaching areas, a gymnasium, cafeteria, and play roof².

It also includes premier faculty housing within the top storeys, 27 three- and four-bedroom units with terraces, as well as ground-floor retail wrapped around the building.

2 Beyer Blinder Belle. *The School at Columbia University and Faculty Residence*, 2003.



Figure A49. Examples of a hospital facility located in a dense urban context and a layered instutional and residential mixed-use (image credit: MSKCC, ZGF, and Beyer Blinder Belle)

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

The research in this section includes a combination of policies and building precedents from different municipalities. While there may not be direct links between policy provision and built form decisions (i.e. each building may not show the policy described), the intent of policies represent the opportunities made possible for certain typologies. It is noted that many buildings in the case studies outlined resulted from partnerships or incentives.

London, UK - Official Plan

".15 The Mayor encourages mixed use development, with different approaches for places where high office values will generally support other uses, and those where values for other uses (such as residential) may be higher and support some office space renewal".

"4.16 Beyond Central Activities Zone (CAZ) and the north of the Isle of Dogs, mixed use redevelopment can play a role in promoting selective renewal and modernisation of the stock in appropriate locations (see paragraph 4.12) and delivery of other uses including housing as part of a managed process to consolidate the strengths of the office market. Supplementary guidance is provided on this process".

"4.17 Within the Central Activities Zone and the north of the Isle of Dogs Opportunity Area, strategically important office development should include other uses, including housing. As a general principle, housing and other uses should be required on-site or nearby to create mixed use neighbourhoods".

LONDON: CHAPTER 7: LONDON'S LIVING SPACES AND PLACES: 7.6

"7.23 The massing, scale and layout of new buildings should help make public spaces coherent and complement the existing streetscape. They should frame the public realm at a human scale and provide a mix of land uses that activate its edges and enhance permeability in the area. New buildings should integrate high quality urban design ensuring an appropriate balance between designing out crime principles and appropriate levels of permeability. Consideration should also be given to the future management of buildings in their design and construction".

Hong Kong - Town Planning Ordinance, 2011

"The Town Planning Board (the Board) recognizes that there are merits in functionally and physically integrating different types of compatible uses within a building or over a spatial area, in particular when it helps create vitality and diversity in an area. Appropriate planning control should be provided to guide mixed use development to avoid the possible nuisance and interface problem".

3. PLANNING INTEGRATION

"Flexibility for the development/redevelopment/conversion of residential or other uses, or a combination of various types of compatible uses including commercial, residential, educational, cultural, recreational and entertainment uses, either vertically within a building or horizontally over a spatial area, is allowed to meet changing market needs. Physical segregation has to be provided to prevent non-residential uses from causing nuisance to the residents".

"3.2 To enable appropriate planning control on different types of buildings and yet give owners/developers the flexibility in developing their land for different types of uses in different mix, three separate User Schedules are applicable to this zone"

"3.3 For a non-residential building or portion of a composite building upon development/redevelopment/

Rotterdam, Netherlands

De Rotterdam

This project calls itself a "vertical city", as the largest building in the Netherlands. Over 162,000 square metres of gross floor area, the three, 44-storey, towers include residential, a hotel with shared amenities (fitness facilities, restaurants, conference rooms), and office units. Linking the uses and the towers is a plinth, which is a "long elevated hall that serves as a general traffic hub"¹, containing the office, hotel, and apartment lobbies.

What this project by the Office for Metropolitan Architecture creates is a new, second city centre, revitalizing the city's old harbour district by returning the critical uses of trade, transport, and leisure.

As a city that endured bombings in 1940 and 1943, it has since been continuously rebuilt with experimental and innovative architecture. It is this courage and curious mindset that drives their intentions for building hyper-mixed use buildings in a variety of typologies. They saw the tragedy as an opportunity to reinvent their architectural style and norms.





1 Maier, Florian. Vertical City: De Rotterdam Mixed-use Building. Detail Online, 2013.

Figure A51. Example from Rotterdam, where architects explored innovative and different typologies of mixed-use development (image credit: OMA, Dezeen)

Hong Kong

International Commerce Centre

Called the "ultimate in mixed-use buildings", the International Commerce Centre (ICC) at 118 storeys, is Hong Kong's tallest structure and third-tallest roof in the world¹. Hong Kong is well known for its multiple intensive land use practice, where mixed-use includes a large variety of multi-functional and shared uses in the city's extremely dense context.

Anchoring this iconic building is the underground connection to Kowloon Station, allowing the tower, the superblock podium, and its uses to be part of a tightknit transit network.

The ICC is composed of nearly 675,000 square metres of high-rise residential and service apartments, 100,000 square metres of retail, 232,500 square metres of office space, a 360 degree observation deck, and two hotels - one of them, the Ritz-Carlton, actually occupies the top 15 storeys of the tower².

 Schindler. East Meets West.
 Malott, David. International Commerce Centre. Elevator World, 2011. An atrium connects the development as a public connection between retail and rail, as this hub feeds a network of over 11 million passenger journeys a day.





Figure A50. Example of a hyper-mixed use and super-tall building (image credit: building.hk, CTUBH, Openbuildings)

conversion (Schedule I), a wide range of uses similar to those always permitted in the "Commercial" zone will be permitted as of right".

• "For a residential building or portion of a composite building upon development/redevelopment/ conversion (Schedule II), residential use, certain Government uses and small-scale utility installations are always permitted".

"3.4 For an existing building within the "OU(MU)" zone before its redevelopment/ conversion (Schedule III), the mixed-use environment as a result of the previous zoning, will be tolerated as far as possible. "

COMPOSITE BUILDINGS

"4.3 A composite building means a building that is constructed or intended for use partly for residential purposes and partly for non-residential purposes such as commercial, educational, cultural and entertainment, but excluding industrial uses. Ancillary accommodation for these uses also forms part of the non-residential portion".

"6.4 No intermixing of residential and non-residential uses on the same floor will be allowed, unless otherwise permitted by way of the planning permission system".

"7.4 When designing a composite building, particular attention should be paid to fire safety requirements and building safety considerations and other special building requirements for the relevant uses as appropriate, e.g. social welfare facilities involving residential care. For instance:

- schools should not be located at a height exceeding 24 metres above ground;
- residential care homes for the elderly and child care centres (CCC) for children aged 2 to 3 years should not be located at a height more than 12 metres above ground;
- domestic accommodation should not be provided within or immediately adjoining a place of public entertainment;
- · schools should not be located over shops".

Adelaide, South Australia - Guide to Mixed-Use Development

"Mixed use: Development which comprises a mixture of two or more land uses, either comprised within a single building (horizontally or vertically) or multiple buildings of different uses within a distinct development site".

"Of the mixed use developments that exist in Adelaide, a large proportion comprise retail, commercial and residential mixes. The economic and amenity synergies between these uses promote successful development".

"Within the Central Business Area, as further premium office space is developed, there are opportunities to convert under-utilised lower grade office buildings to different uses. These buildings are often centrally located in relation to retail, education, entertainment and other facilities and highly accessible to public transport".

New York City, USA - Special Mixed Use (1997)

"The Special Mixed Use District (MX) was established in 1997 to encourage investment in, and enhance the vitality of, existing neighborhoods with mixed residential and industrial uses in close proximity and

create expanded opportunities for new mixed use communities. New residential and non-residential uses (commercial, community facility and light industrial) can be developed as-of-right and be located side-byside or within the same building".

Seattle - Municipal Code

CHAPTER 23.48 - SEATTLE MIXED

"A. Permitted Uses: [...] All uses are permitted outright, either as principal or accessory uses...".

"B. Prohibited Uses: All high-impact uses, heavy manufacturing uses, general manufacturing uses greater than 25,000 square feet of gross floor area, drive in businesses except gas stations, jails, adult motion picture theaters and adult panoramas, outdoor storage...".

"C. Conditional Uses: Mini-warehouses/warehouses may be permitted ...if: the streetlevel portion fronts an east-west street or alley, vehicular entrances will not disrupt traffic or transit, and traffic does not disrupt pedestrian character".

"D. Required Street-level Uses: One or more of the following uses listed in this subsection 23.48.005.D.1 are required at street level along the street-facing façade abutting streets designated as Class 1 Pedestrian Streets...".

- a. General sales and service uses
- b. Eating and drinking establishments
- c. Entertainment uses
- d. Public libraries
- e. Public parks
- f. Arts facilities
- g. Religious facilities
- h. Light rail transit stations

APPENDIX T. 10. HERITAGE - RESEARCH

TORONTO PLANNING & REGULATORY CONTEXT

Provincial Policy Statement (2014)

The revision to the Provincial Policy Statement in 2014 enhanced many requirements that support the retention and adaptation of heritage places including policies on adaptation to climate change, health, sustainability, liveability and resilience in communities. In particular, Section 2.0 Wise Use and Management of Resources: "Ontario's long-term prosperity, environmental health, and social well-being depend on conserving biodiversity, protecting the health of the Great Lakes, and protecting natural heritage, water, agricultural, mineral and cultural heritage and archaeological resources for their economic, environmental and social benefits."

2.6 CULTURAL HERITAGE AND ARCHAEOLOGY

"2.6.1 Significant built heritage resources and significant cultural heritage landscapes shall be conserved".

"2.6.3 Planning authorities shall not permit development and site alteration on adjacent lands to protected heritage property except where the proposed development and site alteration has been evaluated and it has been demonstrated that the heritage attributes of the protected heritage property will be conserved".

4.0 IMPLEMENTATION AND INTERPRETATION

"4.7 The Official Plan is the most important vehicle for implementation of this Provincial Policy Statement. Comprehensive, integrated and long-term planning is best achieved through official plans".

Ontario Heritage Act (last amended 2009)

The OHA sets out the mechanisms for the conservation of heritage resources by enabling municipalities to:

- Establish municipal heritage committees (OHA, Part IV, section 28 (1))
- Designate individual properties as having cultural heritage value or interest (OHA, Part IV, section 29 (1))
- Include potential heritage properties on a register (OHA, Part IV, section 27 (1.2))
- Enter into heritage conservation easements (OHA, Part IV, section 37 (1))
- Establish heritage conservation districts (OHA, Part V)
- Conservation of archaeological resources (OHA, Part VI)

Official Plan (2015)

3.1 THE BUILT ENVIRONMENT

"In order to remain economically competitive in today's global economy, a city must be more than functional. It has to work well, but it also must be beautiful, vibrant, safe and inclusive".

3.1.2 BUILT FORM

"Most of Toronto is already built with at least one generation of buildings. For the most part, future development will be built on infill and redevelopment sites and will need to fit in, respecting and improving the character of the surrounding area".

"1. New development will be located and organized to fit with its existing and/or planned context. It will frame and support adjacent streets, parks and open spaces to improve the safety, pedestrian interest and casual views to these spaces from the development...".

Heritage conservation policy is integrated in many Chapters of the Official Plan but Section 3.1.5: Heritage Conservation was rewritten in its entirety:

3.1.5 HERITAGE CONSERVATION

The Policy preamble describes the objectives and rationale for conservation. Key policies governing built form include policies on identification, protection, protection from neglect, demolition, the requirement for Heritage Impact Assessments (HIAs), relocation and the definition of adjacency, integrity and alteration. Other policies relate to commemoration and recognition of First Nations and Metis resources, archaeology, heritage awareness, incentives, the preservation by the City of its owned resources, protection of cultural landscapes and views and vistas. The listing of heritage properties is encouraged, as is the designation of individual properties under the Ontario Heritage Act Part IV and Heritage Conservation Districts with Plans under the Ontario Heritage Act Part V.

"2. Properties and Heritage Conservation Districts of potential cultural heritage value or interest will be identified and evaluated...".

"5. Proposed alterations, development, and/or public works on or adjacent to, a property on the Heritage Register will ensure that the integrity of the heritage property's cultural heritage value and attributes will be retained, prior to work commencing on the property and to the satisfaction of the City".

"6. The adaptive reuse of properties on the Heritage Register is encouraged...".

"21. Additional gross floor area may be permitted in excess of what is permitted in the Zoning By-law ..." describes the conditions that apply to development in combination with heritage buildings, including design values, conservation and easements".

Heritage Conservation Districts (HCDs)

A Heritage Conservation District (HCD) is a distinct area that is distinguished by specific cultural heritage values; they may be residential or mixed use, including downtown commercial, institutional or industrial uses. They may be blocks or streetscapes with significant structure, open space, landscape, or intangible value. In the Plan Stage, the unique character of the HCD is described and special policies and guidelines provided that affect the management, conservation and change within the area. Policies concerned with the physical alteration of contributing and non-contributing properties within the area relates to alteration of resource attributes, and additions of height or width, to step backs, setbacks, physical compatibility and preservation of open space within the development framework.

PRECEDENTS OF GUIDELINES & REGULATIONS IN OTHER CITIES

Older, Smaller, Better – by the Preservation Green Lab, National Trust for Historic Preservation (2014)

The Older, Smaller, Better study looked at 50 cities across the United States to understand the role that historic buildings (those built prior to 1945) play in promoting positive economic, social and cultural activities. Using spatial analytics, the study overlaid a 200 x 200 metre grid over mixed use areas of each city centre. The grid served two purposes: 1) it generally replicated the size of a city block and 2) it allowed an 'apples-to-apples' comparison of statistical information.

Across the 50 cities, the findings were consistent; notably that blocks containing a mix of older, small buildings of diverse age support greater levels of positive economic and social activity than areas dominated by larger, newer buildings.

Other findings include:

- Older, small buildings provide flexible space for entrepreneurs and small-business owners. Moreover, the small-business owners are more likely to be women or minorities. These types of buildings also support the creative economy with businesses in media production, software publishing and performing arts;
- Streets and blocks with a mix of small, old and new building have a higher proportion of non-chain restaurants and retailers than areas with new, larger buildings;
- Older mixed use areas contain 'hidden density'. In many cities, areas of smaller, older buildings have higher population densities and more businesses per square foot than areas of large, new buildings;
- Young people love old buildings. In several cities, the median age of residents in areas of older, smaller buildings is lower than areas with predominantly new buildings; and
- Nightlife is most alive on streets with a diverse range of building ages.

The study suggests general planning and development principles:

- Focus on streets and blocks rather than individual buildings.
- Realize the efficiencies of older buildings and blocks. Older buildings tend to have mixed daytime and nighttime uses, common entrances and shared services. Codes and regulations that limit these uses should be reviewed and revised to encourage the efficient use of older, smaller buildings.
- New and older buildings should be fit together on a human scale. Variety of building age, including new construction, should be encouraged because it promotes blocks that thrive. The scale of the new construction is important and new infill should be of a compatible size and scale to the older buildings.
- 50 Average of dates of construction: 16% built pre-1920; 22% built 1920-1945; 28% built 1945-1967; and 34% built 1967-2017.
- Neighbourhoods should be encouraged to evolve. Successful areas tend to be those than have evolved over time, adding and subtracting buildings incrementally rather than comprehensively and all at once.

Vacant and underused buildings contain density that should be unlocked. Outdated zoning, parking requirements should be reviewed and revised. Permitting and approvals processes should be streamlined. Incentives and financing programs should be created to assist small-scale projects.

Building on Chicago's Strengths: The Partnership for Building Reuse – Preservation Green Lab and Urban Land Institute (May 2016)

- The Partnership for Building Reuse addresses vacancy and reuse issues related to all existing structures, not just those designated at the local or federal levels. In Chicago, fewer than three percent of the city's existing buildings are protected through local designation.

"Older, smaller buildings contribute in key ways to the vitality of the city:

- Older, smaller buildings provide the foundation for Chicago's new businesses and small businesses.
- Older buildings are often more energy efficient.
- Chicago's best restaurants and bars are in older buildings.
- Chicago's older commercial fabric houses more local, non-chain restaurants."

"The Partnership identified obstacles that make building reuse challenging... These include:

- Weak market conditions and difficulties in securing financing in some areas.
- Zoning rules that unnecessarily limit uses in certain zone districts.
- Onerous parking requirements.
- Limited financial incentives, especially for small projects.
- Appraisals that are out-of-synch with the market.
- Lack of inclusive and coordinated neighbourhood planning.
- · Complexity and cost of meeting building and energy codes".

"The Partnership recommends five key strategies to strengthen building reuse in Chicago in the coming years:

- 1. Adopt adaptive reuse policies within the Chicago Zoning Code.
- 2. Reduce parking requirements for building reuse projects.
- 3. Apply Chicago Building Code in a more flexible manner for older buildings.
- 4. Support community development organizations, non-profit developers, and small-scale developers.
- 5. Strengthen the use of financial incentives that support building reuse and explore the implementation of new financial tools."

Chicago, USA

Outlined below are a range of programs and plans in place in Chicago which support the reuse of existing buildings. NEIGHBOURHOOD OPPORTUNITY BONUS

"Updates to the Chicago zoning code's downtown floor area bonus system and downtown zoning district geography were approved by City Council in May 2016. Coordinated as the Neighborhood Opportunity Bonus, the changes simplify and update the downtown floor area bonus system; accommodate ongoing central area growth through an expanded downtown zoning district; and provide new funding sources to encourage commercial development in neighborhoods lacking private investment".

- The funds are allocated to:
 - "Neighborhood Opportunity Fund: Receives and allocates 80 percent of all bonus contributions to support development projects within under-served West, Southwest and South side commercial corridors, including grocery stores, restaurants, and cultural facilities."
 - "Citywide Adopt-A-Landmark Fund: Receives and allocates 10 percent of all bonus contributions to support the restoration of structures designated as official landmarks by City Council."
 - "Local Impact Fund: Receives and allocates 10 percent of all bonus contributions to support improvements within one mile of the development site generating the development funds, including public transit facilities, streetscapes, open spaces, river walks, and other sites, including landmarks."

RETAIL THRIVE ZONES

"A three-year pilot program aimed at strengthening the economic vitality of eight neighborhood commercial corridors. Each of the Retail Thrive Zone corridors, located on the City's South, Southwest, and West sides,

have economic challenges, but they also have strong potential for growth. Within those corridors, the City will offer an evolving package of financial assistance to entrepreneurs and business. By focusing on targeted areas, the City is able to roll out programs more quickly, experiment with new ideas, and expand those that are successful to other parts of the city."

TROUBLED BUILDING INITIATIVE

"A tool to help reclaim troubled and abandoned buildings that create dangerous and hazardous conditions for residents, neighbors, and first responders. TBI works with existing owners and lien holders, primarily through the housing court process with the use of receivers and by the acquisition of distressed notes and liens, to prevent these buildings from deteriorating into a state of disrepair which may lead to displacement, the loss of affordable housing, and unnecessary demolition."

CHICAGO SUSTAINABLE DEVELOPMENT POLICY (updated 2016)

- The new policy allows development teams to choose from a menu of strategies that can be tailored to fit the project's characteristics. Each strategy is assigned a point value. New construction projects are required to achieve 100 points and renovations of existing buildings are required to reach 25 or 50 points depending on the scale of the renovation.

APPENDIX U. STUDIES AND REPORTS REFERENCES

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By-law 1105-2016

To adopt Amendment No.352 to the Official Plan of the City of Toronto respecting the area generally bounded by Bathurst Street, Lake Ontario, the Don River, Rosedale Valley Road and the CPR tracks.



By-law 1106-2016

To amend former City of Toronto Zoning By-law No. 438-86, as amended, with respect to tall buildings setbacks in the downtown area of the City.



By-law 1107-2016

To amend Zoning By-law No. 569-2013, as amended, with respect to tall buildings setbacks in the downtown area of the City.


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