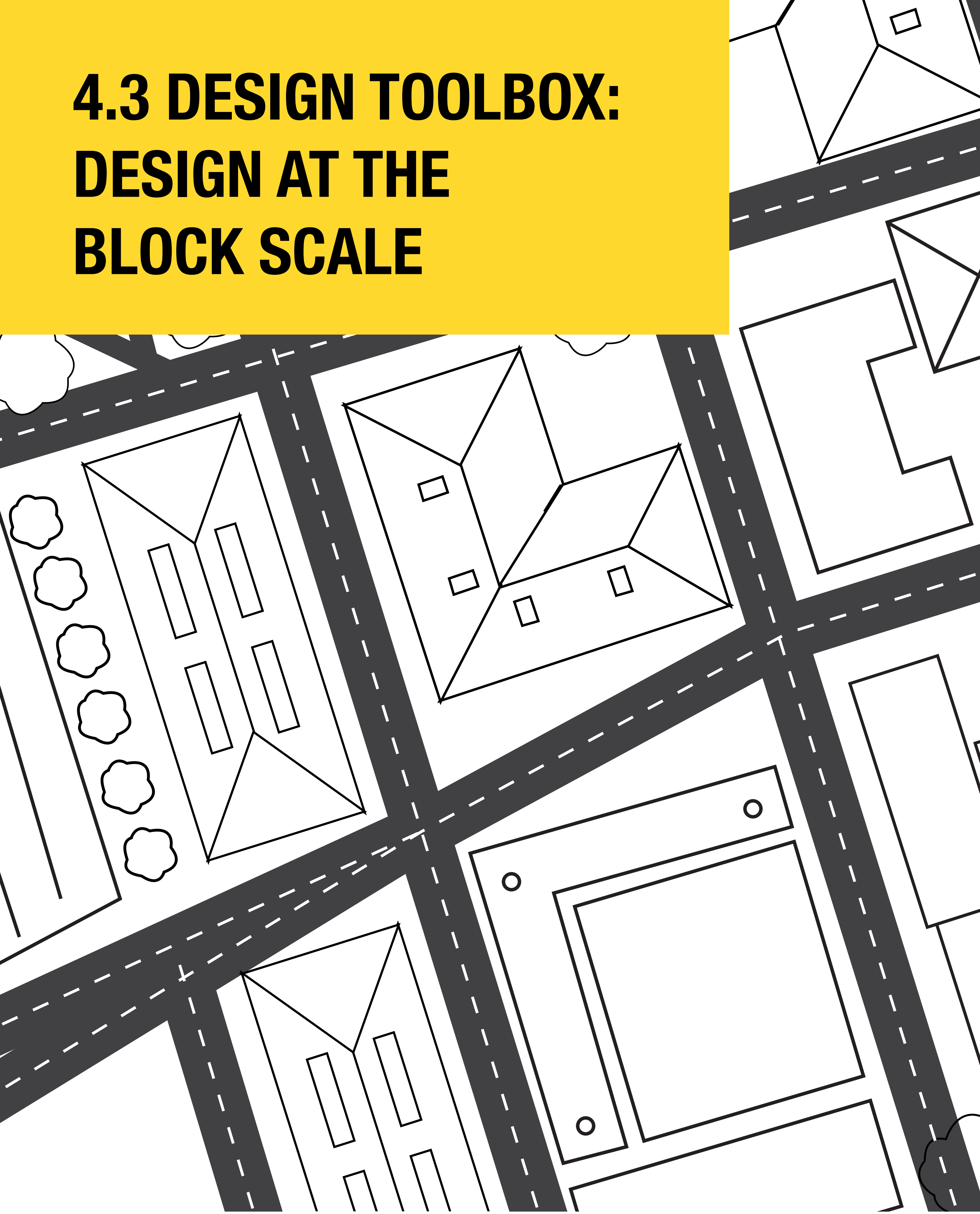
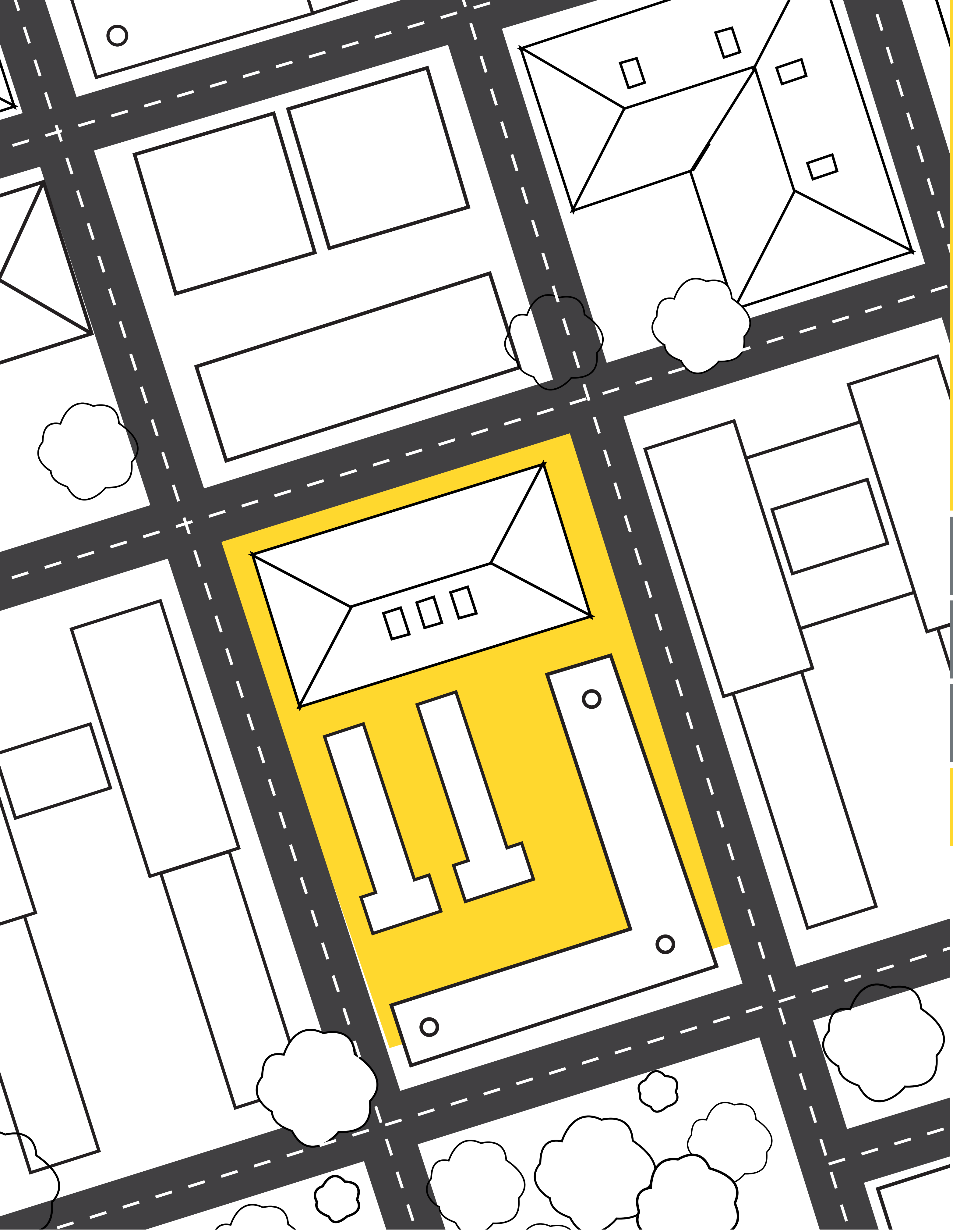
4.3 DESIGN TOOLBOX: DESIGN AT THE BLOCK SCALE





4.3 DESIGN TOOLBOX: DESIGN AT THE BLOCK SCALE

4.3.1 Placement and Orientation of Buildings (Wind)

Strategy

Place and orient the buildings to minimize the "wind canyon effect" and the acceleration of wind speeds in urban areas.

Intent

The primary intent of this strategy is to create safer, more comfortable pedestrian environments by reducing strong winds at ground level. This approach, rooted in an understanding of wind behaviour, acknowledges that the design and placement of buildings significantly influence local wind patterns, especially at the street level where pedestrians are most affected.

Guidelines

A. Refer to the Pedestrian Level Wind Study Terms of Reference Guide for Wind Responding Design Guidelines.

B. Locate and orient the buildings to minimize "wind canyon effect" (funneling, channeling) which refers to the acceleration of wind speed between closely spaced buildings. The intensity of the acceleration is influenced by the building heights, size of the facades, building separation distance and building orientation.

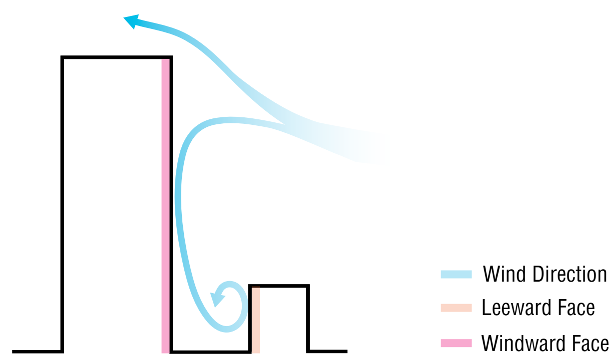
- Varying Building Heights: Avoid aligning the tops of buildings at the same height. Varying the heights of buildings disrupts the wind flow, reducing the wind tunnel effect. This needs to be reviewed case by case; but generally, a minimum height difference of 2 or more floors will have an effect on the wind patterns.

- Staggered Tall Building/Tower Placement: Instead of placing towers directly opposite each other, stagger their placement. This arrangement can help disrupt and diffuse wind flow, lessening the intensity of wind funneled between buildings.

- Orientation Considerations: Orient tall buildings diagonally to the prevailing wind directions. This alignment helps in redirecting and reducing wind speeds, improving overall thermal comfort and minimizing direct exposure to harsh winds.

- Increased Separation Distances: Increase the distance between tall buildings beyond the minimum requirements of Tall Building Design Guidelines, if possible. More space allows the wind to disperse and lose some of its speed, reducing the canyon effect. In highly dense urban areas, achieving large separation distances may be challenging. In such cases, other design strategies like building orientation, facade treatment, and the use of wind-mitigating features become crucial.

C. If possible, when positioning buildings, avoid a layout where the leeward side (the side sheltered from the wind) of a low-rise building directly faces the windward side (the side exposed to the wind) of a taller building. This setup can lead to faster winds at ground level in the space between the two buildings and near the corners of the taller building exposed to the wind. If this arrangement cannot be avoided, it's important to implement alternative wind mitigation strategies to reduce the impact on pedestrian-level wind conditions.



Prevent setups as shown above, where possible, that cause accelerated ground winds and discomfort.

Windward face vs. Leeward Face

Windward Face: This is the side of the building that faces directly into the wind. The windward face is the first part of the building that the wind "hits." This side of the building experiences the full force of the wind.

Leeward Face: This is the side of the building that is opposite to the windward face, meaning it's on the side sheltered from the wind. This side experiences less wind compared to the windward face and is often more calm and sheltered.

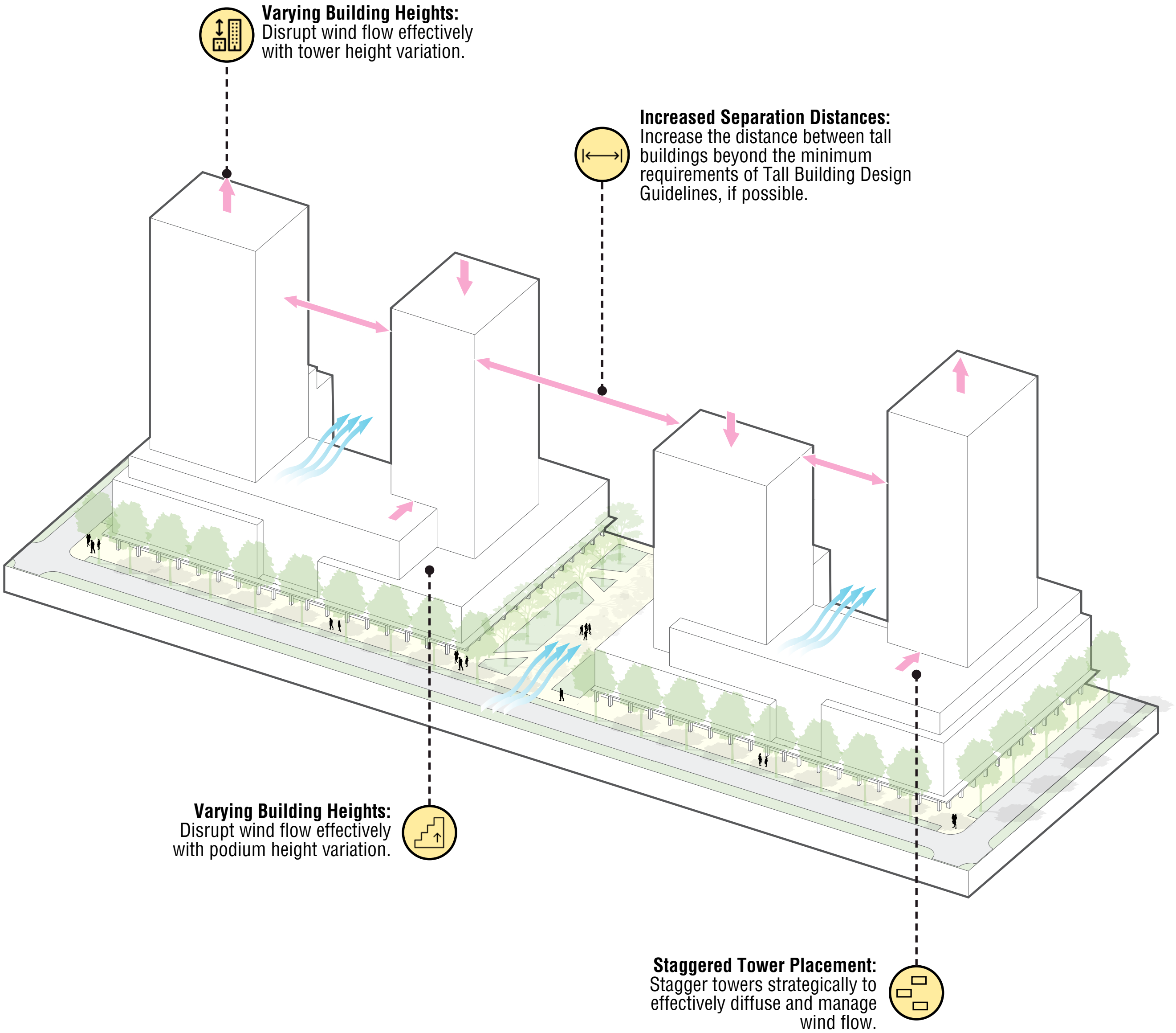


Diagram showcasing the design, strategic placement, and orientation of buildings to minimize the "wind canyon effect" and the acceleration of wind speeds in urban areas. For illustrative purposes only.

4.3.2 Placement and Orientation of Buildings (Sunlight)

Strategy

Strategically place and orient the buildings to optimize access to sunlight in publicly accessible open spaces for both human comfort and the thriving of all living beings including trees and vegetation.

Intent

This strategy acknowledges that proper sunlight exposure is crucial not only for human comfort but also for the health and longevity of all living beings. Particularly in high-density areas, minimizing overshadowing is essential to maintain a healthy urban environment.

Guidelines

A. Analyze the shadow patterns cast by existing and proposed buildings, especially during the fall and spring, to maximize access to sunlight and limit shadow impacts on the public realm.

B. Ensure adequate spacing between buildings to allow sunlight to penetrate public spaces.

C. In areas where sunlight is important but where there is also a risk of overheating during the summer, prioritize localized shading solutions. Focus on providing shade to key parts of the space rather than covering the entire area, allowing sunlight to reach other regions as needed.

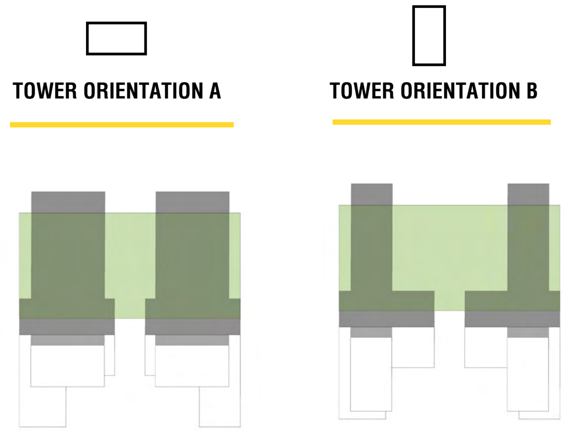


Diagram illustrating the shadow impact on a public park/open space, comparing two tower orientations at different times of the day. For illustrative purposes only.

Parkland / Open Space

Shadows Cast By Demonstration Buildings

Sun/shadow analysis informs the placement and orientation of buildings, especially taller structures, to optimize sunlight access.

Strategically place and orient the buildings to optimize access to sunlight in publicly accessible open spaces.

4.3.3 Placement and Design of Parks and Outdoor Recreation Areas

Strategy

Implement thoughtful placement and design of parks and outdoor recreation areas such as POPS, plazas, and private amenity spaces to optimize thermal comfort, balancing sunlight exposure, wind protection, and adaptable features.

Intent

This strategy acknowledges the importance of both sunlight exposure and providing adequate shade. The strategy prioritizes human-scale localized shade and adaptable features and explores wind protection opportunities in the open space.

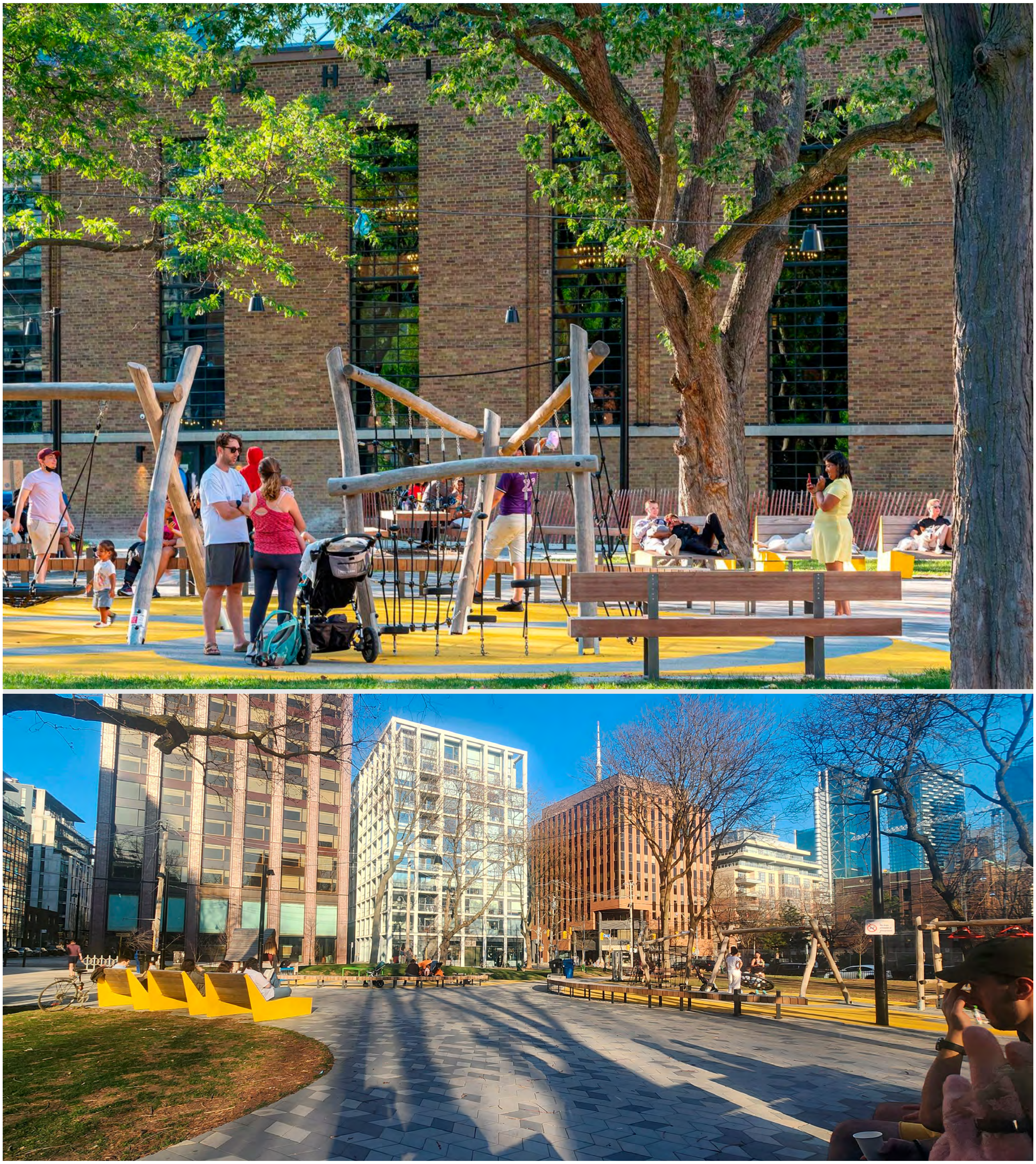
Guidelines

A. **Sunlight Exposure:** Orient parks and outdoor recreation areas towards the south of the building to ensure they receive the most sunlight throughout the year, especially in colder months. For warmer months, ensure these areas have adequate shade. This can be achieved through natural means like deciduous trees or adjustable structures like pergolas.

B. **Shelter from Prevailing Winds:** Identify the prevailing wind directions for different seasons and design landscapes and structures that provide shelter. Summer winds are generally beneficial and enhance thermal comfort, whereas winter winds reduce thermal comfort. This could include strategic placement of walls, fences, or dense vegetation.

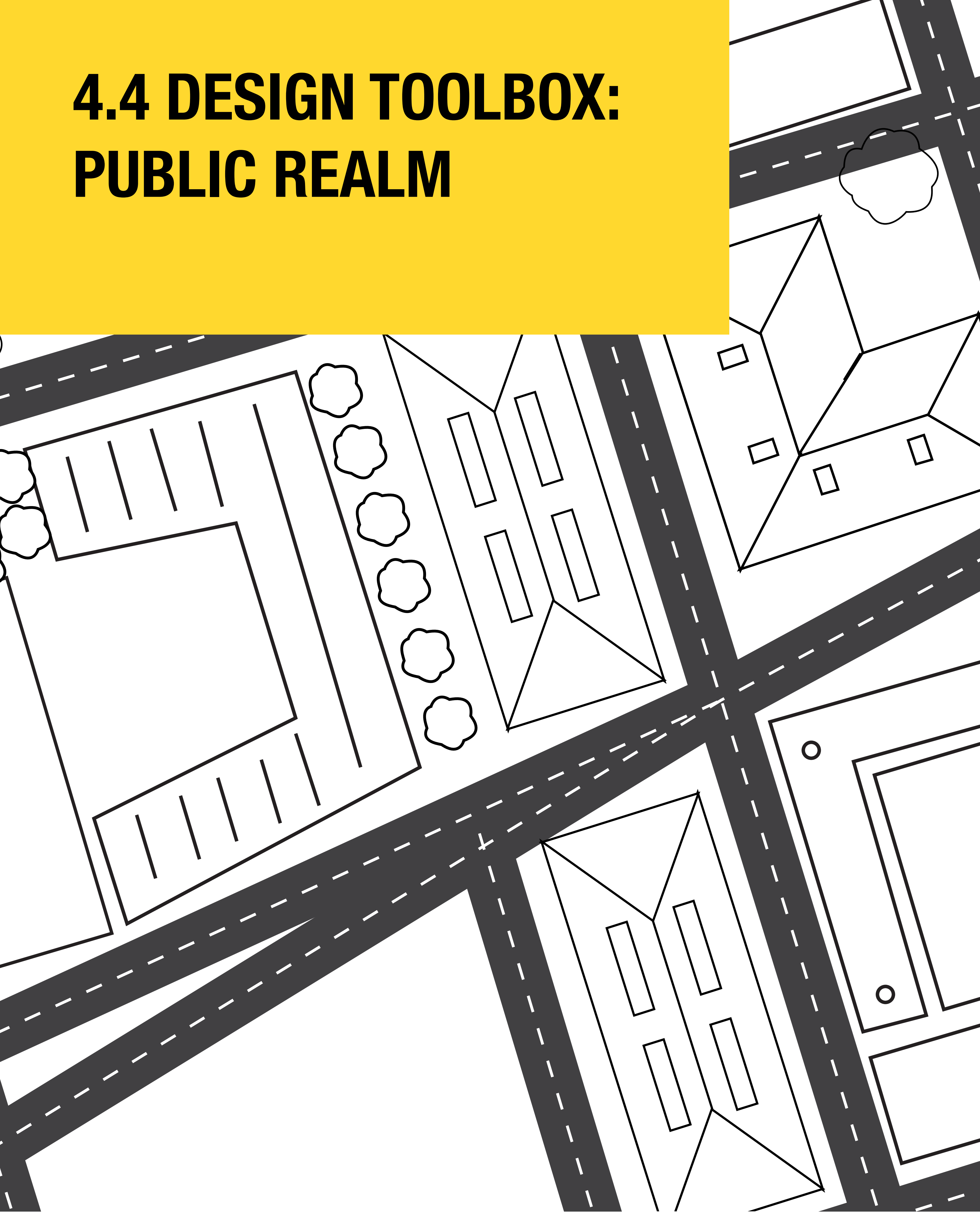
C. **Strategic space programming with relation to shade:** Position seating and activity areas based on the sun/shadow analysis to ensure they are in the sun or shade, as desired, during peak usage times. Leverage Building Architecture: Use the architecture of adjacent buildings to provide wind protection. Balconies, overhangs, and walls can be effective in altering wind patterns.

St. Andrew's Playground Park is thoughtfully positioned on the south side of the block, benefits from optimal sunlight exposure and is designed to maximize winter sunlight and provide shade in summer.



St. Andrew's Playground Park design provide options for both sun and shade, with flexible seating areas and a tree-covered playground, ensuring comfort across seasons. Image Credit for the top image: DTAH

4.4 DESIGN TOOLBOX: PUBLIC REALM



4.4 DESIGN TOOLBOX: PUBLIC REALM

4.4.1 Tree Planting

Strategy

Strategically plant deciduous trees for shade during warmer months and sunlight penetration in winter, and strategically design tree planting mitigate wind impact in combination with other landscape design and features.

Intent

The purpose is to naturally regulate outdoor temperatures and wind for year-round comfort, using trees to create adaptable and sustainable environments.

Guidelines

A. Combine upper tree canopy with understory planting of shrubs and perennials for added effect.

B. Prioritize planting large-growing deciduous trees with the potential to grow large canopies in areas with full sunlight.

C. Consider species with both a high leaf-area density and a high transpiration rate to maximize the cooling effect.

D. In open spaces, favour coniferous trees on the west side of the space to mitigate Toronto's westerly prevailing winter winds.

E. Place trees in strategic locations to maintain safety and key sightlines.

F. Ensure that trees are planted in a growing environment with access to sunlight, moisture, sufficient and healthy soil, nutrients, and allowance for space to grow (both above and below ground). Trees need sunlight for energy to convert carbon dioxide into sugar and grow tall. Adequate soil volume and conditions that support tree growth are crucial for the health of urban trees. Refer to Toronto Green Standards for soil volume requirements.

G. Tree planting areas should be designed to incorporate urban features like benches, walkways, and playgrounds. This enhances the usability and comfort of these areas by providing shade and shelter.

H. Prioritize total tree canopy size over quantity of trees. With the correct spacing of trees, there is less competition for resources such as water, nutrients, and sunlight. This results in healthier and more vigorous growth for individual trees.

I. Consider species and specimens that are multibranched.

Favour multibranched species with potential to grow large canopies.

The Shade Guidelines

The Shade Guidelines (2010), developed by the Toronto Cancer Prevention Coalition, highlight the role of shade in protecting people from harmful ultraviolet radiation (UVR), a major cause of skin cancer. Children are particularly vulnerable to UVR exposure because they spend more time outdoors and have more sensitive skin. Southern Ontario, including Toronto, experiences high levels of UVR from spring to fall, making shade a critical tool in protecting public health.

Trees are a natural solution for providing shade in parks, playgrounds, and public spaces, helping to shield people and all living things from direct sunlight. By reducing solar exposure, trees not only prevent harmful UVR but also help to cool the environment, mitigating the urban heat island effect. The Shade Guidelines recommend increasing tree cover and vegetation to enhance public safety and comfort, especially in areas like playgrounds, waterplay facilities, and other outdoor venues. These efforts align with Toronto's broader goals of improving public health and promoting sustainability.

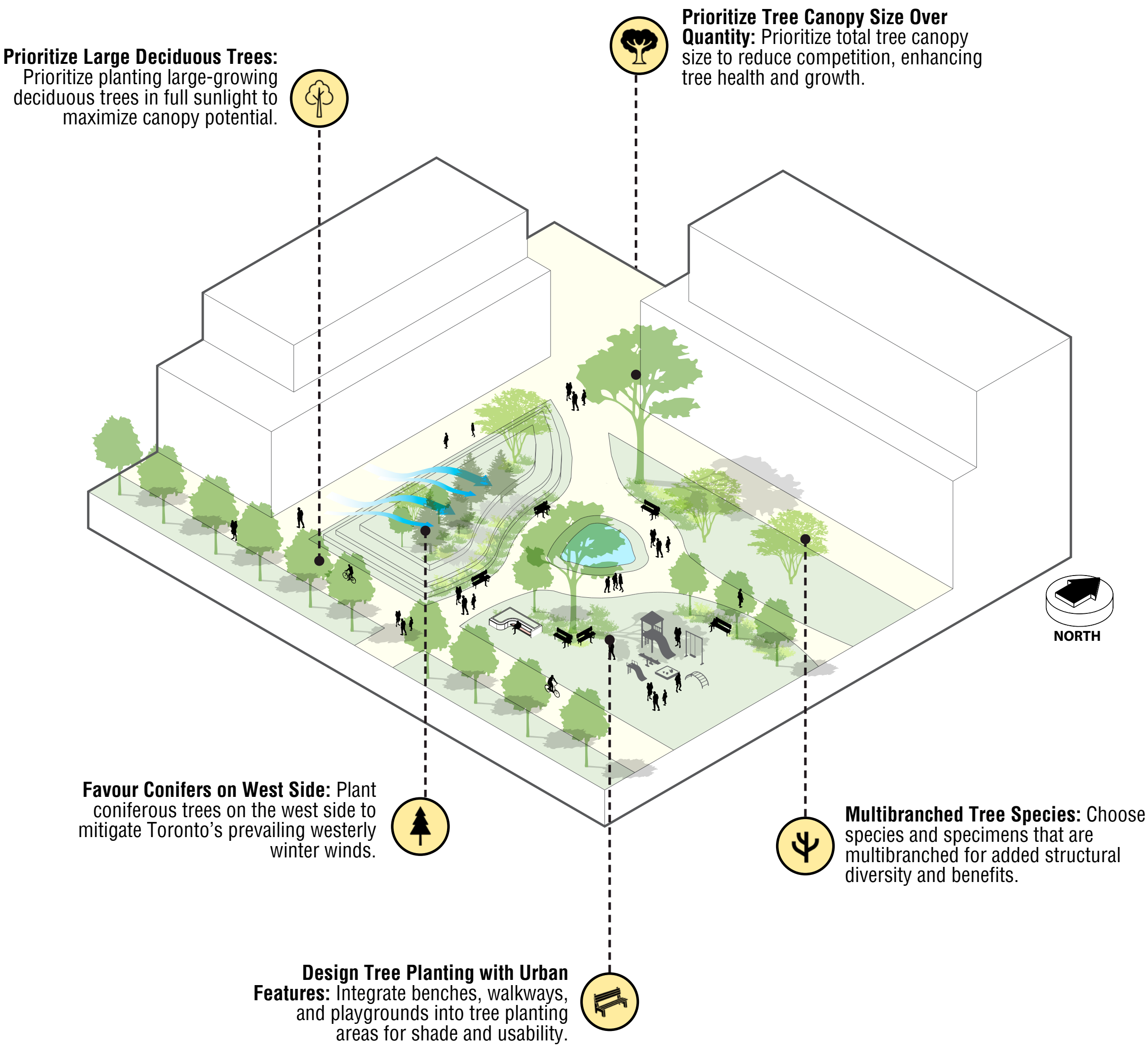


Diagram demonstrating how trees contribute to adaptable and sustainable environments. For illustrative purposes only.

4.4.2 Vegetation and Landscape Features

Strategy

Utilize vegetation to enhance thermal comfort in urban spaces by moderating wind effects and optimizing natural heat regulation.

Intent

The objective is to create thermally comfortable outdoor environments through the strategic use of plants, contributing to a pleasant and sustainable urban experience.

Guidelines

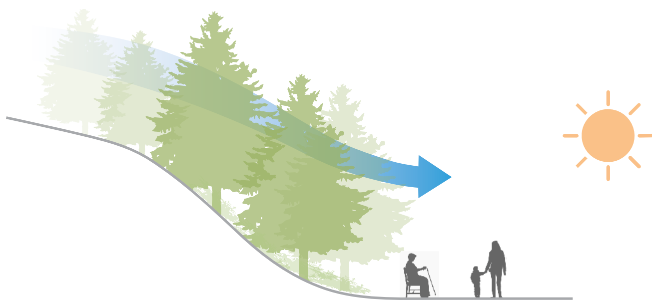
A. Plant dense shrubbery and other vegetation along open spaces' edges and near blank walls. This helps slow down wind without completely blocking airflow, balancing protection and ventilation.

B. Employ landscape features such as grass mounds and berms as natural wind barriers and to define spaces. These can double as recreational areas, like tobogganing spots in winter.

C. Plan for growth and upkeep of vegetative windbreaks, ensuring regular pruning and care for sustained effectiveness and aesthetics.

D. Position benches and seating areas near dense shrubs or coniferous plants for wind protection, creating inviting spaces in winter. South-facing benches near wind blocks are optimal for comfort in colder months.

E. Combine soft and hard landscaping.



South-facing benches and coniferous trees offer sheltered, welcoming spots for relaxation.

Position benches and seating areas near dense shrubs or coniferous plants for wind protection.

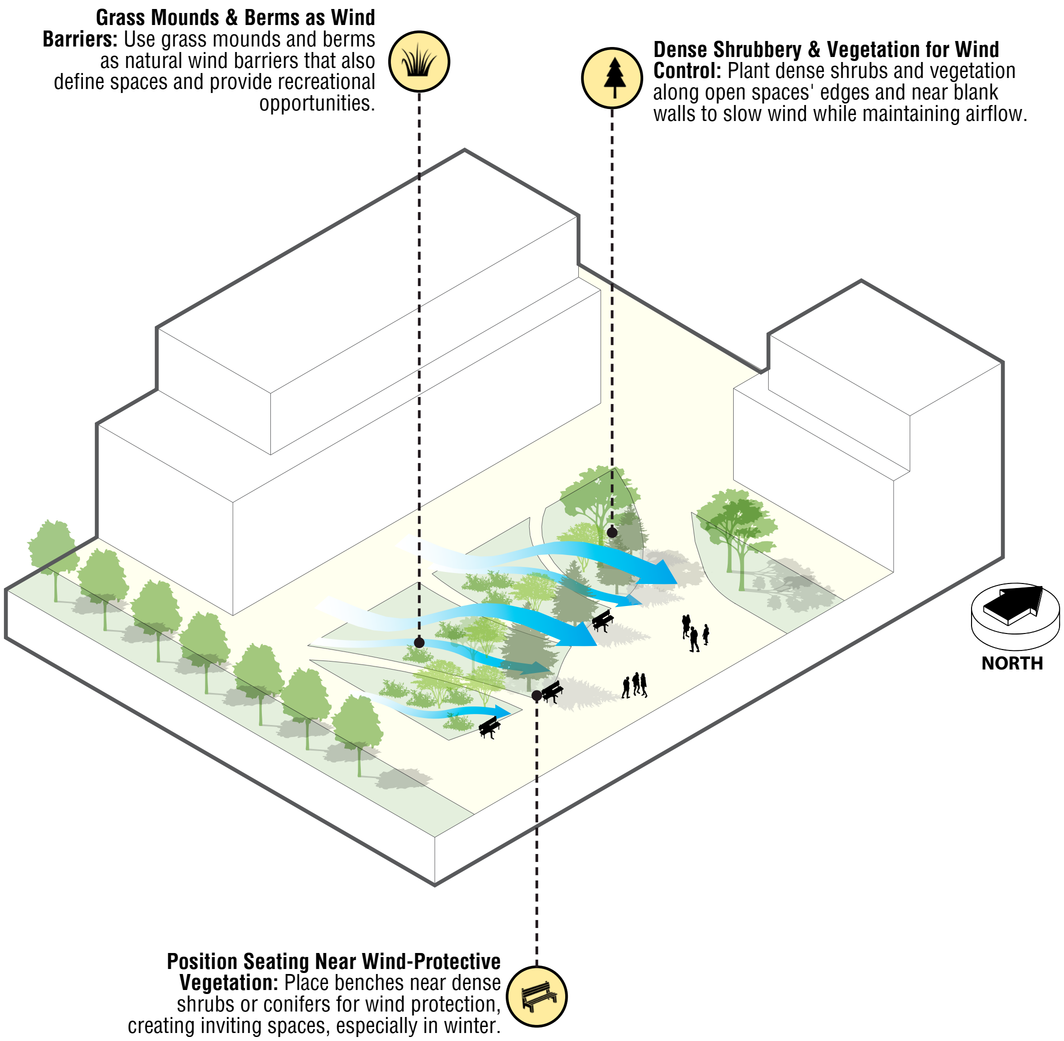


Diagram demonstrating some of the ways how vegetation can be used to enhance thermal comfort in urban spaces. For illustrative purposes only.

4.4.3 Water

Strategy

Strategically place water features, such as ponds and fountains, to utilize evaporative cooling to enhance microclimates.

Intent

The primary goal is to leverage water features not only for their cooling effects but also for their psychological benefits, enhancing the visual appeal and comfort of outdoor spaces.

Guidelines

A. Avoid static or more permanent water bodies that might intensify heat loss and cause more thermal distress during cold seasons.

B. Prioritize active water features that create/form smaller water droplets to enhance evaporative cooling in summer.

C. Water feature placement should be carefully considered to avoid stagnant areas to reduce the chance of increasing mold growth.

D. Active water features require schedules and maintenance. Ensure systems are lined and treated to avoid long-term maintenance and account for freeze thaw cycles.

Pools and Reflective Ponds

E. Design and position pools in central public spaces and densely built areas or places along the prevailing wind direction with accessible features to maximize their cooling effect and visual appeal.

F. Design certain pools to be convertible into ice rinks in winter, providing year-round recreational value and community engagement opportunities.

Fountains

G. Install fountains in key public spaces to benefit from the cooling effect of water evaporation. Active fountains that repeatedly elevate water vertically can be more effective in cooling an area.

H. Use fountain designs that maximize surface area for evaporation, thereby increasing their cooling potential.

Splash pads

I. Place splash pads in parks to provide a cooling play area during hot weather. Subject to public health considerations, splash pads could be designed to recycle water efficiently, minimizing waste while maximizing cooling effects.

J. Additional benefits: Splash pads encourage outdoor physical activities and social interactions among children, fostering community engagement.

Misting

K. Strategically place misting stations in high-traffic areas for immediate pedestrian cooling during heatwaves, particularly beneficial during heatwaves for vulnerable populations such as children, the elderly or people exposed under the sun for long duration including those experiencing homelessness.

L. Where present, misting (and any other means of adding moisture to the air to provide cooling effects) should be periodic. They should only be active when conditions allow them to be effective to reduce water use.

M. Shelter from wind is often necessary to achieve cooling effects from misting, or the effects are dispersed to widely to be effective.

N. Design for portability creates solutions for flexible spaces during events or high foot traffic areas.

Water Features and Mental Health

Water features can contribute to greater psychological comfort by enhancing the visual appeal of outdoor spaces. These can be part of the "cool spaces" network that the City of Toronto has identified to provide refuge during heat waves. The psychological benefits of being surrounded by nature can positively influence perceived thermal comfort. People are more likely to spend time outdoors and engage in physical activities when the environment is aesthetically pleasing and comfortable.

City of Toronto Parks and Recreation Facilities Master Plan (FMP)

To manage investment and facility provision over the next twenty years, the City of Toronto prepared a 20-year Parks and Recreation Facilities Master Plan (FMP), which was unanimously adopted by City Council on November 9, 2017. The FMP considers various facility types including outdoor pools, splash pads, and wading pools. The Implementation Strategy for the FMP provides strategic direction and design and operational considerations for these facilities.

Splash pads in parks and plazas provide a cooling play area during hot weather.

Portable misting stations can be placed in high-traffic areas for immediate pedestrian cooling during heatwaves.

4.4.4 Shelter Structures

Strategy

Locate shelter and overhead structures to reduce direct sunlight exposure and provide protection from wind and weather conditions.

Intent

Shelter structures, including transit shelters, are designed to offer flexible and effective weather protection across Toronto's diverse environments. Movable structures provide adaptability to seasonal changes, while permanent structures ensure consistent protection with minimal upkeep. Additionally, transit shelters can be tailored to local microclimates, enhancing comfort and contributing to the overall functionality of public spaces.

Guidelines

Movable Overhead Structure

A. Movable shading devices should be integrated into areas with variable sunlight exposure throughout the year. They should offer sun protection during warmer months and be adjustable to allow more sunlight during colder months.

B. Incorporate features such as retractable awnings into building designs to enhance flexibility.

C. Position movable overhead structures in high-traffic areas like outdoor dining spaces, seating areas, and playgrounds to maximize their benefit.

Permanent Overhead Structure

D. Install permanent overhead structures in areas where continuous shade and weather protection is desirable.

E. Canopies should be placed over bike parking areas and stations to protect bikes from excessive heat in summer and snowfalls in winter.

F. Opt for permanent structures over movable ones when minimal maintenance and long-term operation are desired. These structures can also create visually distinct areas that serve as community landmarks or meeting points, adding functional and aesthetic value beyond thermal comfort.

Transit Shelter

G. Locate shelters considering solar and prevailing wind directions to maximize natural comfort conditions.

H. Design transit stops and stations with features such as shelters, roofs, canopies, and overhangs to provide maximum weather protection.

I. Customize shelter designs to fit the specific microclimate of the site. Consider designs ranging from wrap-around structures for maximum protection, especially near tall buildings where wind downwash needs buffering, to more open structures for natural ventilation.

J. Install side panels or barriers that can shield occupants from wind. Design these panels to be adjustable, allowing them to be opened in warmer months to facilitate air circulation and closed in winter to provide warmth and wind protection.

K. Select materials with suitable albedo and reflectivity to avoid unnecessary heat gain or glare. This is crucial in managing the thermal environment inside the shelter.

L. Ensure adequate ventilation to prevent overheating and provide air circulation. Design seating that is elevated to prevent cold transfer, using materials like wood that are less conductive to heat and cold.

M. Create a diversity of microclimates within the bus stop area, allowing commuters to choose environments that suit their comfort needs or engage in adaptive behaviour.

N. Install energy-efficient, motion- or user-activated heaters at transit shelters and centres where possible, prioritizing locations with high-frequency transit service, high passenger volume, or exposure to harsh weather conditions. Ensure that the shelter design supports effective heater use, and assess potential snowmelt and drainage issues to avoid creating icy surfaces around the shelter

O. Transit shelters can be added to the cooling space network if they are well-ventilated, provide ample shade, comfortable seating, have access to drinking water, and potentially include active cooling features, while being accessible, well-maintained, and clearly marked as part of the cooling network.

Portable canopies provide flexible shade, allowing for sun protection in warmer months.

Permanent overhead structures in play areas offer continuous shade and weather protection.

Position the transit shelter opening strategically to minimize the impact of prevailing winds at the site.

4.4.5 Windbreak

Strategy

Design open spaces with integrated features that mitigate wind effects, using landscaping and public art elements to enhance thermal comfort.

Intent

The intent of this strategy is to enhance thermal comfort in outdoor spaces by effectively mitigating wind effects. By integrating windbreaks into the landscape and public art features, we aim to create sheltered zones that protect users from cold winds in the winter and reduce wind chill effects. This approach encourages the use of natural and multi-functional elements, ensuring that outdoor spaces remain comfortable and usable throughout the year without relying on standalone windbreak structures.

Guidelines

A. Avoid standalone windbreak structures that detract from the space's cohesion and visual appeal. Instead, integrate windbreaks into the design of buildings, landscaping, furniture, and public art.

B. Orient windbreak structures perpendicular to the prevailing wind direction for maximum effectiveness. Place them at strategic locations where wind acceleration in the form of funneling effects are most pronounced or where pedestrian traffic is highest. (Placement of mitigation measures may need to be supported by analysis.)

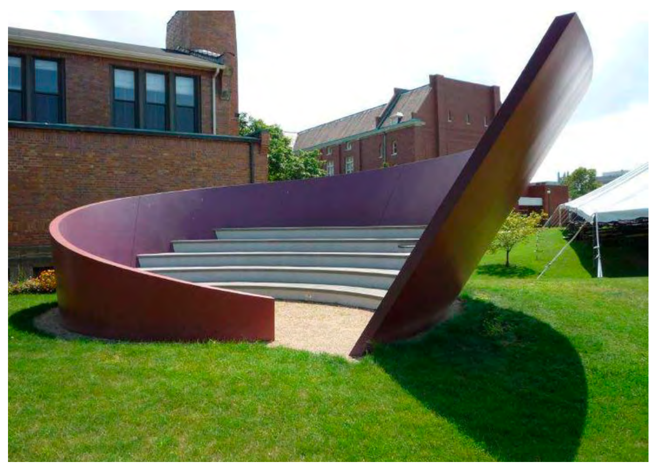
C. Consider the following when using trees and vegetation for wind breaks:

- Select plants with dense foliage to block wind but allow some airflow to prevent turbulence.
- Consider evergreens to provide year-round protection and maintain foliage in winter.
- Combine trees and dense shrubs to create a low barrier and fill gaps between trees.
- Use multiple rows of vegetation, combining tall trees, medium-height shrubs, and low ground covers.
- Avoid large gaps in the wind break to maintain its effectiveness.

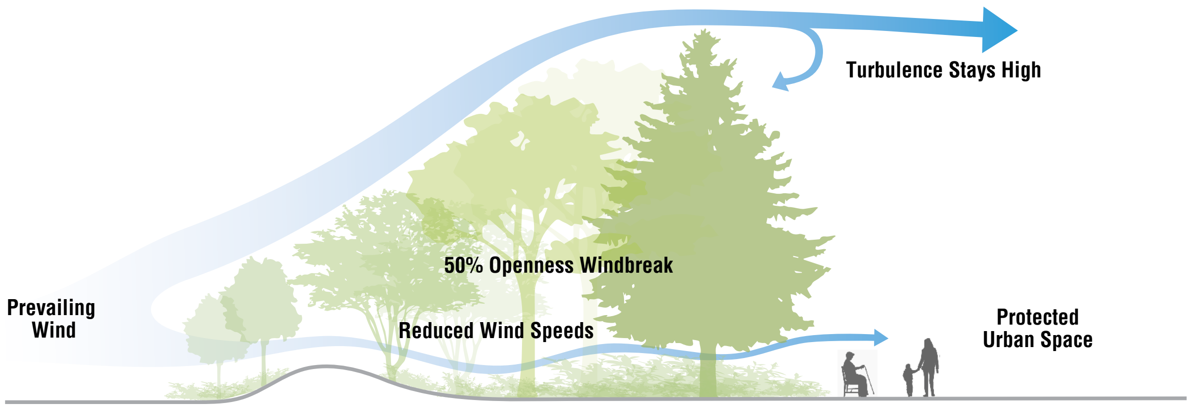
D. Incorporate sculptural elements that double as windbreaks. These can add aesthetic value to the space while serving a functional purpose. Ensure their design disrupts and slows down wind flow effectively. Combine different types of windbreaks, such as walls with hedges or trees, to create layered protection. This can be more effective than a single type of windbreak.

E. Integrate windbreaks with urban furniture like benches or seating areas to provide sheltered spots for relaxation and social interaction.

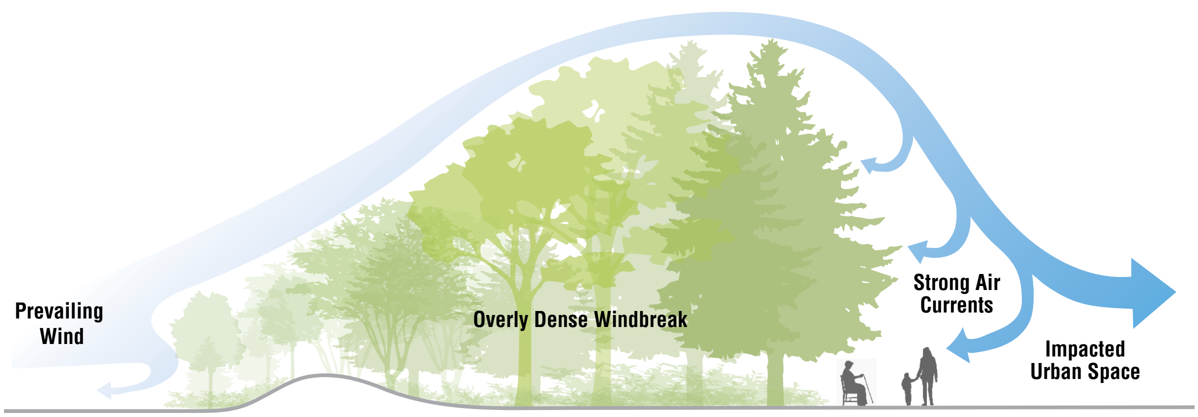
F. Design natural windbreaks with about 50% openness to prevent turbulence on the sheltered side. This level of porosity effectively reduces wind speed without creating swirling air currents (eddies).



Integrate windbreaks with urban furniture to enhance comfort.



Design natural windbreaks with about 50% openness to prevent turbulence on the sheltered side.



If a natural windbreak is too dense, it may lead to the creation of strong, concentrated air currents in urban spaces.

4.4.6 Material (Surface)

Strategy

Select surface materials for sidewalks, roads, plazas, surface parking, and public spaces that optimize heat absorption, reflection, and evaporation to enhance comfort and reduce the urban heat island effect.

Intent

Surface materials are crucial for managing thermal comfort in urban environments. By using light-colored, reflective, and permeable materials, public spaces can minimize heat absorption and enhance cooling through evaporation.

Guidelines

A. Use light-coloured, reflective materials in the design of pedestrian pathways and public spaces to minimize heat absorption. For non-roof hardscapes, use high-albedo paving materials with a solar reflectance of at least 0.33 or an SRI of 29 to reduce heat absorption.

B. Incorporate permeable paving materials to aid in cooling through water evaporation and reduce the urban heat island effect. Permeable surface materials also help in stormwater management and reducing flood risk. For more information, refer to the City of Toronto's Construction Specifications and Drawings for Green Infrastructure.

C. Explore alternatives to asphalt for trails and cycling paths, considering materials that have lower surface temperatures during heat events.

D. Select seating materials that are less heat conductive. Wood and coated metals are preferable to bare metal, which can become very hot in summer or cold in winter.

E. Opt for lighter-coloured materials for playgrounds as they absorb less heat compared to darker surfaces, and/or provide them with shading.

Wooden benches provide a comfortable seating option by minimizing heat and cold conduction, suitable for all seasons.

Light-coloured concrete surfaces in the park and around the wading pool reduce heat absorption and improve thermal comfort.

Incorporate permeable paving materials to aid in cooling through water evaporation and reduce the urban heat island effect.

4.4.7 Public Amenities

Strategy

Design and position public amenities to support thermal comfort.

Intent

While these amenities may not directly impact the microclimate of the area, they offer crucial refuge for people, helping them manage their thermal comfort through opportunities for rest, hydration, and protection from the elements. Thoughtfully designed amenities, such as seating and drinking water stations, enhance the overall comfort experience by offering necessary breaks from extreme weather, thus contributing to a more pleasant and usable public space.

Guidelines

Drinking water fountain

A. Install water fountains and/or water bottle filling stations in strategic locations to provide easy access to drinking water, helping to prevent heat-related illnesses. Strategic locations include:

- In parks, near playgrounds and recreational facilities
- In trails at all trailheads and trail access points as well as rest stops and viewing areas when possible.
- Urban squares and plazas

B. Where possible, locate the fountains in sheltered areas, ensuring they are usable even during hot conditions.

C. Prioritize water bottle filler stations over drinking fountains.

Seating

D. Offer a variety of fixed and flexible street furniture styles. This diversity allows users to choose seating based on their preference for sun exposure, proximity to others, or nearby street features like trees.

E. Provide seating under shade, whether from trees, canopies, or umbrellas, to offer a respite from the intense sun. This is crucial during hot days as it allows people to rest and cool down.

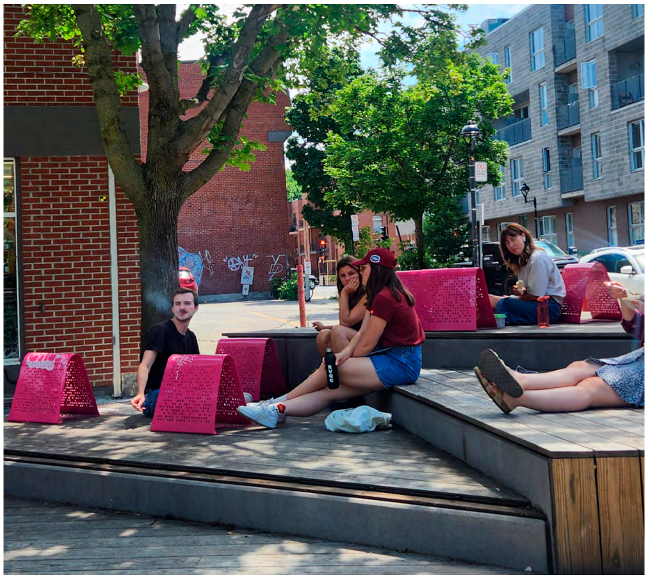
F. Orient seating and gathering places to maximize sunlight exposure while providing some wind protection. Consider how the sun's position changes across seasons to ensure comfort throughout the year.

G. Select seating materials that balance durability, comfort, and aesthetic appeal. Avoid materials like metal that can become extremely hot or cold. Opt for wood, coated metal, or composites that maintain a more neutral temperature.

H. Incorporate features such as fire pits or other heating elements in seating and dining areas to enhance comfort during cooler weather.

I. Design seating with ease of maintenance in mind, particularly for snow-clearing. Arrange benches in straight lines to accommodate snow plows and consider using central pedestal benches, which are easier to clear of snow than traditional four-legged benches.

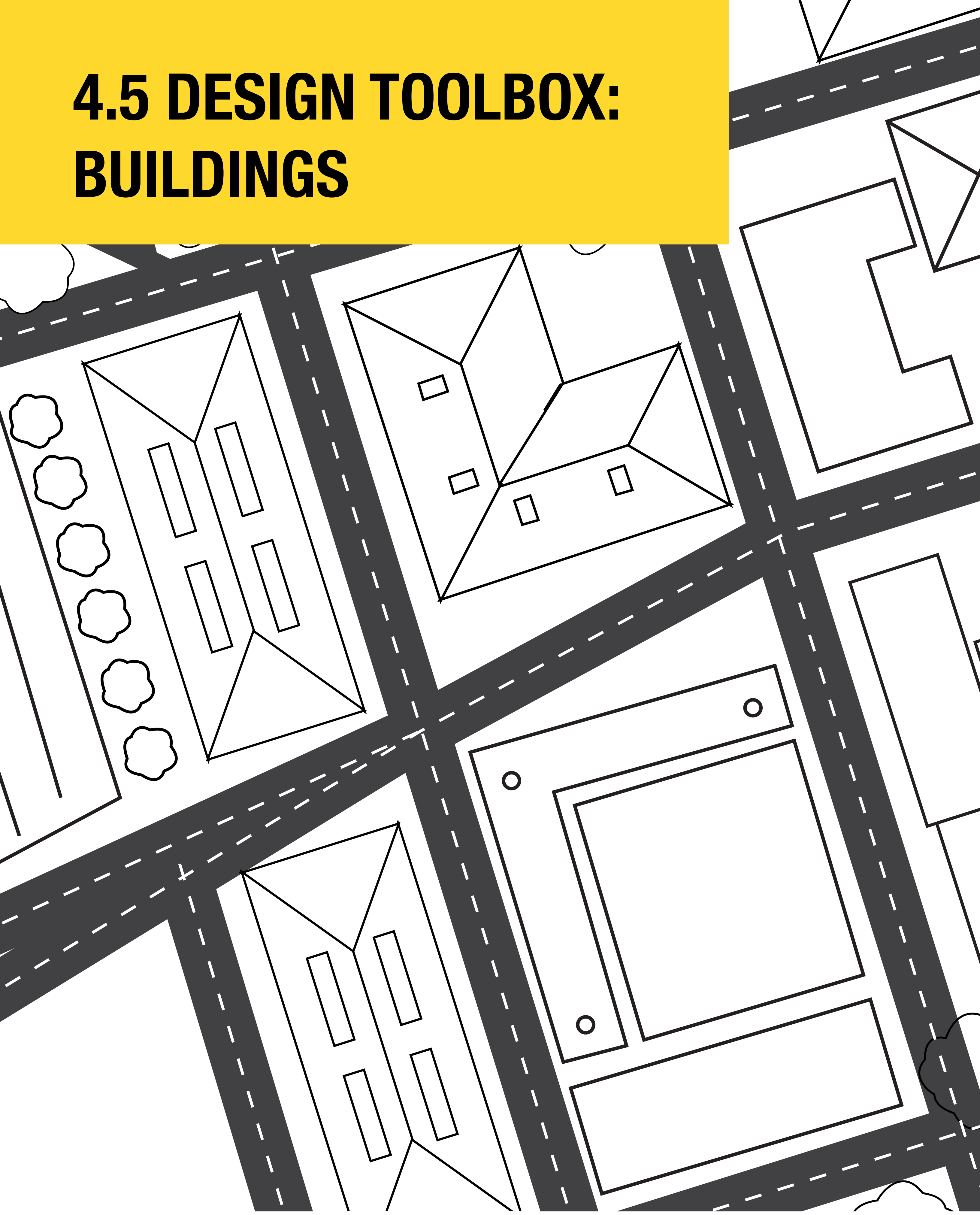
Benches in this park are strategically positioned, with some fully under the canopy for complete shade and others near the edge, offering a choice between sun and shade to suit user preferences

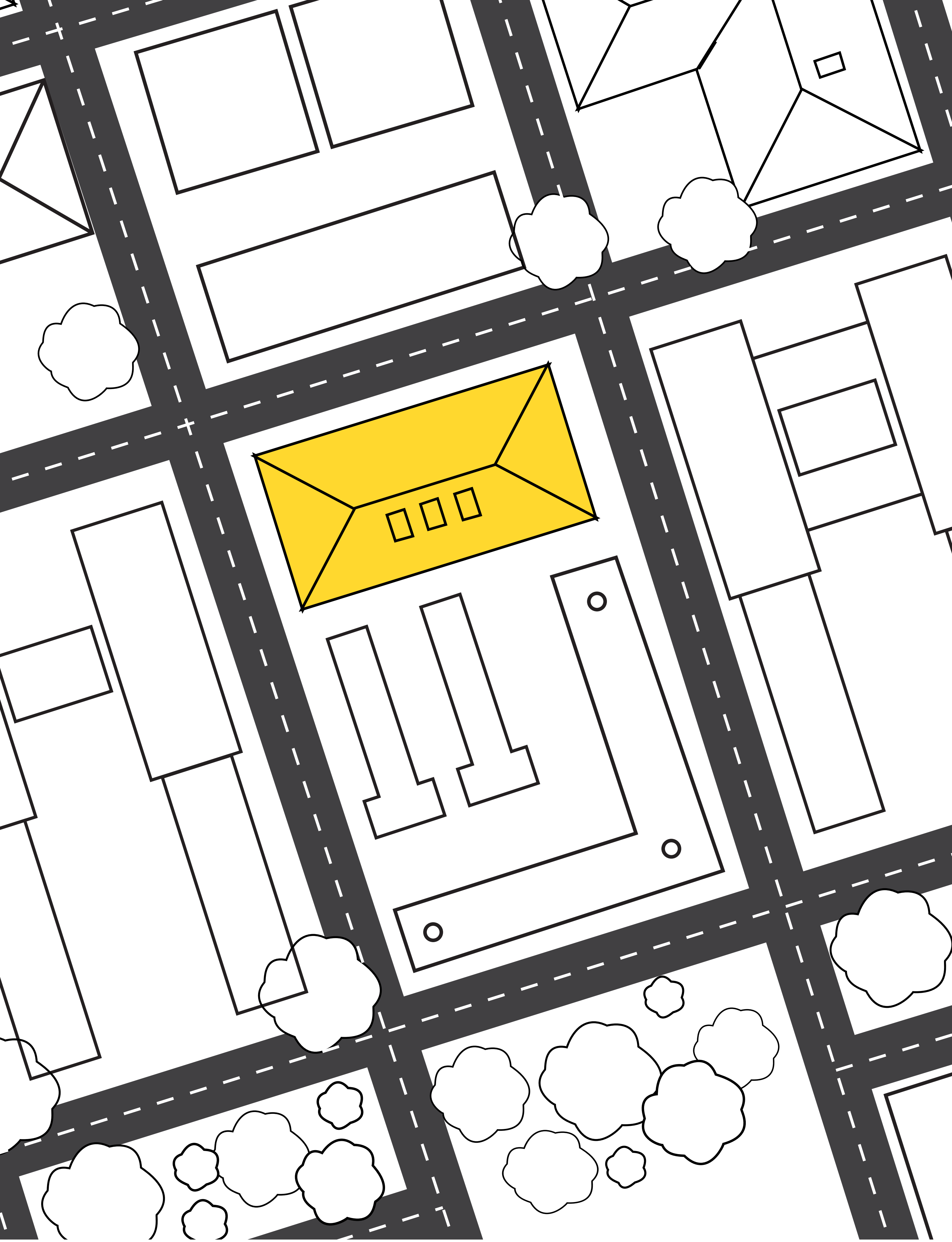


Flexible seating options under the natural shade of a tree allow users to choose their preferred sun exposure and enjoy a cooler, more comfortable environment.

Seating is thoughtfully positioned with backs facing the prevailing wind direction, using shrubs and greenary as natural windbreaks to enhance comfort.

4.5 DESIGN TOOLBOX: BUILDINGS





4.5 DESIGN TOOLBOX: BUILDINGS

4.5.1 Building Form and Wind

Strategy

Design tall building elements to adopt strategies to mitigate negative impacts of wind at the pedestrian level.

Intent

Wind can be beneficial or detrimental for thermal comfort. During the summer wind movement is likely to enhance thermal comfort, but wind speeds need to be kept within the activity thresholds set by the Wind Study Terms of Reference Guide. In Winter the opposite occurs, wind movement is likely to reduce comfort conditions, so a reduction in the wind movement is desired. The careful design of tall buildings can help to mitigate the negative impact of wind at the pedestrian level.

When wind hits the windward face of a tall building, the building tends to deflect the wind downwards, causing accelerated wind speeds at the pedestrian level and around the windward corners of the building. The intent is to introduce design interventions to mitigate the wind downwash and increase thermal comfort during winter months when wind is the principal factor influencing thermal comfort.

Guidelines

A. Refer to the Pedestrian Level Wind Study Terms of Reference Guide for detailed Wind Responding Design Guidelines.

B. Downwash occurs when winds are pushed down by large flat wind-facing facades. To reduce downwash driven acceleration:

- Avoid flat tall slab building facades that face the prevailing winds.
- Use step-backs on windward sides to deflect downward wind
- Design buildings with more aerodynamic shapes to allow wind to flow around them smoothly

C. Implement landscaping on the podium roofs and the stepped-back sections of towers to further reduce wind speeds at grade. Addressing wind conditions on these roofs is crucial, as intense, unmitigated winds can create discomfort and pose safety risks for pedestrians.

D. Adding parapet walls around podium edges can further increase their effectiveness in managing wind flow at the pedestrian/ground level.

E. Consider the use of porous materials to abate wind movement while also allowing solar radiation to pass through.

F. Incorporating a colonnade to the windward side (the side facing the wind) of a building can offer pedestrians two options: a sheltered, calm walking area within the colonnade, or a breezier experience just outside of it. This design feature can also provide shade, particularly when on the southern side of a building where it provides shade during summer when that shade is most needed. Colonnades need to be carefully considered, as in some configurations, their inclusion can increase local wind speeds.

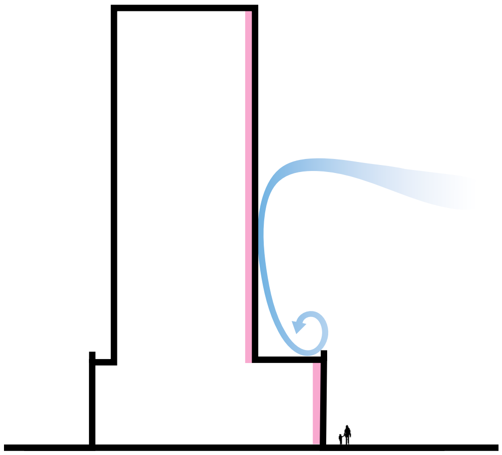
G. Design ground-level structures, such as pavilions or arcades, with a degree of porosity to allow wind to pass through without creating strong gusts.

H. Wind mitigation should be mostly addressed through appropriate massing, design and orientation of a building. Mitigation measures such as wind screens on public sidewalks and in open spaces are to be avoided.

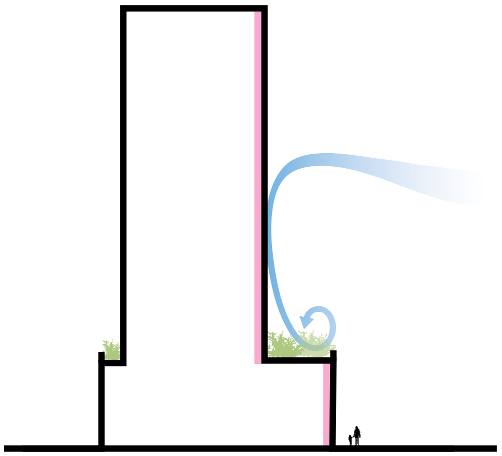
Corner Treatment

I. Incorporate architectural elements like rounded corners or chamfered edges on building masses that can effectively redirect wind flow, reducing the wind tunnel effect at street level.

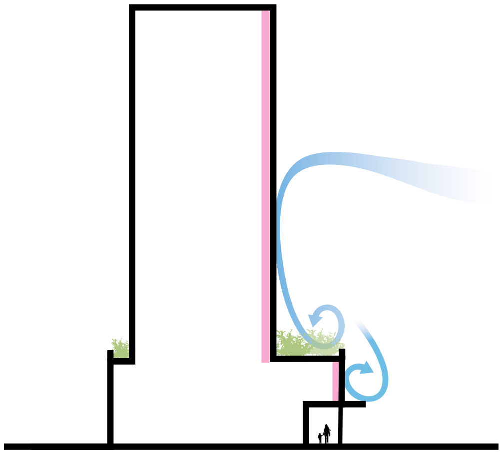
J. Place sculptural elements at corners that disrupt and slow down wind, while adding aesthetic value.



Use step-backs on windward sides to deflect downward wind.



Implement landscaping on the podium roofs and the stepped-back sections of towers to further reduce wind speeds at grade.



Adding a colonnade on the windward side of a building provides pedestrians with a sheltered walk inside or a breezier path outside.

Wind Direction
Windward Face

4.5.2 Building Form and Sunlight

Strategy

Design building forms and elements to balance sunlight access and thermal comfort in surrounding areas by minimizing negative shadowing and prioritizing adaptable shading solutions.

Intent

The design of a building—its form, height, and articulation—significantly impacts the surrounding area's access to sunlight. The taller the building, the broader the impact boundary. Careful consideration must be given to how the building's mass will affect thermal comfort in its vicinity.

In colder months, access to sunlight is highly desirable to provide warmth and enhance comfort. Conversely, in hotter months, relief from the sun is preferred to maintain cooler, more comfortable conditions. This strategy distinguishes between shade and shadow, as detailed in Chapter 2, and prioritizes localized shade provided by trees and shade structures over the permanent shadows cast by buildings.

Guidelines

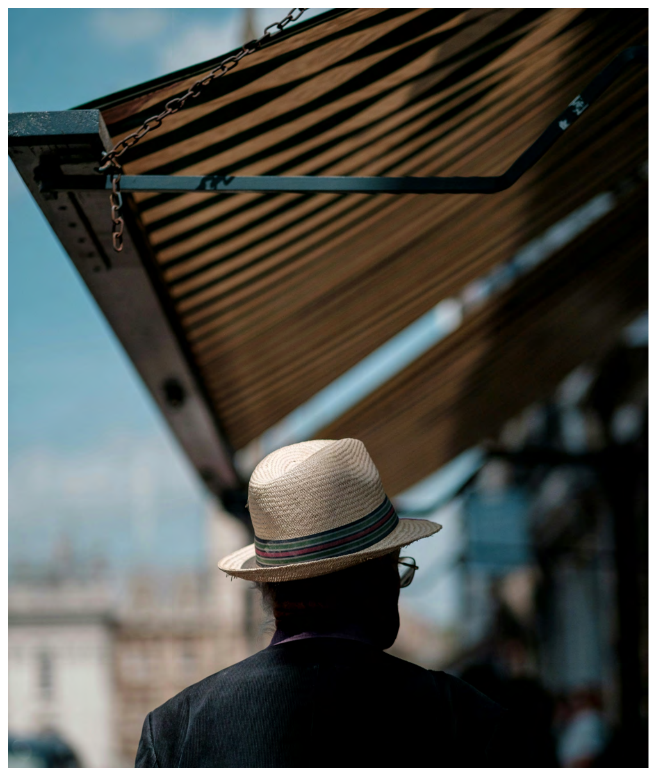
A. Design the building's form and height to minimize extensive shadowing on adjacent areas.

B. Use architectural articulation to break up the building's mass, allowing more light to penetrate surrounding spaces. Incorporate design elements such as recesses, projections, and varied facade treatments to break up the building's bulk. This creates opportunities for light to filter through and reach adjacent areas.

C. Consider the high angle of the sun in summer months and the lower angle in winter when designing sun shades and shelters.

D. Integrate features such as retractable awnings or adjustable shading devices that can be adapted seasonally to optimize sunlight access. These features allow for the control of sunlight exposure, providing shade during the hot summer months and allowing sunlight to enter during the colder winter months.

E. Prioritize minimizing shadow impact on tree and vegetation zones, as well as seating and gathering areas. Ensure that these critical areas receive ample sunlight to support the health of the vegetation and provide comfortable, inviting spaces for people to sit and gather. Avoid placing large building masses that would create long-lasting shadows over these areas, especially during times of the year when sunlight is most needed.



Incorporate retractable awnings or adjustable shading devices that can be adapted seasonally to optimize sunlight access.

The quarter-circle form of one tower allows sunlight to penetrate between the two buildings.

4.5.3 Balconies

Strategy

Incorporate balconies in tall buildings to reduce wind speeds at ground level and provide comfortable, weather-adaptive outdoor spaces.

Intent

Balconies can contribute to the building's wind management strategy while also enhancing thermal comfort for users. By strategically designing balconies, they can deflect wind away from pedestrian areas and offer a pleasant, functional outdoor space that remains comfortable in different weather conditions. Additional steps can be taken to ensure balconies are thermally comfortable and pleasant for their users.

Guidelines

A. Consider larger, more protruding balconies on the windward side of the building instead of smaller, flush balconies.

B. Incorporate balconies with shading elements to create comfortable amenity spaces that provide protection from excessive heat, snow, and rain.

C. Orient balconies to balance sun exposure and shade. South-facing balconies can maximize sun exposure, while east or west-facing balconies may provide a comfortable balance of morning or afternoon sun and shade.

D. Install adjustable shading devices such as retractable awnings, pergolas, or balcony umbrellas. These allow residents to control the amount of sunlight entering the balcony, providing flexibility for different weather conditions.

E. Consider incorporating an overhang or a cantilevered design. This provides built-in shade and can protect the balcony from rain and direct overhead sun, especially during the hottest parts of the day.

F. Include windbreak features such as glass panels, lattice screens, or tall plants. These can reduce the impact of strong winds, making the balcony more comfortable to use, particularly in high-rise buildings.

G. Add plants and greenery to create a natural cooling effect through evapotranspiration, which will have a direct comfort benefit to people using the balconies. Plants can also provide additional shade and improve the aesthetic appeal of the space. Balconies and green roofs, help with the overall impact of UHI effect.

H. Choose materials for the balcony floor and railings that do not heat up excessively in the sun. Wood, tiles, or heat-resistant outdoor rugs can make the balcony more comfortable underfoot.

Adjustable shading, greenery, and heat-resistant materials enhance thermal comfort on balconies.

Protruding balconies strategically located on the windward face of the building help reduce wind speeds at street level.

4.5.4 Building Materials

Strategy

Choose building materials optimized for thermal insulation and reflection to reduce the urban heat island effect in the outdoor environment.

Intent

The built environment contributes to the urban heat island effect, as materials in buildings and the landscape absorb heat differently than natural landscapes. By using materials which reflect more solar radiation (and absorb less) as well as increasing building insulation levels (to keep cooler air in during summer and warmer air in during winter), the energy demands, and therefore the heat emitted by those buildings, can also help reduce the UHI effect.

Guidelines

Building envelope

A. Utilize cool materials, retroreflective materials, and phase change materials in building cladding to reflect solar radiation and reduce heat absorption.

B. Incorporate where possible a transitional space (a semi open space) that allows users to get familiar with internal or external conditions to reduce the likelihood of thermal shock.

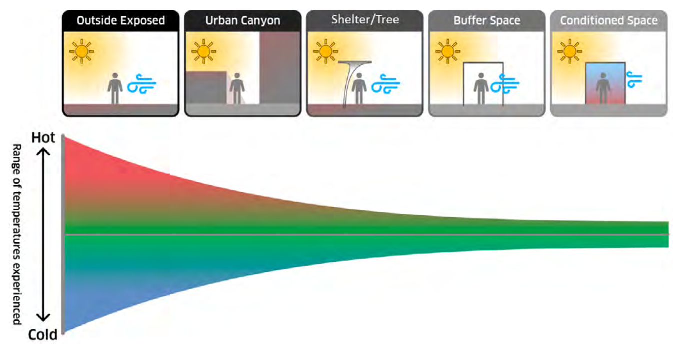
C. Implement green façades with appropriate plant species for cold winters, which can mitigate temperature extremes and contribute to the Oasis-effect in urban areas.

Roof material

D. Install green or vegetated roofs, which can reduce temperature fluctuations and provide additional insulation.

E. Use high-albedo or reflective roofing materials with a higher solar reflectance index (SRI) to minimize heat absorption. This helps reduce the urban heat island effect and keeps buildings cooler.

Green and vegetated roofs can reduce temperature fluctuations.



Analysis of comfort conditions - transition strategy

Transitional Space Strategy

A buffer zone will help the reduction of thermal shock for people moving from an internal space to the outdoor. A transitional space will help people to acclimatize with the internal/external conditions reducing the possibility of thermal shock.