WIND ENGINEERING CONSULTANTS

QUALITATIVE WIND ASSESSMENT
CPP PROJECT 21012
31 OCTOBER 2025

270 Pacific Highway

Crows Nest, NSW

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Executive Summary

A qualitative assessment of the 270 Pacific Highway development to be built in Crows Nest, NSW was conducted to provide an initial assessment of the surrounding pedestrian wind environment. The assessment was based on the local wind climate, CPP's experience in the region and on comparable projects, and the characteristics of the proposed development.

The wind environment around the development is likely to be generally suitable for pedestrian walking style activities from a comfort perspective with reference to the Lawson criteria. No major adverse impacts to pedestrian comfort or amenity are foreseen as a result of the proposed development. Areas intended for long term stationary activity such as seating and dining are likely to require treatment to ensure they are suitable for their intended use. All areas in the public domain in the vicinity of the subject site are expected to satisfy the relevant wind safety criterion.

Relatively windy conditions are expected to occur on the podium terrace. The requirements for mitigating stronger wind conditions will depend on the intended use of these areas.

Wind conditions on residential balconies are expected to be generally mild and typical of or better than comparable buildings in the region.

This report is a high level qualitative assessment based on basic features of the local wind climate and proposed built environment. Comfort and safety estimations were made based on wind tunnel testing completed for an earlier stage of the development (CPP, 2022).

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Document Tracking and Version Control

REVISION	RELEVANT INFORMATION	
R00D	Date Issued:	27 March 2025
	Prepared by:	Tomer Libman
	Reviewed by:	Joe Paetzold, PhD
	Approved by:	Joe Paetzold, PhD
	Document Name:	CPP21012_270 Pacific Highway_REP_DS_PW_R00D00.pdf
R00	Date Issued:	19 May 2025
	Prepared by:	Tomer Libman
	Reviewed by:	Joe Paetzold, PhD
	Approved by:	Joe Paetzold, PhD
	Document Name:	CPP21012_270 Pacific Highway_REP_DS_PW_R00.pdf
R01	Date Issued:	20 June 2025
	Prepared by:	Tomer Libman
	Reviewed by:	Joe Paetzold, PhD
	Approved by:	Joe Paetzold, PhD
	Document Name:	CPP21012_270 Pacific Highway_REP_DS_PW_R01.pdf
R02	Date Issued:	20 June 2025
	Prepared by:	Joe Paetzold, PhD
	Reviewed by:	Joe Paetzold, PhD
	Approved by:	Joe Paetzold, PhD
	Document Name:	CPP21012_270 Pacific Highway_REP_DS_PW_R02.pdf

Contents

1. Introduction

CLIENT STANDARD CONSULTANT TEXT

The application seeks development consent for the development of a 16 storey mixed use development at 270 Pacific Highway, Crows Nest, comprising 168 build to rent units and non-residential uses in the podium. Specifically, the SSDA seeks development consent for:

- demolition of two existing 5 storey commercial buildings
- construction of a maximum 16 storey building, including:
    - 2 basement parking levels (with 82 carparks, 8 motorbike spaces and 168 bicycle spaces)
    - 3 podium levels comprising non-residential uses such as medical centre, retail, and residential uses (build to rent units and residential amenity facilities such as a gym and sauna, steam room, outdoor pool, class space, cinema room, co-working space)
    - 13 storeys of residential uses in the tower, comprising build-to-rent units
    - communal open space
    - landscaping on ground, level 2 – level 15
    - rooftop solar panels
    - internal and external residential amenities space on roof top
- streetscape upgrades
- office and substation along the northwestern boundary

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 31 January 2025 and issued for the SSDA (SSD-79658964). Specifically, this report has been prepared to respond to the SEARs requirement issued below.

Item	Description of Requirement	Section Reference (this report)
7. Environmental Amenity	Assess amenity impacts on the surrounding locality, including solar access, visual privacy, view loss and view sharing, as well as **wind**, lighting, and reflectivity impacts. A high level of environmental amenity for any surrounding residential or other sensitive land uses must be demonstrated.	Section 4

GENERAL INFORMATION

The assessment of the wind environment around developments can ensure adverse impacts are minimized and inform designers about the suitability of outdoor areas for their intended uses. Where necessary, design modifications can be made, or intervention measures added to mitigate areas with the potential for excessive wind speeds.

The proposed development is located in Crows Nest, approximately 4 km to the north of the Sydney CBD. The surrounding terrain is comprised primarily of low-rise suburban development, with some larger commercial towers, Figure 1

The proposed development is comprised of a single prismatic tower set back over a podium, reaching a maximum height of about 54 m above ground level, Figure 2. As it is slightly larger than most of the surrounding structures, the addition of the proposed development is expected to have some impact on the local wind conditions, and the extents are broadly discussed in this report.

Figure 1: Aerial view of proposed development site (Google Earth, 2025)

Figure 2: Typical Residential Floor plan (top) and West Elevation (bottom) of proposed development

2. Wind Climate

The proposed development lies approximately 13 km to the north of the Sydney Airport Bureau of Meteorology anemometer, which provides the best source of historical wind data for the project. To enable a qualitative assessment of the wind environment, the wind frequency and direction information measured by the Bureau of Meteorology at a standard height of 10 m from 1995 – 2022 have been used in this analysis.

The wind rose for Sydney Airport is shown in Figure 3. The arms of the wind roses point in the direction from where the wind is blowing, the width and color of the arm represent the wind speed, and the length of the arm indicates the percent of the time that the wind blows for that combination of speed and direction.

The distribution and frequency of winds on an annual basis were analyzed to assess the project with regards to wind comfort and safety. As can be seen from the wind rose in Figure 3, winds from the north-east, south, and west directions are predominant. This wind assessment is structured around these prevailing wind directions.

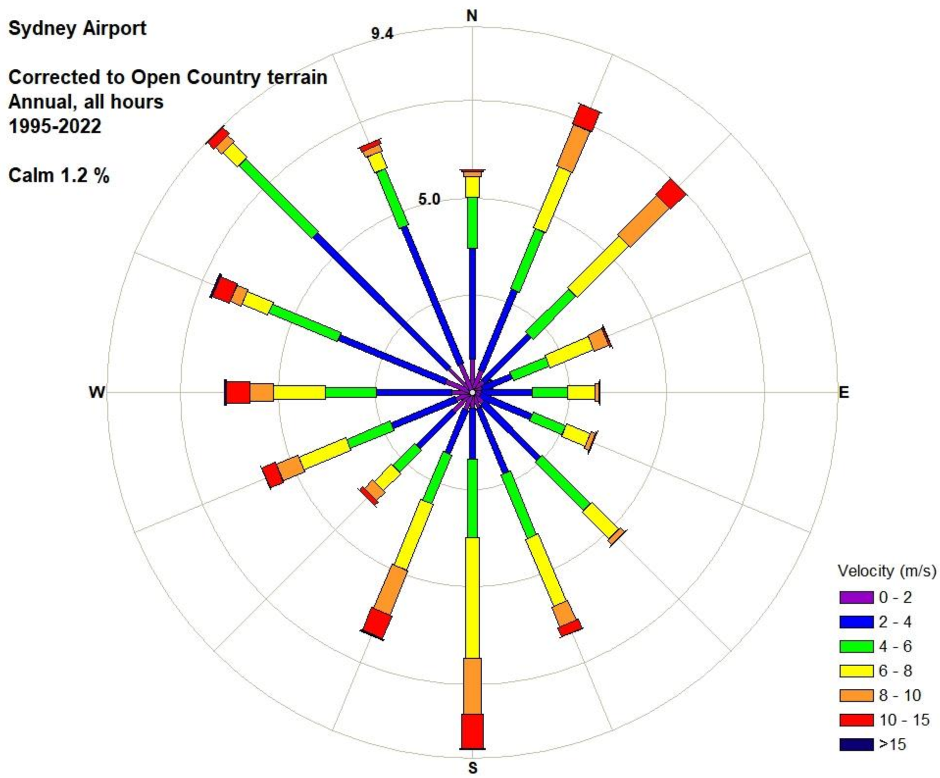

Figure 3: Probability of Wind Speeds by Direction: Sydney Airport – (1995 – 2022, All Hours)

3. Wind Assessment Criteria

A number of researchers have suggested quantitative methods for assessing wind comfort and safety based on estimated wind speeds and local climate statistics. These criteria provide a means of evaluating the wind amenity of location based on the frequency of threshold wind speeds, noting that pedestrians will tolerate higher wind speeds for a shorter time period than lower speeds. The comfort criteria also allow planners to assess the usability, with respect to the wind environment, of different locations for various purposes.

The North Sydney Council DCP specifies that wind speeds along public streets, and in public spaces, should not exceed 13 m/s. It is not stated whether this wind speed is a gust or mean, as such it is assumed to correspond to a 3-second gust after the work of Melbourne (1978), and would relate to a "pedestrian standing" type classification. There are not many locations within Sydney that would satisfy this level of wind amenity without some form of shielding. This criterion would relate to the once per annum gust and uses this as an estimator of the general wind conditions at a site, which depending on the wind climate may not be relevant to frequent wind events.

To combat this limitation, the wind assessment criteria that will be used in this study will be based upon the criteria of Lawson (1990), which are described in Table 1 for both pedestrian comfort and distress/safety. The benefits of these criteria over many in the field are that they use both a mean and gust equivalent mean (GEM) wind speed to assess the suitability of specific locations. The criteria based on the mean wind speeds define when the steady component of the wind causes discomfort, whereas the GEM wind speeds define when the wind gusts cause discomfort. The level and severity of these comfort categories can vary based on individual preference, so calibration to the local wind environment for all wind directions is recommended when evaluating with Lawson ratings. Another benefit of these from a comfort perspective is that the 5% of the time event is appropriate for a precinct to develop a reputation from the general public.

Table 1: Wind Comfort and Safety criteria (after Lawson, 1990)

COMFORT RATING	U_{EQUIV}*	DESCRIPTION
Dining**	< 2 m/s	Calm / light breezes suitable for outdoor restaurant uses, seating areas, and other amenities based on CPP experience.
Sitting	2-4 m/s	Calm or light breezes suitable for long duration seating areas, and other amenities.
Standing	4-6 m/s	Gentle breezes suitable for sitting for shorter periods, main entrances and bus stops where pedestrians may linger.
Pedestrian Walking	6-8 m/s	Moderate winds appropriate for window shopping and strolling along a downtown street, or park.
Business Walking	8-10 m/s	Relatively high speeds that can be tolerated if one's objective is to walk, run, or cycle.
Uncomfortable	> 10 m/s	Strong winds unacceptable for all pedestrian activities; wind mitigation is typically required.

*U_{Equiv} = Max (U_{Mean}, U_{Gust} / 1.85).
*U_{Equiv} speeds are based on an annual exceedance of 5% (~8 hours / week) assessed over all hours.
** For regular outdoor dining, and in semi-enclosed spaces, it has been the experience of CPP that the comfort rating of Sitting may be windier than desired and a comfort criterion of 4 m/s or less may be more applicable.

SAFETY RATING	U_{EQUIV}*	DESCRIPTION
Pass	< 15 m/s	Meets wind safety criterion.
Able-Bodied	15-20 m/s	Acceptable where only able-bodied people would be expected; not acceptable for frail persons or cyclists
Fail	>20 m/s	Excessive wind speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is often required.

* U_{Equiv} = Max (U_{Mean}, U_{Gust} / 1.85).
*U_{Equiv} speeds are based on an annual exceedance of 0.022% (~2 / year or 1 / season) assessed over all hours.

4. Assessment

SITE DESCRIPTION

The development site is surrounded in most directions by low-rise buildings. Topography surrounding the site is relatively flat from a wind perspective except to the west of the site, where the land declines significantly. Winds in such surrounds tend to experience less channelling than areas with many tall structures, with local effects instead being dictated by exposed buildings and their relation to prevailing strong wind directions. Several wind flow mechanisms such as downwash and channelling flow are described in Appendix A and the effectiveness of some common wind mitigation measures are described in Appendix B.

The subject site is located on the block bounded by Pacific Highway, Bruce Street, Sinclair Street and Shirley Road. The existing site comprises two 5-storey buildings; given the similar height to surrounding buildings, no significant downwash would be expected in the existing configuration. The proposed development consists of a single prismatic tower with a generally rectangular planform. A ground floor plan is shown in Figure 4, and indicates retail and medical tenancies along the Pacific Highway frontage.

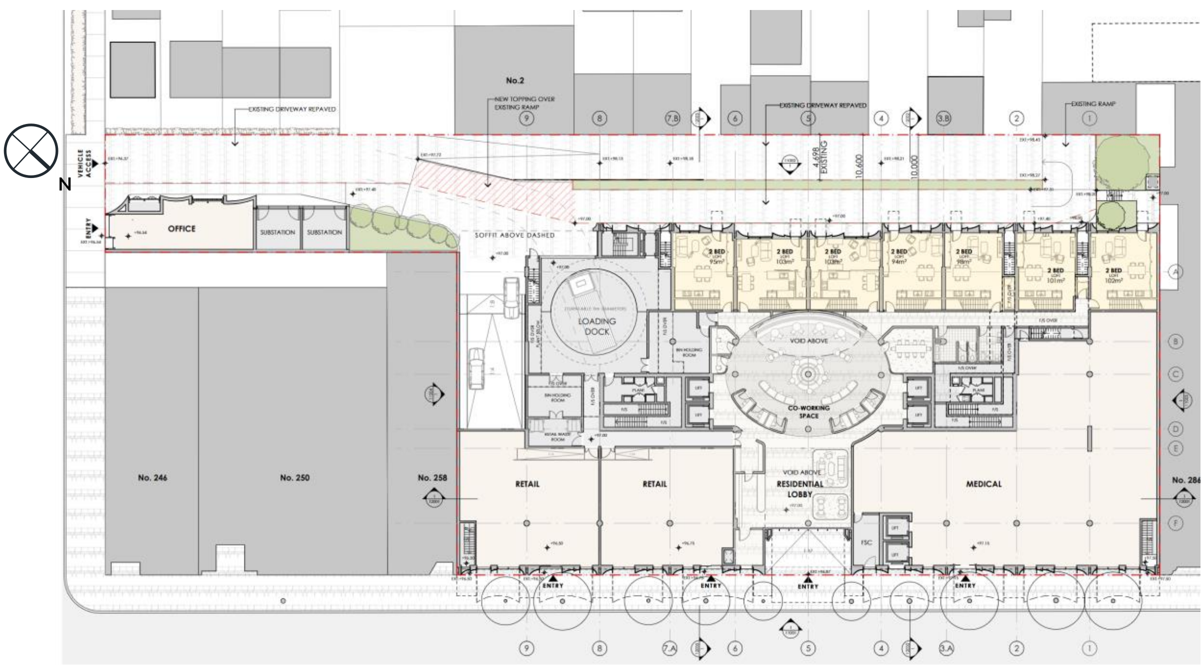

Figure 4: Ground floor plan of proposed development

WINDS FROM THE NORTH-EAST

Winds from the north-east quadrant will approach relatively unimpeded over the low-rise buildings of Crows Nest before impinging on the broad façade of the proposed development. This incident flow would be expected to generate a degree of downwash, which would accelerate around the north and east corners of the tower before discharging over the roofs of the neighbouring low-rise buildings which would act to keep the majority of this flow elevated above ground level. The break in the façade on the north-eastern side is considered a good design feature from a wind perspective, as it will help reduce accelerated flow around the corners of the tower. Additionally, the tower setback from the podium helps shield the street level from downwash flow. Considering the pedestrian protection provided by these features, the impact of winds from this direction are expected to be minor. For winds from the north-east quadrant, wind conditions around the proposed development site are expected to remain similar to the existing wind conditions and pass the Lawson distress criterion.

Figure 5: Level 3 plan view, with podium terrace and façade break indicated.

WINDS FROM THE SOUTH

Winds from the south quadrant will be approximately aligned with the corner of the tower, and will tend to be directed horizontally around the tower, reducing the amount of downwash descending to ground level. Some level of downwash would be expected for winds from the south-east. As with winds from the north-east, the break in the south-west façade would help reduce downwash and accelerated flow reaching ground level, as is the tower's recession from the podium. The downwash flow would provide a small additional contribution to the existing channelling flow along Pacific Highway. For winds from the south quadrant, conditions around the proposed development site are expected to remain similar to the existing wind conditions and pass the Lawson distress criterion.

WINDS FROM THE WEST

Approach flow from the west will accelerate as the terrain rises to the subject site, before striking the tower at an oblique angle, encouraging flow to pass horizontally around the tower. Some downwash would still be expected for winds from the west, with flow accelerating around the windward corners of the tower before discharging over the roofs of the neighbouring buildings. Wind conditions around the proposed development site are expected to remain similar to the existing wind conditions and pass the distress criterion.

SUMMARY – PUBLIC DOMAIN

For most locations, wind conditions within the proposed development site are expected to remain similar to the existing wind conditions. From a pedestrian comfort perspective, the wind environment around the proposed development site is likely to be classified as acceptable for pedestrian standing on the northern section of the ground level, and pedestrian walking on the southern Pacific Highway frontage of the ground level under the Lawson comfort criteria. These pedestrian comfort levels would be suitable for public accessways, and for stationary short-term exposure activities. All locations would be expected to satisfy the safety/distress criterion.

WIND CONDITIONS WITHIN THE DEVELOPMENT

PODIUM TOP

At the Level 3 podium rooftop, stronger wind conditions are expected than at ground level, as the tower setback from the podium deflects the downwash flow at podium height and diverts the vertical flow over the podium terrace space. For winds from the south and north-east in particular, downwash flow and flow acceleration around the windward corners of the tower are expected to create stronger conditions near the northern, eastern and western corners of this space. It is understood that this area is not generally accessible, however private terraces on the west and to a lesser extent on the south may be subject to strong cross flow near the building corners. At these locations, Lawson comfort levels of Pedestrian Walking to Business Walking would be expected.

Broad mitigation measures such as horizontal awnings along the south-eastern and north-eastern façades, or local measures such as cabana-type structures or screening elements, may be implemented if the windy areas are accessible and milder wind conditions are required, such as for seating and outdoor dining areas.

BALCONIES

Most tower balconies, due to their highly inset nature, are shielded from the predominant wind directions, and are expected to have relatively mild conditions, with a Lawson comfort level of Pedestrian Sitting likely on the inset balconies. The balconies at the south and west corners of the building may be subject to stronger winds across the outer parts of the balconies for winds from the west and south. If milder wind conditions are desired for these balconies, solid or porous screening on the short side of these balconies can be an effective way to reduce wind speeds on these balconies.

COMMUNAL TERRACES

The communal terraces in the centre of the south-west façade on Levels 2, 4, 6, 8, 10, and 12 are well located from a wind perspective with the massing of the tower itself protecting these spaces from the prevailing wind directions and therefore providing a mild wind climate on these terraces.

The larger rooftop terraces on Levels 12 and 14 are quite exposed to winds from the south and west. The tower massing behind the terraces would provide some relief from flow acceleration over the roof of the tower. Overall these areas would be expected to achieve a Pedestrian Walking comfort rating. Mitigation measures such as tall (1.8 m or higher) solid or glass balustrades around the south and west edges of the L12 terrace, and the north and west edges of the L14 terrace would be recommended to encourage flow to pass above terrace level if these spaces are to be used for stationary activities such as sitting or outdoor dining.

5. Conclusion

Cermak Peterka Petersen Pty. Ltd. has provided a qualitative assessment of the impact of the proposed 270 Pacific Highway project on the local wind environment in and around the development site. Being slightly larger than most surrounding structures, the proposed development will have some effect on the local wind environment, though any changes are not expected to be significant from the perspective of pedestrian comfort or safety. Wind conditions around the development are expected to be classified as acceptable for pedestrian standing or walking from a Lawson comfort perspective and pass the distress/safety criterion. No adverse conditions requiring specific mitigation are foreseen, however local amelioration may be advised for areas intended for long-term stationary or outdoor dining activities, particularly on the podium and rooftop terraces. The comfort and safety estimations were made based on wind tunnel testing completed for an earlier stage of the development (CPP, 2022).

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References

Lawson, T.V. (1990), “The Determination of the Wind Environment of a Building Complex before Construction” Department of Aerospace Engineering, University of Bristol, Report Number TVL 9025.

Melbourne, W.H., 1978, Criteria for Environmental Wind Conditions, Journal of Wind Engineering and Industrial Aerodynamics, Vol.3, No.2-3, pp.241-249.

CPP (2022), “Environmental Wind Tunnel Tests for 270 Pacific Highway”, CPP 16748, dated July 2022

Appendix A – Wind Flow Mechanisms

When the wind hits a large, isolated building, the wind is accelerated down and around the windward corners, Figure A1 this flow mechanism is called downwash and causes the windiest conditions at ground level on the windward corners and sides of the building. In Figure A1smoke is being released into the wind flow to allow the wind speed, turbulence, and direction to be visualised. The image on the left shows smoke being released across the windward face, and the image on the right shows smoke being released into the flow at about third height in the centre of the face.

Techniques to mitigate the effects of downwash winds on pedestrians include the provision of horizontal elements, the most effective being a podium to divert the flow away from pavements and building entrances. Awnings along street frontages perform a similar function, and the larger the horizontal element, the more effective it will be in diverting the flow.

Channelling occurs when the wind is accelerated between two buildings or along straight streets with buildings on either side.

Figure A2 shows the wind at mid and upper levels on a building being accelerated substantially around the corners of the building. When balconies are located on these corners, they are likely to be breezy, and will be used less by the owner due to the regularity of stronger winds. Owners quickly become familiar with when and how to use their balconies. If the corner balconies are deep enough, articulated, or have regular partition privacy fins, then local calmer conditions can exist.

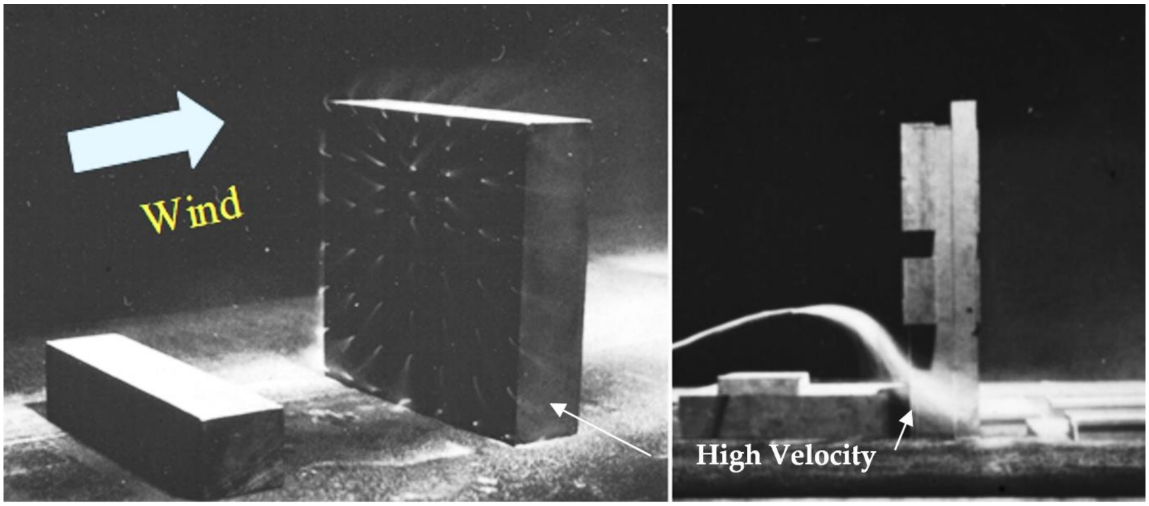

Figure A1: Flow visualisation around a tall building.

Figure A2: Channelling between buildings (L) and visualisation through corner balconies (R).

Appendix B - Wind Impact Planning Guidelines

It is well known that the design of a building will influence the quality of the ambient wind environment at its base. Below are some suggested wind mitigation strategies that should be adopted into precinct planning guidelines and controls (see also Cochran, 2004).

Building form – Canopies

A large canopy may interrupt the flow as it moves down the windward face of the building. This will protect the entrances and sidewalk area by deflecting the downwash at the second storey level, Figure B1. However, this approach may have the effect of transferring the breezy conditions to the other side of the street. Large canopies are a common feature near the main entrances of large office buildings.

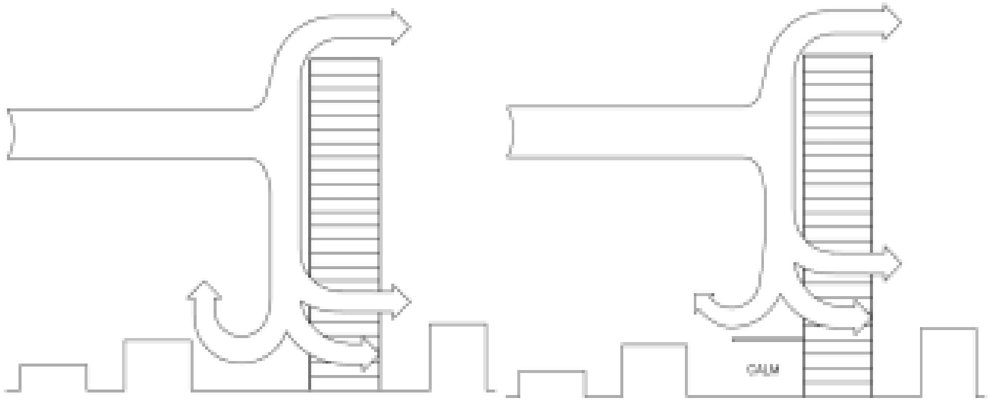

Figure B1: Canopy Windbreak Treatment. (L) Downwash to street level may generate windy conditions for pedestrians. (R) A large canopy is a common solution to this pedestrian-wind problem at street level.

Building form – Podiums

The architect may elect to use an extensive podium for the same purpose, Figure B2, if it complies with the design mandate. This is a common architectural feature for many major projects, but it may be counterproductive if the architect wishes to use the podium roof for long-term pedestrian activities, such as a pool or tennis court.

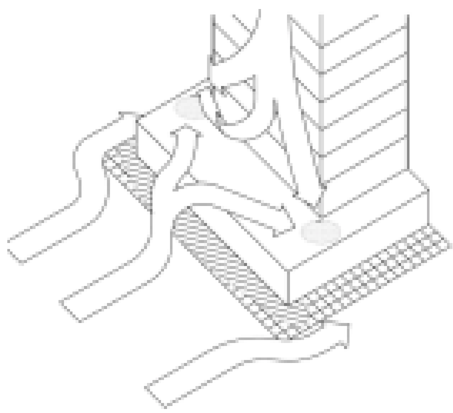

Figure B2:The tower-on-podium massing often results in reasonable conditions at ground level, but the podium may not be useable.

Building form – Arcades

Another massing issue, which may be a cause of strong ground-level winds, is an arcade or thoroughfare opening from one side of the building to the other. This effectively connects a positive pressure region on the windward side with a negative pressure region on the lee side; a strong flow through the opening often results, Figure B3. The uninvitingly windy nature of these open areas is a contributing reason behind the use of arcade airlock entrances (revolving or double sliding doors).

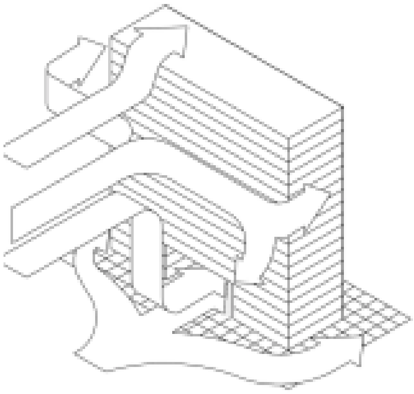

Figure B3: An arcade or open column plaza under a building frequently generates strong pedestrian wind condition.

Building form – Alcove

An entrance alcove behind the building line will generally produce a calmer entrance area at a mid-building location, Figure B4(L). In some cases, a canopy may not be necessary with this scenario, depending on the local geometry and directional wind characteristics. The same undercut design at a building corner is usually quite unsuccessful, Figure B4 (R), due to the accelerated flow mechanism described in Figure B1 and the ambient directional wind statistics. If there is a strong directional wind preference, and the corner door is shielded from those common stronger winds, then the corner entrance may work. However, it is more common for a corner entrance to be adversely impacted by this local building geometry. The result can range from simply unpleasant conditions to a frequent inability to open the doors.

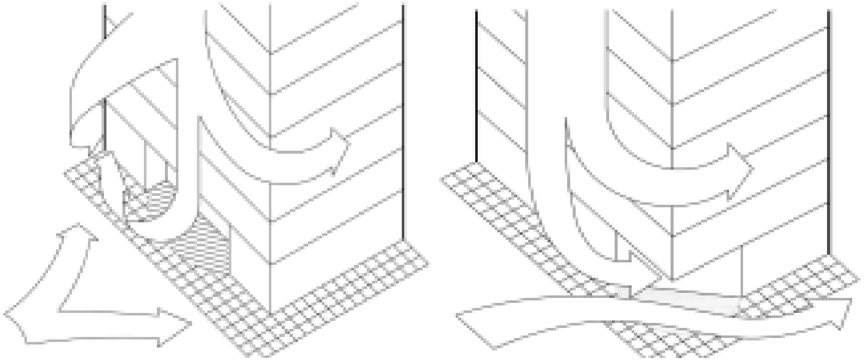

Figure B4: Alcove Windbreak Treatment. (L) A mid-building alcove entrance usually results in an inviting and calm location. (R) Accelerated corner flow from downwash often yields an unpleasant entrance area.

Building form – Façade profile and balconies

The way in which a building's vertical line is broken up may also have an impact. For example, if the floor plans have a decreasing area with increased height the flow down the stepped windward face may be greatly diminished. To a lesser extent the presence of many balconies can have a similar impact on ground level winds, although this is far less certain and more geometry dependent. Apartment designs with many elevated balconies and terrace areas near building ends or corners often attract a windy environment to those locations. Mid-building balconies, on the broad face, are usually a lot calmer, especially if they are recessed. Corner balconies are generally a lot windier and so the owner is likely to be selective about when the balcony is used or endeavours to find a protected portion of the balcony that allows more frequent use, even when the wind is blowing.

Use of canopies, trellises, and high canopy foliage

Downwash Mitigation – As noted earlier, downwash off a tower may be deflected away from ground-level pedestrian areas by large canopies or podium blocks. The downwash then effectively impacts the canopy or podium roof rather than the public areas at the base of the tower, Figure B2. Provided that the podium roof area is not intended for long-term recreational use (e.g. swimming pool or tennis court), this massing method is typically quite successful. However, some large recreational areas may need the wind to be deflected away without blocking the sun (e.g. a pool deck), and so a large canopy is not an option. Downwash deflected over expansive decks like these may often be improved by installing elevated trellis structures or a dense network of trees to create a high, bushy canopy over the long-term recreational areas. Various architecturally acceptable ideas may be explored in the wind tunnel prior to any major financial commitment on the project site.

Horizontally accelerated flows between two tall towers may cause an unpleasant, windy, ground-level pedestrian environment, which could also be locally aggravated by ground topography. Horizontally accelerated flows that create a windy environment are best dealt with by using vertical porous screens or substantial landscaping. Large hedges, bushes or other porous media serve to retard the flow and absorb the energy produced by the wind. A solidity ratio (i.e. proportion of solid area to total area) of about 60-70% has been shown to be most effective in reducing the flow's momentum. These physical changes to the pedestrian areas are most easily evaluated by a model study in a boundary-layer wind tunnel.

References

Cochran L., (2004) Design Features to Change and/or Ameliorate Pedestrian Wind Conditions, Proceedings of the ASCE Structures Congress, Nashville, Tennessee, May 2004.