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A Review of Planning Regulations for Pedestrian Wind Effects

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Abstract

A review of the regulatory requirements for pedestrian wind effects from planning authorities from around the world has been conducted. The review has identified what constitutes current best-practice in regulatory requirements for pedestrian wind effects and a summary of the findings of the review are presented in this paper.

Introduction

Most planning authorities in Australia have little or no regulation covering pedestrian wind effects for consideration in planning applications for new developments. Among those that do have documented requirements, most fail to set the tone for the required wind outcome by providing little description of the benefits of good design for pedestrian wind effects, little or no practical guidance on good design, or fail to set criteria in a manner that a professional wind engineer would consider technically incorrect.

At least partly as a result of this lack of regulation, there have been a number of developments in Australian capital cities that have been granted planning approval but which have, it seems fair to say, broadly failed to meet the public expectations of wind conditions (refer to newspaper articles such as, "Can Docklands be put back together again?", Ian Munro, The Age, 3 March 2012).

Global Wind Technology Services (GWTS) was engaged by a planning authority to provide advice on improved planning regulations for pedestrian wind effects. Part of the research conducted by GWTS, in order to provide the advice, was a review of the regulatory requirements for pedestrian wind effects from planning authorities worldwide.

The aim of this review was to develop an understanding of how planning authorities regulate pedestrian wind effects and what constitutes current best-practice regulation, at least in terms of written requirements. It is considered that an awareness of current best-practice would help planning authorities when considering updating their regulations to include requirements for pedestrian wind effects.

Method

One hundred and twenty-one cities in North America, South America, Europe, Asia and Oceania were the subject of this review. The cities investigated were selected based on having three or more of the following attributes;

- being in higher latitudes where stronger winds are common,
- having many medium and/or high-rise buildings,
- being in coastal locations exposed to prevailing winds,
- located in countries with an active wind engineering community.

In many cases, planning regulations were available online and these were downloaded and searched for requirements relating to wind. In some cases, where online searches yielded nothing, planning authorities were contacted by telephone to request documentation. In some of these cases, the planning documentation was available but not in English (this study has only considered documents in English), in other cases the planning authority advised that wind was not a planning consideration for that municipality and no documentation was forthcoming. In some cases, no regulations concerning wind were identified in the documentation.

On searching for, or requesting, the planning regulations of the one hundred and twenty-one subject cities, sixty-two were available, in English and found to have some planning requirements relating to pedestrian wind effects. Of these, thirty-two provided some level of guidance on design for wind and only eleven had clearly stated pedestrian wind effects criteria.

The cities chosen were:

Oceania: Canberra, Perth*, Sydney*, Brisbane*, Parramatta*, Melbourne*, Wellington*, Auckland*, Hamilton*
North America: Ottawa*, Vancouver, Montreal*, Quebec City, Toronto*, Hamilton*, Oakville*, Winnipeg*, Yellowknife*, Edmonton*, St Catherine's*, Burlington*, Brampton*, Mississauga*, Kingston*, Lethbridge*, Kitchener*, Vaughan*, Los Angeles, Miami, Florida City, New York*, San Diego, San Jose, Fresno, Sacramento*, San Francisco*, Phoenix, Tucson, Mesa, Albuquerque, Houston, San Antonio, Dallas, Austin, Chicago*, Philadelphia, Indianapolis, Columbus, Charlotte, Boston*, Memphis, Las Vegas, Milwaukee, Atlanta, Denver*, Seattle, Washington DC, Oakland*, Anchorage*, Portland*, Somerville*, Berkeley*, Germantown*, Salt Lake City*
South America: Santiago, Buenos Aires, Rio de Janeiro,
Asia: Tokyo, Fukuoka, Beijing, Hong Kong, Taipei, Seoul, New Delhi*, Mumbai*, Singapore*,
Europe: London*, Bristol*, Cardiff*, Belfast, Sheffield, Manchester*, Islington*, Nottingham*, Brighton*, Liverpool*, Plymouth*, Newcastle-Upon-Tyne*, Leeds*, Portsmouth*, Hackney*, Leicester*, Cambridge*, Glasgow*, Swansea*, Basingstoke*, Dublin, Dun Laoghaire*, Oslo, Stockholm, Helsinki, Copenhagen, Amsterdam, Berlin, Hamburg, The Hague, Paris, Monaco, Marseille, Rome, Zadar, Split, Dubrovnik, Malta*
Africa: Cape Town*
Middle East: Abu Dhabi*, Dubai, Jerusalem, Tel Aviv

Cities listed above marked with an asterisk had planning regulation documentation available in English that had some level of acknowledgement of the need to consider pedestrian wind effects in the design process.

Analysis

On conducting the review it became clear what constituted best-practice in planning regulation for pedestrian wind effects. The planning regulations with the more comprehensive and carefully considered regulations for pedestrian wind effects had most or all of the following five key elements:

1) An acknowledgement of pedestrian wind effects as an important design aspect that designers may be required to consider
2) A clearly stated "trigger" indicating in what scenario a pedestrian-wind-effects assessment would be required
3) Some guidance on good design for wind
4) Clearly stated, technically correct pedestrian-wind-effects criteria
5) Direction on the application of the criteria

Each of these five elements are discussed in more detail below.

Acknowledgement of Wind

Of the sixty-two planning authorities whose regulations acknowledged pedestrian wind effects, in fifteen cases this acknowledgement was a brief statement or statements to the effect that pedestrian wind effects should be considered in the course of good design.

At the other end of the spectrum, however, several cities dedicated multi-page documents solely on pedestrian wind effects. Possibly the best example of this is the Canadian City of Mississauga (2014) with their comprehensive Pedestrian Wind Comfort and Safety Studies document (refer to Figure 1), which is part of their Urban Design Terms of Reference series. This clearly outlines the City's pedestrian wind safety and comfort criteria, triggers for wind assessments, design configurations to be encouraged or avoided, requirements for qualitative and quantitative testing, and mitigation strategies.

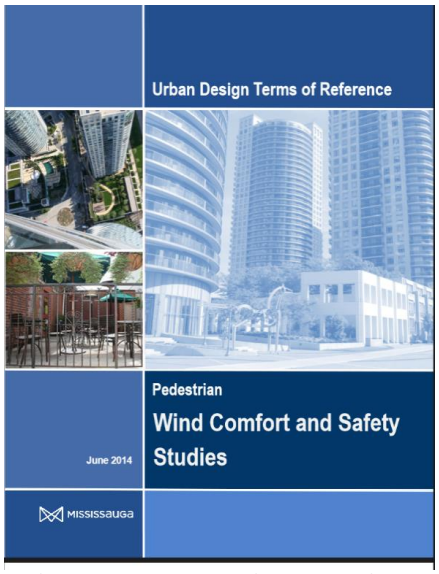

Figure 1: City of Mississauga guidelines for wind comfort.

Guidance on Design for Wind

Of the sixty-two planning authorities whose regulations acknowledged pedestrian wind effects, thirty-two provided some level of guidance on good building design to minimise adverse wind effects at ground level. This guidance ranges from a brief mention of façade setbacks to providing detailed guidance on multiple aspects of design for wind. An example of the latter category is the highly detailed Design Guide for Wind, City of Wellington (current), which provides illustrations of the effects of different wind flows and how they apply to a variety of buildings and outdoor areas (refer to Figure 2). It also provides some limited guidance for mitigation.

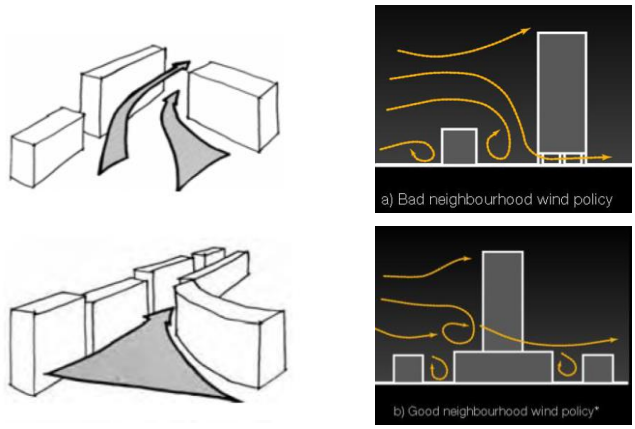

Figure 2: Guidance on design for pedestrian wind effects reproduced from City of Wellington (current) and City Bristol (undated).

Assessment Trigger for Wind

Of the sixty-two planning authorities whose regulations acknowledged pedestrian wind effects, thirty-six had stated triggers for wind assessments. The triggers varied widely, with very different degrees of specificity.

At the less-specific end of the spectrum, the City of Cape Town (2012) requires a pedestrian wind assessment of "tall buildings" where the height is left undefined. Similarly imprecise is the statement from the City of Cambridge (2006) for a pedestrian wind assessment for "any structure that breaks the skyline".

The difficulty this lack of clarity poses to city councils is that it leaves a great deal open to interpretation, which may result in inconsistencies in application of the regulations to new developments.

Less ambiguous is the City of Montreal (undated) requirement for testing of buildings of "…heights half again as high as surrounding building heights in a 50m radius…". Importantly this trigger clearly recognises that pedestrian wind effects are less a function of absolute height of a building and more a function of relative height to the surrounding buildings.

Several planning regulations do provide a clear and unambiguous trigger for pedestrian wind assessments. City of Winnipeg (2004) stipulates that "…new buildings or additions that exceed 15 storeys in height or the height of buildings on adjacent properties by 10 storeys or more…" require a pedestrian wind effects assessment. City of Hamilton (2012) requires a pedestrian wind assessment for "all buildings over 12 metres".

Wind criteria

Only eleven of the sixty-two planning authorities whose regulations acknowledged the need to consider pedestrian wind effects nominated a specific set of criteria against which any wind assessment must be made. Since criteria vary widely, this leaves the door wide open to interpretation of the acceptability of the wind speeds predicted by an assessment.

Of the planning regulations reviewed, those that best addressed pedestrian wind criteria, such as City of Melbourne (2015) and

City of Mississauga (2014), presented clearly stated criteria and included all the necessary components to define the required wind measurement for a given safety or comfort level, i.e. limit wind speed, wind speed averaging period and limiting probability of exceedance.

For example, the criteria required by City of Melbourne (2015) are clearly stated (a slightly modified version of Professor Bill Melbourne's 1978 criteria) and are technically correct in that they state a limit wind speed, an averaging period for that wind speed and a limiting probability of exceedence.

In a number of cases, whilst criteria are stated, they are not stated correctly in that they do not state a probability level or a wind speed averaging period. City of Wellington (2012) and Sydney City Council (2012) are both examples of planning documentation with criteria stated, but without probability levels or wind gust speed averaging periods.

Application of wind criteria

Of the planning regulations that do have criteria for pedestrian wind effects, some provide relatively clear directions on the application of these criteria. Typically this is restricted to which criteria are applicable to which type of area, e.g. City of Ottawa (undated) indicates the "Standing" wind category should be applied to "Major building entrances and bus stops".

None of the planning regulation documentation reviewed included directives as to how far afield from a proposed development wind conditions should be assessed and none appeared to have directions for the application of criteria for adjacent private properties. Of the documentation reviewed, only Australasian Wind Engineering Society (2014) provides any guidance in these areas.

Summary Discussion

On reviewing the various planning regulations, it became clear that there was a very wide range of approaches to regulation of pedestrian wind effects.

Some planning regulations had a discussion of the importance of good design for wind, a clear trigger for a pedestrian wind effects assessment to be required of a proposed development, illustrated guidance on good design for pedestrian wind effects, criteria that must be met and how those criteria are to be applied. In more than one case, the planning authority had produced a comprehensive, dedicated document on design for pedestrian wind effects.

In many cases, the approach to regulating pedestrian wind effects is either non-existent or somewhat lacking in direction. For many cities, although it may be noted that pedestrian wind effects is a design consideration and an assessment could be required, there may be little or no further guidance or regulatory requirements about the outcome of such an assessment. Many regulatory documents therefore left the impression that a good outcome for pedestrian wind effects would be more likely due to good fortune than anything else.

Conclusions

This study has presented a review of worldwide planning regulations for pedestrian wind effects. The review has found that, while a significant number of planning authorities have some level of regulatory requirements for pedestrian wind effects, the regulatory approaches vary greatly, ranging from non-existent, to vague, to very well-defined.

The elements that constitute current best-practice in regulation of pedestrian wind effects have been identified by comparing the relative merits of the various documentation reviewed. It is concluded that current best-practice planning regulation for pedestrian wind effects would comprise; a) a description of why good design for pedestrian wind effects is important, b) guidance on good design for wind, c) an unambiguous trigger for wind effects assessments, d) clearly stated, technically correct criteria and e) directions on how to apply the criteria noting how far afield from the development wind effects must be considered.

Acknowledgments

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