APEC-WW Pedestrian Wind Environment Report: Australia – 2011-12

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ABSTRACT: The lack of agreed minimum criteria for pedestrian wind environments is causing some problems for planning authorities, developers and wind engineers. The need for at least an agreed minimum criterion is discussed and the form and definition of a possible minimum criterion is explored. The Australasian Wind Engineering Society's current approach to achieving consensus on a minimum criterion is outlined.

KEYWORDS: Pedestrian, Environmental, Wind, Safety, Criteria.

1 INTRODUCTION

Pedestrian wind effects assessments are triggered as a planning requirement by planning authorities for large developments across much of Australia. However, few planning authorities specify pedestrian wind criteria and the Australasian Wind Engineering Society have no specified criteria. With no specified benchmark, planning authorities often cannot adequately assess the pedestrian wind effects report in a planning application.

In some Australian municipalities, property developers lack the confidence they seek for their projects, as their wind engineering may be successfully challenged on the basis of their selection and use of criteria. Wind engineering consultants must tread a tricky path with their clients in order to meet their client's commercial interests, while not compromising the interests of the wider community.

In some of the most unfortunate cases, developments have gone a very long way down the path of design development and planning application before being rejected by the responsible planning authority, in part due to disputes over the suitability of wind criteria and the way they have been applied to the wind tunnel modeling results.

It would seem some guidelines on the selection and application of criteria could significantly reduce these problems.

1.1 *Planning authority requirements*

Typical of Australian planning requirements is the City of Melbourne Planning Scheme (City of Melbourne, 2012). This document notes the need for the consideration of pedestrian wind affects in the planning stages of larger developments. Formal pedestrian wind assessments are, in general, successfully triggered by the City of Melbourne Planning Scheme when developments are proposed which are significantly taller than existing developments.

However the City of Melbourne Planning Scheme and the vast majority of other local planning schemes in Australia have no specific requirements for wind criteria to be used in the assessment of planning applications. The City of Melbourne Planning Scheme requires that a development "…minimise the adverse impacts of wind in surrounding public spaces…" leaving the way open to a wide range of interpretations. This is in contrast

to most other planning considerations for the design which have clearly stated requirements, criteria etc. such as building heights and shadowing.

1.2 *Assessment of pedestrian wind effects by planning authorities*

The assessment by the planning authority of a pedestrian wind environment report, which has been triggered as part of the planning process, becomes uncertain without any specified criteria.

In many cases the planning authority relies on the statements of the applicant's wind consultant as to whether conditions are acceptable or not. In some cases planning authorities engage their own wind engineering advice to assess the applicant's findings and have challenged the applicant's wind engineering advice. However, since there are rarely any specified criteria, the dispute usually ends up between the applicant's wind engineer and the planning authority's wind engineer over the suitability of criteria.

2 DEVELOPING A MINIMUM CRITERION

Whilst there may be a good deal of debate regarding the relative merits of various criteria we must, as a profession, be able to agree on a minimum criterion for a busy city footpath. A minimum acceptable criterion for pedestrian areas should be prescribed in a similar manner to wind loading codes such as the Australia/New Zealand Wind Actions Standard AS/NZS 1170.2:2011(Standards Australia, 2011) which require a minimum design wind pressure load for structures.

2.1 *Comparison of existing criteria*

Melbourne (1978) indicated a high degree of agreement between his own criteria and a number of well-known and widely-used pedestrian wind comfort and safety criteria based on some assumptions. However, since then, it appears a majority of studies such as Sparks and Elzebda (1983), Ratcliff and Peterka (1990), Koss (2006) and Fricke and Holmes (2012) suggest agreement between the various criteria to be relatively poor. The reason for Melbourne (1978) finding good agreement is at least in part due to the assumption of 15% turbulence intensity. Whilst this level of turbulence might occur in open terrain scenarios it is most unlikely to occur in an urban setting.

At least two studies, Ratcliff and Peterka (1990) and Koss (2006), have concluded the criteria suggested in Melbourne (1978) are relatively conservative. Of course, as a relative comparison, it could equally be said the other criteria are relatively non-conservative compared with Melbourne (1978).

It is perhaps timely to note at this point in relation to Melbourne's safety criterion that Melbourne appears to be the only researcher who observed unwitting members of the public being blown over by the wind and measured the corresponding gust wind speeds. Therefore, the use of the term "conservative", at least in relation to Melbourne's safety criterion, is cautioned.

While the debate over criteria has gone on for decades and we seem to be no closer to agreement, it seems there is agreement that the built environment is capable of generating wind conditions capable of knocking people over where, prior to the built environment, such conditions did not previously exist. There also appears to be agreement that wind conditions generated by the built environment, capable of knocking down typical individuals and occurring more frequently than approximately once per year are not acceptable and steps to address this in the building design should be required. Melbourne

(1978), Alan G Davenport Wind Engineering Group (2007), Lawson (1990), Isyumov and Davenport (1975) all indicate safety criteria based on approximately a once per year event.

2.2 *Defining a minimum criterion*

It is suggested that the single most important criterion that the wind engineering community should achieve consensus on is a criterion for safety since ensuring safety in public areas adjacent to a development should be paramount to designers and planning authorities.

In defining a safety criterion it seems we must consider and agree on four points:

1) The wind conditions at which typical members of the public begin to be knocked over
2) The probability of occurrence of those winds at given location
3) The probability the given location will be occupied by members of the public
4) An appropriate duration (peak factor or gust factor) for the gust wind speed

In relation to Point (1), a review of the published papers on pedestrian wind effects criteria suggests only Melbourne (1971) made field observations of unwitting members of the public being knocked over by the wind and measured the corresponding wind speeds (peak gusts of 23m/s). Of the gust-based criteria, Melbourne (1978) are one of the most stringent, however, two important points should be noted; a) the people observed being blown over by the wind by Melbourne (1971) were young, able-bodied adults, with the implication that 23m/s gusts may be non-conservative for the less able-bodied, b) given the safety of the public is at stake, it seems reasonable to err on the side of caution when selecting a safety criterion.

ASCE (2003) reviewed various safety criteria and surmised that "If wind conditions with this gust speed [25m/s] are exceeded more than two to three times per year then the chance of someone being injured becomes unacceptably high. Two or three times per year corresponds to events that occur for about 0.1% of the time. Thus, to satisfy the requirement for safety it is suggested that wind conditions with peak 3-second gusts exceeding 25m/s should not occur for more than 0.1% of the time."

In relation to Point (2), the commonly used probability of occurrence appears to not be in dispute by most researchers and is of the order of 0.1% or 0.001.

In relation to Point (3) we can illustrate the question of the use of the area with two examples; a city footpath adjacent to the site of a large development and a large storage shed at a rural site on private property. The latter example may not trigger an assessment of safety for planning permits since few people might be expected to use the areas adjacent to the building and no members of the public, i.e. point (3) is a non-event in this case. Responsibility for safety would fall to the property management for their staff and visitors. In the case of a city footpath, such an area is likely to be occupied almost constantly by members of the public at least during daylight hours. If wind speeds capable of knocking pedestrians over were to occur even rarely in such a highly occupied area it would still be likely to result in members of the public being knocked over.

In relation to Point (4), the gust duration of 2-3 seconds should be re-considered in this application. A gust of this duration has a much larger equivalent frontal area com-

pared with the area of the human body. However the response/reaction of a human to a gust of shorter duration also needs consideration.

3 THE WAY FORWARD

3.1 *Agreement on the need for standards*

The Australasian Wind Engineering Society (AWES) has been approached by town planners from one of Australia's state governments to provide standard criteria. AWES has responded by setting up a working group to address the issue.

3.2 *Who is responsible for setting the standard?*

Feedback from planning authorities has been to the effect that wind engineers are the experts in this field and AWES, as the peak wind engineering body in Australia, should provide guidance on the selection and application of criteria. Planning authorities will not set criteria without advice from peak bodies.

3.3 *What form will the guidance from AWES take?*

The Australasian Wind Engineering Society produces a Quality Assurance Manual covering the accepted methods of conducting and reporting on wind engineering studies. Section C of the Manual is devoted to pedestrian wind environment assessments and part C7, "Assessment criteria" may be revised to include more specific guidance by explicitly stating at least a criterion for public safety and the types of areas where this criterion would typically be applied.

It is not possible to predict the outcomes of the working group but the authors hope that it may be possible to provide, if not specific numbers, at least some descriptive guidance on assessing comfort conditions.

4 CONCLUSIONS

There is a growing recognition by the wind engineering community that some guidance on the selection and application of pedestrian environmental wind criteria should be provided and that, as the peak body in this field, it is the responsibility of AWES to do this for Australia and New Zealand.

The impact of an agreed minimum criterion may not be trivial. In the shorter term and depending on what is decided, it may be that the form, location and orientation of some proposed developments may need to be revised. The medium and long term benefits are to provide more transparency in the planning approvals process which will have positive flow-on effects for developers, their design teams and investors by providing more certainty in what is required. The benefit to the public is in ensuring safe wind conditions in public areas.

It is very likely there will be much discussion in AWES and probably many disagreements but we will learn a great deal from an open discussion and the authors are hopeful that at least a minimum criterion for public safety can be agreed upon and provided through the Australasian Wind Engineering Society's Quality Assurance Manual.

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