Report on Recent Development on Wind Code in Singapore

Thambirajah Balendra[a] and TAN See Chee[b]

[a] *Department of Civil Engineering, National University of Singapore, 21 Lower Kent Ridge Road, Singapore*

[b] *Civil & Infrastructures Division, CPG Consultants Pte Ltd, 238B Thomson Road, #16-00 Tower B, Novena Square, Singapore*

1 BACKGROUND

Historically Singapore wind load has been based on British Code. First CP3 was used until it was superseded by BS6381. In 2009, in order to adopt the Eurocode, Singapore National Annex to SS EN 1991-1-4:2009 has been prepared by the Technical Committee on Building Structures and Sub-structures, and is approved by Building and Construction Standards Committee on behalf of the Standard Council of Singapore. This standard has to be read in conjunction with the SS EN 1991-1-4:2009- Eurocode 1: Action on Structures. Part 1-4: General actions – Wind actions. The salient features of the Singapore National Annex are highlighted in this report.

2 TERRAIN CATEGORIES

Singapore being a small country with fairly uniform development over a substantial part of the country, for simplicity, all structures except the low rise roof structures within 2 km radius from the sea coast to be designed using a country terrain (Cat II in EN Code). The low rise roof structures within 2km from the sea coast to be designed using the terrain for sea (Cat 0 in EN Code).

3 WIND SPEED

The local climate in Singapore is such that the small scale wind due to thunderstorm produces higher gust speed than the large scale wind due to monsoon wind. And thus it is appropriate to use a 3sec gust as the basic wind speed in order to capture the extreme event. However, the basic wind speed to be used in the Eurocode is 10 minutes mean wind. Since buildings designed using 3sec gust have performed satisfactorily in all terrains in Singapore, equivalent 10 minutes mean of 20m/sec has been proposed as the basic wind speed.

4 NATIONALLY DETERMINED PARAMETERS

Information on the following items are included in the Singapore Annex as nationally determined parameters; while making references to relevant documents (1,2)

1. Guidance on design assisted by wind tunnel testing
2. Basic wind speed
3. Influence of altitude on basic wind speed
4. Directional factor
5. Seasonal factor
6. Roughness factor

7. Assessment on terrain roughness
8. Air density
9. Correlation of loads between windward and leeward faces
10. Effects of ice and snow
11. Permeability in determining the internal pressure
12. Wind actions for other types of bridges
13. Limits on maximum pressure when road traffic or railway traffic considered simultaneously with the wind
14. Condition under which along wind response and vertical wind response can be ignored for highway and railway bridges
15. Reduction in drag coefficients for bridges
16. Criteria to determine whether a bridge is susceptible to aerodynamic excitation and whether dynamic response procedure are needed
17. Wind load factor for bridges
18. Force coefficient corresponds to longitudinal wind forces for bridges
19. Force coefficient for piers
20. Quasi-static procedure for along wind effects in bridges
21. Transition between roughness categories
22. Applicability of Annexes A to F of SS EN 1991-1-4

5 IMPLEMENTATION

This standard is expected to be implemented as the national code for wind loading with effect from 2010.

6 REFERENCES

1 UK National Annex to Eurocode 1: Actions on structures, Part 1-4: General actions-Wind actions (NA to BS EN 1991-1-4:2005)

2 Draft Singapore Code of Practice for wind loading on structures