

**INTERNATIONAL CODE COUNCIL (ICC)
Code Technology Committee (CTC)**

**INTERIM REPORT NO. 3 OF THE CTC
AREA OF STUDY – REVIEW OF NIST WTC RECOMMENDATIONS**

**March 15, 2007
Embassy Suites Hotel
Atlanta Airport**

The CTC held a public hearing on March 15, 2007 to receive written and verbal comments regarding CTC recommendations for the ICC Board - approved area of study entitled Review of NIST WTC Recommendations. This report includes interim recommendations No. 3 for this area of study, approved by the CTC upon conclusion of the public hearing on March 15, 2007. It should be noted that as an interim report this does not complete this area of study. Other aspects of this area of study are still under investigation. The recommendations contained in this report will be forwarded to the ICC Chief Executive Officer in accordance with ICC Council Policy No. 5

Scope: As noted in the CTC approved Scope & Objectives Statement, the scope of this activity is:

Review the recommendations issued by NIST in its report entitled “Final Report on the Collapse of the World Trade Center Towers”, issued September 2005, for applicability to the building environment as regulated by the I-Codes.

Recommendation: The CTC Interim Recommendation Number 3 is for CTC to submit a public comment to Code Change S16-06/07 relative to the following NIST Recommendations:

#2 Development of national standards for conducting wind tunnel testing

CTC continues to recommend further study on other aspects of this area of study.

CTC action at the public hearing: Approve the submittal of the public comment to Code Change S16-06/07.

S16 starts on the next page.

S16-06/07

1609.1.1

Proposed Change as Submitted:

Proponents: Paul K. Heilstedt, P.E., Chair, representing ICC Code Technology Committee (CTC)

1. Revise as follows:

1609.1.1 Determination of wind loads: Wind loads on every building or structure shall be determined in accordance with Chapter 6 of ASCE 7. The type of opening protection required, the basic wind speed and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609.1.1.1, the provisions of SBCCI SSTD 10 Standard for Hurricane Resistant Residential Construction shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of the AF&PA WFCM.
3. Designs using NAAMM FP 1001.
4. Designs using TIA/EIA-222 for antenna-supporting structures and antennas.
5. Designs using wind tunnel testing in accordance with Section 1609.1.1.2

1609.1.1.1 Applicability. The provisions of SSTD 10 are applicable only to buildings located within Exposure B or C as defined in Section 1609.4. The provisions of SSTD 10 and the AF&PA Wood Frame construction Manual for One- and Two-Family Dwellings shall not apply to buildings sited on the upper half of an isolated hill, ridge or escarpment meeting the following conditions:

1. The hill, ridge or escarpment is 60 feet (18 288 mm) or higher if located in Exposure B or 30 feet (9144 mm) or higher if located in Exposure C;
2. The hill, ridge or escarpment is 60 feet (18 288 mm) or higher if located in Exposure B or 30 feet (9144 mm) or higher if located in Exposure C;. The maximum average slope of the hill exceeds 10 percent; and
3. The hill, ridge or escarpment is unobstructed upwind by other such topographic features for a distance from the high point of 50 times the height of the hill or 1 mile (1.61 km), whichever is greater.

1609.1.1.2 Wind tunnel testing. Where wind tunnel testing is used to determine design wind loads, such testing shall be in accordance with ASCE xx.

2. Add standard to Chapter 35 as follows:

ASCE xx-yy Wind Tunnel Testing

Reason: The ICC Board established the ICC Code Technology Committee (CTC) as the venue to discuss contemporary code issues in a committee setting which provides the necessary time and flexibility to allow for full participation and input by any interested party. The code issues are assigned to the CTC by the ICC Board as "areas of study". Information on the CTC, including: meeting agendas; minutes; reports; resource documents; presentations; and all other materials developed in conjunction with the CTC effort can be downloaded from the following website: <http://www.iccsafe.org/cs/cc/ctc/index.html> Since its inception, the CTC has held six meetings - all open to the public.

This proposed change is a result of the CTC's investigation of the area of study entitled "Review of NIST WTC Recommendations". The scope of the activity is noted as:

Review the recommendations issued by NIST in its report entitled "Final Report on the Collapse of the World Trade Center Towers", issued September 2005, for applicability to the building environment as regulated by the I-Codes.

This proposal is intended to address NIST recommendation 2. For this specific proposed change, CTC is working in cooperation with the NIBS/MMC Committee to Translate the NIST World Trade Center Investigation Recommendations for the Model Codes. The

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CTC notes in their investigation that many of the recommendations contained in the NIST report require additional information for the CTC to further investigate. As such, CTC intends to continue to study the other NIST recommendations.

NIST Recommendation 2 recommends that nationally accepted performance standards be developed for: (1) conducting wind tunnel testing of prototype structures based on sound technical methods that result in repeatable and reproducible results among testing laboratories; and (2) estimating wind loads and their effects on tall buildings for use in design, based on wind tunnel testing data and directional wind speed data.

The IBC requires that wind loads be determined in accordance with Chapter 6 of ASCE 7, with specific exceptions depending on the size, configuration and location of the building. Section 6.1 of ASCE 7-05 provides three procedures to determine design wind loads: Method 1- Simplified Procedure; Method 2- Analytical Procedure; and Method 3- Wind Tunnel Procedure. Due to unique wind load considerations for certain building configurations and locations, Section 6.5.2 of ASCE 7 - 05 further mandates compliance with either the wind tunnel procedure of Section 6.6 of ASCE 7 or requires the design to be based on recognized literature documenting the wind load effects. Section 6.6 of ASCE does not currently prescribe specific wind tunnel test procedures. These are being developed by an ASCE Wind Tunnel Testing standard committee.

The purpose of this change is not to mandate wind tunnel testing in the IBC, but rather to achieve uniformity in results where the design involves wind tunnel testing – either as required by ASCE 7 or where the designer determines that wind tunnel testing is to be used to determine the wind loads.

As of the submission of this proposal, it is CTC's understanding that the wind tunnel test standard is not complete but is under development.

Bibliography:

Interim Report No. 1 of the CTC, Area of Study – Review of NIST WTC Recommendations, March 9, 2006.

National Institute of Standards and Technology. Final Report of the National Construction Safety Team on the Collapses of the World Trade Center Towers. United States Government Printing Office: Washington, D.C. September 2005.

Cost Impact: The code change proposal will not increase the cost of construction

Analysis: Results of review of the proposed standard(s) will be posted on the ICC website by August 20, 2006.

Note: The following analysis was not in the Code Change Proposal book but was published in the "Errata to the 2006/2007 Proposed Changes to the International Codes and Analysis of Proposed Referenced Standards" provided at the code development hearings:

Analysis: Review of proposed new standard indicated that, in the opinion of ICC staff, the standard did not comply with ICC criteria for referenced standards, Section 3.6.3-1 readily available.

Committee Action:

Disapproved

Committee Reason: This proposal was disapproved because it would incorrectly reference the wind tunnel test standard as an exception to the ASCE 7 wind load requirements. Doing so would allow designers to circumvent other applicable wind load requirements by performing a wind tunnel test. In addition the proposed standard is not in compliance with the ICC code development process since it is not yet readily available.

Assembly Action:

None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Paul Heilstedt, PE, Chair, Code Technology Committee (CTC)

Gerry Jones/Herman Brice, Co-Chairs, NIBS/MMC Committee for Translating the NIST World Trade Center Investigation Recommendations into Building Codes

Modify proposal as follows:

1609.1.1.2 Wind tunnel testing. Where wind tunnel testing is used to determine design wind loads, such testing shall be in accordance with ASCE/SEI 49. The minimum design wind load shall not be less than the minimum prescribed by ASCE 7. The lower limit on pressures for main wind-force resisting systems and components and cladding shall be in accordance with Sections 1609.1.1.2.1 and 1609.1.1.2.2.

1609.1.1.2.1 Lower limits on main wind-force-resisting system. Base overturning moments determined from wind tunnel testing shall be limited to not less than 80 percent of the design base overturning moment determined in accordance with Section 6.5 of ASCE 7, unless specific testing is performed that demonstrates it is the aerodynamic coefficient of the building, rather than shielding

from other structures, that is responsible for the lower values. The 80 percent limit may be adjusted by the ratio of the frame load at critical wind directions as determined from wind tunnel testing without specific adjacent buildings, but including appropriate upwind roughness, to that determined in Section 6.5 of ASCE 7.

1609.1.1.2.2 Lower limits on components and cladding. The design pressures for components and cladding on walls or roofs shall be selected as the greater of the wind tunnel test results or 80 percent or the pressure obtained for Zone 4 for walls and Zone 1 for roofs as determined in Section 6.5 of ASCE 7, unless specific testing is performed that demonstrates it is the aerodynamic coefficient of the building, rather than shielding from nearby structures, that is responsible for the lower values. Alternatively, limited tests at a few wind directions without specific adjacent buildings, but in the presence of an appropriate upwind roughness, shall be permitted to be used to demonstrate that the lower pressures are due to the shape of the building and not to shielding.

Chapter 35:

ASCE/SEI 49-07 Wind Tunnel Testing for Buildings and Other Structures

(Portions of the proposal not shown remain unchanged)

Commenter's Reason: The committee correctly noted that ASCE 7 prescribes a minimum design load. This load is 10 psf in accordance with Section 6.1.4.1 of ASCE 7. In code change S17-06/07, the proponent of the change provides the criteria to be used in conjunction with wind tunnel testing. This public comment is merely correlating the text of S16, including the proposed new referenced standard, with the text that was approved as modified in S17 by the IBC Structural committee.

As to availability of the standard, ASCE has indicated that the public comment phase of the standard development has been completed and the standard will be published and available prior to the Final Action Hearing. If the standard is not available, this public comment will be withdrawn.

If this public comment is successful and the action taken on S17 stands, the correlated text between the two code changes should include the text of exception 5 from S16 as this text refers to the new referenced standard.

Final Action: AS AM AMPC____
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