Subject: WTC Comments
From: "Rhonda Lynn" <RLynn@iccsafe.org>
To: <wtc@nist.gov>

Attached are the comments submitted by the International Code Council on the World Trade Center Investigation Draft Final Reports.

Rhonda Lynn
International Code Council
5203 Leesburg Pike, Suite 600
Falls Church, VA 22041

phone: 888-422-7233 ext. 6239
local: 703-931-4533
fax: 703-379-1546
email: rlynn@iccsafe.org

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WTC Comments Final 7-05.pdf

INTERNATIONAL CODE COUNCIL®

Setting the Standard for Building Safety™

Headquarters
5203 Leesburg Pike, Suite 600 ▪ Falls Church, VA 22041-3405 U.S.A.
Tel: +1 (703) 931-4533 ▪ Fax: +1 (703) 379-1546
www.iccsafe.org

August 4, 2005

WTC Technical Information Repository
Attention: Mr. Stephen Cauffman
National Institute of Standards and Technology
Stop 8610
Gaithersburg, MD 20899-8610

Subject: Responses to Request for Public Comments on WTC Investigation Draft Final Reports (70 Fed Reg 38105 et. sec., July 1, 2005)

Dear Mr. Cauffman:

The International Code Council® (ICC®) submits the attached comments to the National Institute of Standards and Technology (NIST) on the draft NIST reports concerning the WTC investigation (70 Fed Reg 38105). The ICC would like to commend NIST and its subcontractors on the quality and thoroughness of the reports. The level of effort, complexity of the issues, organization and presentation, thoroughness and professionalism associated with and exhibited by the reports is commendable and well represents to others in the U.S. and the world the technical and management capabilities and expertise of the U.S. public and private sectors.

The ICC is a membership association dedicated to building safety and fire prevention. The ICC mission is to provide the highest quality codes, standards, products, and services for all concerned with the safety and performance of the built environment. This mission and the activities of the ICC directly relate to providing a safe physical environment through the adoption, implementation and use of codes and standards developed under the auspices of the ICC and the provision of a robust infrastructure to support those codes and standards. These codes and standards, and the support infrastructure ICC provides for them, coupled with the ICC membership in the public and private sector, are a vehicle through which NIST and others can realize change in and enhancements to the built environment.

The codes developed under the auspices of the ICC, with the involvement of all interested and affected parties, serve as a baseline for the design, construction, operation and maintenance of the majority of both public and private sector buildings in the U.S. Through their adoption and implementation by Federal, state and local government, buildings are increasingly safer and more responsive to the growing challenges we all face.

The ICC Codes (I-Codes®) are readily recognized and understood by building owners, product manufacturers, designers, contractors, code officials and all others involved in building design, construction, approval, and operation. The International Fire Code®, International Building Code®, International Existing Building Code® and 11 other ICC codes contribute to making the built environment safer. Once these reports are finalized ICC encourages NIST to take an active role in the ICC code development process and/or assist others who are motivated to use the research NIST has conducted related to the WTC. ICC staff has provided briefings to NIST staff on this process and will be pleased to

provide additional assistance as required by NIST to facilitate bringing the results of the NIST investigation to the public forum managed by ICC.

The attached comments focus on specific areas in the NIST reports that are associated with building regulations, codes, standards and related issues. All comments are in the form requested by NIST, listing the report number, page, sentence and paragraph and then the comment, reason and suggested revision. In some instances the comments are editorial in nature or suggest clarifying language. Other comments are more substantive in nature and we trust they will be considered in the collaborative and supportive manner in which they are intended.

One common thread in a number of ICC's comments is the manner in which the reports refer to building regulations, codes, model codes, building codes, standards, and similar terms and then also refer to specific documents such as the NYC Building Code, BOCA Basic Building Code, ICC International Building Code, etc. As different NIST authors and contractors were involved in writing the reports it is understandable that different terms associated with building codes, standards, regulations, etc. would be used. Being intimately familiar with the U.S. system of development, adoption, implementation and enforcement of building regulations, ICC had some difficulty with these aspects of the reports and at times questioned the accuracy of portions of the reports.

As these reports will be read with interest by a vast world-wide audience, ICC feels it is important to be clear, consistent and precise when discussing building regulations and associated terms, whether in general or with respect to specific documents. For this reason a number of ICC's comments have attempted to revise the reports so they are consistent and more accurate. In addition, as the U.S. system of building regulations is unique and can be quite confusing to others not intimately familiar with the U.S. system, the ICC has also recommended that an appendix document be developed for the reports that provides an overview of the U.S. system and can serve as a needed foundational piece for better understanding the reports and implementing the recommendations. ICC would be pleased to work with NIST staff on the creation of such an appendix to the reports.

The ICC appreciates the opportunity to provide this input to NIST. Once again ICC would like to commend NIST for the valuable and comprehensive work that has been performed in completing the subject reports. Should additional information be needed, or should NIST want to participate in the code development process or involve ICC further through our relationship with state and local officials and the building community, please do not hesitate to contact us.

Sincerely,

Sara C. Yerkes

Sara C. Yerkes
Senior Vice President of Government Relations

Comments on NIST Reports on World Trade Center Investigation

International Code Council Staff

August 4, 2004

The following comments apply to the report number indicated and are in order of the presentation of reports by NIST (e.g. 1, 1-1, 1-2, etc.). Where comments are made on a particular report and review of reports that form a basis for that particular report (e.g. 1-4D forming a basis for 1-4) indicates the same comment would be applicable ICC assumes that in accepting the comment to the primary report (e.g. 1-4) that the text upon which the primary report is based will be similarly corrected in the supporting report (e.g. 1-4D) and has, therefore not restated the comment from the primary report in its review and comment of the supporting report.

Report Number: NCSTAR 1 (Executive Summary of the Final report)

Page Number: Section E.1 page xli

Paragraph/Sentence: 2nd bullet and item 4

Comment: The terms "codes, standards, and practices" and "building and fire codes, standards and practices" are used and area focus of the objectives of the study.

Reason for Comment: Clarification and to establish an understanding early on the role codes, standards and practices can play in addressing building safety and performance.

Suggestion for Revision: Add a footnote to provide further clarification to the above citations as follows: "The enhancement of building design, construction, and operation can be affected trough mandatory means such as building construction regulations. It can also occur through market forces that create change in the absence of regulatory action. The terms building and fire codes, standards and practices are presented in a generic sense. It is recognized that these documents are typically developed within the U.S. voluntary sector and then made available for adoption as a basis for building regulations as well as voluntary programs outside the regulatory community. In using the terms "codes, standards, and practices" throughout these reports it is the intent of NIST to recommend enhancement, revision, and improvement to such documents as well as to foster their increased adoption and implementation through appropriate building regulatory and voluntary market driven mechanisms."

Page Number: xlv and 172

Paragraph/Sentence: 1st paragraph second sentence on page xlv and last bullet on page 172

Comment: The statement that egress capacity from current building codes is based on single floor calculations should be changed if it is intended to apply to model building codes or clarified if it applies to current NYC building codes.

Reason for Comment: As presented the statement is misleading. First, as noted above, the appropriate term in this case is building regulations. Building codes are one vehicle to address this issue but there are other documents that, while not specifically named building codes, address this issue and are part of a larger set of regulatory documents. From a technical standpoint the issue of egress is based on occupant load and not single floor calculations. Pursuant to Chapter 10 of the International Building Code (IBC), a document adopted by the vast majority of federal, state and local agencies, required egress width is determined based on the total occupant load served by the means of egress. In multi-story buildings the

occupant load associated with each floor would be additive with the load from above stories in determining egress capacity moving downwards through the building.

Suggestion for Revision: "Egress capacity required by the building codes adopted and enforced for the WTC buildings ...."

Page Number: xlv

Paragraph/Sentence: First full bullet

Comment: The report refers to the New York City Building Code. It is not clear at this point in the report if the reader fully understands that building codes, fire codes, standards and practices in New York City are different than most other areas of the United States. This is because presently NYC develops its own building code as opposed to basing their code on national model codes.

Reason for Comment: As written the report is misleading and confusing as to the subject of building codes.

Suggestion for Revision: "...deck, the building code that was applicable to the WTC buildings, which was the New York City building code, required ....." (e.g. be specific as to the code that the WTC was required to be designed and constructed to.)

Page Number: xlv

Paragraph/Sentence: Second full bullet, last sentence

Comment: The cause of the shaft enclosures not being fire rated is not presented.

Reason for Comment: As written the report is misleading.

Suggestion for Revision: "...but under the codes that governed the design and construction of the WTC they were not required to..."

Page Number: xlvi

Paragraph/Sentence: Second bullet, first sentence

Comment: the term "external building code" is confusing. Note also in following the above comments there is a pattern within the report of using different terms to refer to building codes. Each is different and has a specific meaning within the context in which they are used. It is strongly suggested that the report provide, possibly in the footnote suggested above, an overview of the code environment applicable at the time of the construction of the WTC. This should highlight the existence of national model codes, standards and practices on the voluntary sector side as well as the existence of a state code in New York, a separate NYC code and then a separate code for Port Authority structures that applied to the WTC.

Reason for Comment: To clarify the report.

Suggestion for Revision: ".... buildings were not subject to other Federal, state or local codes that might have applied had the Port Authority not been considered as a separate "municipality".

Page Number: xlvi

Paragraph/Sentence: Second bullet, all but the first sentence

Comment: The text may not adequately present the intended conclusion in a defensible manner. As there were a considerable number of "other" building codes at that time it is not likely that the design was compared to those codes. In addition the concept of approval processes is raised. While it is relevant to refer to the approval processes of the Port Authority compared to those of the city, the statement about "other building codes of that time" is not relevant to approval processes as they are determined by state and local government.

Reason for Comment: To improve the accuracy of the report and eliminate confusion between code requirements and approval processes.

Suggestion for Revision: "Nevertheless, the actual design and approval process produced two buildings that appear generally consistent with nearly all of the provisions of the New York City Building Code and the approval processes of the city in effect at that time. The loads for which the building was designed exceeded those of the New York City Code. The quality of the structural steels was consistent with the building specification. The departures from the New York City building code did not have a significant effect on the outcome of the events of September 11."

Page Number: xlvi

Paragraph/Sentence: Fifth bullet, first sentence

Comment: the term "selected other building codes of the day" is too general and misleading. Some readers may also be confused because other building codes applicable in other areas would not logically have wind loading criteria for NYC in them.

Reason for Comment: improve the accuracy of the report.

Suggestion for Revision: "...Code and the wind loads found in national model codes and standards available at the time the WTC was designed." Alternatively note by name the specific "building codes of the day" that were selected and upon which this portion of the report is based.

Page Number: xlvii

Paragraph/Sentence: First paragraph, second sentence

Comment: the term "building codes" is not broad enough to address the point being made. Building codes are a subset of a larger body of requirements commonly considered building construction regulations. Such regulations include the building code but also fire codes, structural design and loading standards and a number of other relevant criteria not found in a "building code" but relevant to the subject of design to address the impact from aircraft.

Reason for Comment: clarify the report.

Suggestion for Revision: "...severity; building construction regulations do not...."

Page Number: xlvii and 200

Paragraph/Sentence: First bullet and item 1

Comment: standards cover the design and construction of structural systems

Reason for Comment: clarification

Suggestion for Revision: "...and the design and construction of ..."

Page Number: xlvii and 200

Paragraph/Sentence: Second and third bullets and items 2 and 3

Comment: procedures and practices do address fire resistance but so to do codes and standards

Reason for Comment: clarification

Suggestion for Revision: "The codes, standards and practices used to ensure..."

Page Number: xlvii and page 200

Paragraph/Sentence: Third bullet and item 3, last sentence

Comment: technical standards are not necessarily barriers to the introduction of new materials. For instance all codes typically include a section on alternative methods of construction and materials that allow anything to be used as long as it can be shown to be no more hazardous or less safe than something specifically allowed by the codes. Through testing, simulation, calculations, etc. such equivalency can be supported. The key, however, is that the barriers are not in the technical or standards side as much as they are in the availability of regulatory officials to review and consider such alternatives and/or the reluctance of building owners and designers to try them due to the additional work that must be undertaken to secure their approval.

Reason for Comment: to ensure the report accurately reflects what is available to facilitate the introduction and use of new technology.

Suggestion for Revision: replace the last sentence as follows: "The introduction of new materials and technologies should be encouraged through increased use of provisions in codes and standards that allow for the assessment of new technology on the basis of performance and education of the design, construction and regulatory communities on ways to measure, express and access such performance."

Page Number: xlviii and page 200

Paragraph/Sentence: second bullet and item 7

Comment: no mention is made of code administration and enforcement. Code administration and enforcement are critical elements in making sure that what is provided by designers and others as meeting code is reviewed at the time of design submittal for code compliance and is then checked during construction to ensure the final building meets code. The recommendation speaks to design, construction, etc. and encouraging code compliance by non-governmental and quasi governmental entities. In reality all buildings of the nature addressed by the WTC investigation will be designed and constructed under federal, state and/or local codes and standards. A recommendation to encourage code compliance is misplaced.

Reason for Comment: as presented the recommendation does not focus on a key component that will ensure better building performance.

Suggestion for Revision: revise the recommendation to read as follows: "The procedures and practices used in the design, construction, review, approval and maintenance and operation of buildings should be enhanced to further ensure that the plans and specifications meet or exceed code. This should be provided at initial occupancy and during the life of the building. The records associated with as-built and operational conditions should be retained during the life of the building. Technological changes applicable to egress and fire detection and protection should also be applied to existing buildings."

Page Number: xlviii and page 200

Paragraph/Sentence: Third bullet and item 8

Comment: there is a need to train all those associated with building design, construction, operation, maintenance, review and approval. As written the focus is on professionals with no inclusion of the individuals in the building regulatory or fire service sectors.

Reason for Comment: increase scope of recommendation to apply to all those who can impact building safety.

Suggestion for Revision: add a second sentence as follows: "The skills of building regulatory and fire service sector individuals should also be upgraded so as to compliment the enhanced skills of building designers and enhance their knowledge of building technology, conformity assessment and other factors affecting delivery and maintenance of safe buildings.

Page Number: xlviii

Paragraph/Sentence: fourth paragraph

Comment: a statement is made about waiting for codes, standards and practices to change. While these documents are relevant to improvements in building safety, as previously noted these documents are part of a larger set of building regulations. In addition, since codes and standards are developed in the voluntary sector, it is more appropriate to recognize that one should not wait until building regulations change.

Reason for Comment: clarification

Suggestion for Revision: "....without waiting for changes to occur in building regulations."

Page Number: xlviii

Paragraph/Sentence: last paragraph

Comment: as written the text does not address federal buildings.

Reason for Comment: clarification and enhancement.

Suggestion for Revision: change to read as follows: "NIST further urges federal, state and local agencies having any responsibility for building design, construction, approval, inspection, operation and maintenance to rigorously implement and enforce building regulations to ensure that the level of safety

intended by those regulations is actually delivered at initial occupancy and during the life of the building. Unless they are satisfied, the best building regulations, codes and standards which make up those regulations and their foundational research cannot effectively provide for the intended public safety."

Page Number: xlix

Paragraph/Sentence: headings under "responsible community"

Comment: the titles applied to "responsible community" are confusing. These need to be changed to more clearly designate who is responsible for each action.

Reason for Comment: clarification

Suggestion for Revision: Change the designations of responsible community to actual job descriptions or titles so individuals will know who has what responsibility. For instance "adoption and enforcement" should be changed to "federal, state and local government agencies". Education and training could be changed to university and college, trade associations, and government.

Page Number: 1

Paragraph/Sentence: last paragraph, second sentence

Comment: the term building codes, as noted before, can have different meanings to different people. The focus should be on the building regulations or building construction regulations, which include building codes but many other requirements such as fire, mechanical, zoning, etc.

Reason for Comment: clarification

Suggestion for Revision: change building codes to building construction regulations (e.g. building, fire, mechanical, electrical, etc. codes, zoning regulations, etc.) It is also suggested that consideration be given to the use of the term building construction regulations or building regulations as appropriate throughout the document when referring to the broad body of requirements applied to buildings and more specific documents such as building code, fire code, etc. when a more precise focus is warranted.

Page Number: 6

Paragraph/Sentence: Second paragraph, last line

Comment: the text refers to allowance by some state and local codes for alternative designs. It is assumed that NIST researched this and the statement is based on code in effect in the late 60's. Virtually all current state and local codes have provisions for acceptance of building designs, materials, and technologies on the basis of equivalent performance. As written the text suggests that "some" do, which may not adequately describe the degree to which performance equivalency is allowed.

Reason for Comment: Clarification.

Suggestion for Revision: change "some" to "most" or if statistical data were not developed that support "some" then eliminate the subjective statement and simply report that state and local codes provide a performance alternative without trying to equate or report how many.

Page Number: 6

Paragraph/Sentence: footnote 3

Comment: reference is made to the prescriptive codes. It is unclear which codes the report is referring to.

Reason for Comment: clarification.

Suggestion for Revision: "...was not accounted for in the building regulations that governed the design and construction of the WTC towers."

Page Number: 8

Paragraph/Sentence: second paragraph

Comment: the report mentions the unique nature of the pre-fabricated modular approach to constructing the steel structural elements but does not appear to cover (at least on page 8) the impact that this has on inspection associated with building regulatory compliance as well as design verification. The report should mention how fabrication of the structural steel elements was inspected off-site, by whom and was determined to satisfy the design, specifications and relevant codes and standards adopted as part of the building regulations.

Reason for Comment: enhance value of the report and to cover the issue of off-site steel assembly fabrication and conformity assessment that is an important element to verifying the building satisfies relevant criteria.

Suggestion for Revision: no suggested revision other than to add a paragraph on the issue or if included elsewhere in the report add a reference to the subject of off-site steel assembly fabrication and conformity assessment activities that occurred to ensure design, specification and building regulatory compliance.

Page Number: 11 and page 12

Paragraph/Sentence: first title on page 11 and last paragraph on page 12

Comment: the title of the section is fire protection systems but the text discusses fire-resistance ratings. Fire protection systems are typically considered sprinklers, standpipes, fire alarm and detection systems, alarms, and smoke control systems. In other words items that protect once a fire has been detected and is underway. The text presented refers to fire-resistance ratings and might not be readily distinguished as fire protection systems. The last paragraph of page 12 then describes the previous discussion about ratings as passive fire protection and then initiates a discussion about sprinklers.

Reason for Comment: increased accuracy for experts and clarification for those who may not recognize the difference between fire protection systems and fire-resistance rated construction

Suggestion for Revision: change title to read "Building construction with respect to resistance against fire" and then add a new title at the bottom of page 12 to read "Fire protection systems". In the alternative leave the text as presented and add an introductory paragraph or "sidebar" to explain the subtleties between active and passive fire protection systems.

Page Number: 15

Paragraph/Sentence: third paragraph, second sentence

Comment: the text suggests that automatic sprinklers, covered in detail on page 12, were installed after the building was initially designed and occupied. This would seem to be a significant fact that may not be readily apparent to most readers. It also appears that the application of automatic sprinklers allowed the removal of some of the passive fire protection systems (e.g. fire-rated construction).

Reason for Comment: enhancement of information on the WTC buildings as designed and as they existed in 2001.

Suggestion for Revision: include text that better covers the as built situation regarding active and passive fire protection and what occurred over time and the end result with respect to these issues in 2001. Include also the driving forces for these changes (e.g. addition of sprinklers and elimination of passive fire protection assemblies).

Page Number: 15 to 17

Paragraph/Sentence: all text

Comment: after considering the above comment and reading further there is discussion about food service, stairways from floor to floor, etc. that would make it appear that over the life of the building that renovations, tenant build-outs, and other modifications were made to the tenant spaces. These could have an impact on the building systems, egress, fire protection, etc. associated with the building. They may or may not have tracked with the Port Authority requirements or building construction regulations and codes, standards and practices that were considered current at the time.

Reason for Comment: the report seems to be missing needed information on how the buildings were modified over time.

Suggestion for Revision: include a few paragraphs describing what occurred in the building over time related to major change to tenant spaces and how that was addressed by the relevant building regulations, if at all.

Page Number: 26

Paragraph/Sentence: sidebar

Comment: the text refers to the NYC building code as not requiring the roof to be accessible for emergency escape. As noted in previous comments if the building was not under the NYC building code but instead that of the Port Authority then it would seem the sidebar should cover what the Port Authority required at the time. In addition it may be relevant to cover if and when such roof access became prevalent in model building codes and why the WTC had not modified the buildings to allow for roof access either voluntarily or in response to renovation or building modification that would have caused some upgrading of the building.

Reason for Comment: clarification and accuracy

Suggestion for Revision: change sidebar to refer to what the Port Authority required and as necessary include addition coverage in the text on the issue of roof access as suggested in the comment above.

Page Number: 28

Paragraph/Sentence: last paragraph, second sentence

Comment: it is noted that temperature is provided in degrees C (SI) while dimensions in the report, such as on the next page, are given in IP dimensions. There should be consistency throughout the reports with respect to the convention chosen.

Reason for Comment: clarity and consistency

Suggestion for Revision: use throughout the document IP with (SI)

Page Number: 51

Paragraph/Sentence: second paragraph, first sentence

Comment: model codes are not developed by model code organizations themselves but are developed under the processes and procedures they provide for the public at large, building industry, designers, government and all interested parties to come together and address building safety issues.

Reason for Comment: clarification

Suggestion for Revision: change sentence to read "...(model codes) developed under the auspices of private sector organizations through the involvement of all interested and affected parties in the development process."

Page Number: 51

Paragraph/Sentence: second paragraph, second sentence

Comment: the text does not accurately describe the model code process and the issue of development is now covered in the above comment.

Reason for Comment: clarification

Suggestion for Revision: delete the sentence as it is covered by the comment below.

Page Number: 51

Paragraph/Sentence: second paragraph, other than first two sentences

Comment: The text is not accurate with respect to the process.

Reason for Comment: clarification and accuracy.

Suggestion for Revision: Change the remainder of the paragraph (that not covered by the previous two comments) to read as follows: "Proposals to update the ICC model codes, submitted by individuals, organizations and any interested party, are published and made available for public comment at public hearings where a committee of balanced interests recommends a disposition on each proposal. The results of those hearings are published for public comment and a second hearing is held to discuss those proposals on which a public comment was submitted. The final disposition of all proposed changes is through a vote by federal, state and local government agency participating in this second hearing. The result of the process is published as a new edition of the code (every three years) or as a supplement to the

code (18 months between each new edition). Federal, state or local government who regulate building design and construction will adopt these model codes as a basis for their building construction regulations. Adoption typically lags publication of new editions of the model code by 6 to 18 months and may also involve amendment of the model code by the adopting entity. To a lesser and decreasing extent, federal, state and local government have developed their own unique building construction regulations until now no state and only a handful of local governments do not use the model codes as a basis for their regulations. The federal government role in this process has increased due to the National Technology Transfer and Advancement Act and most federal agencies with authority to adopt and implement building regulations adopt model codes pursuant to 40 USC Chapter 12 Section 619 or refer to the state or local code applicable where the federal building is located."

Page Number: 51

Paragraph/Sentence: third paragraph, first sentence

Comment: standards developers do not develop the standards but instead provide a process by which interested parties come together to develop standards.

Reason for Comment: clarification.

Suggestion for Revision: revise sentence to read as follows: "The model codes adopt by reference a number of standards developed within the voluntary sector under the auspices of a sponsoring organization."

Page Number: 51

Paragraph/Sentence: fourth paragraph

Comment: stakeholder groups are not necessarily responsible for the codes via the code development process. They do participate but, as written, the text seems to convey that they have more control over the process. These groups are not the only entities that provide training. The entities under which the model codes and standards are developed also provide training. In addition the frequency of participation by the general public and building occupants, while true, is confusing. The processes are totally open and all can participate.

Reason for Comment: clarification.

Suggestion for Revision: change to read: "...that participate in the code development process and through this participation and other mechanisms not related to the codes influence the design, construction, operation and maintenance of buildings. These include... and insurers. Organizations representing these groups, in addition to the codes and standards organizations provide training on the aforementioned regulations and this training has a significant impact on the implementation of the codes on a federal, state and local level."

Page Number: 51

Paragraph/Sentence: last paragraph

Comment: it is not clear to the reader, given the previous discussion on model codes and standards, what the basis for the NYC code is or was.

Reason for Comment: clarification.

Suggestion for Revision: Add a sentence or sidebar statement indicating to the reader that the NYC code has been a "home grown" city-developed code since its inception and only now with the planned adoption of the International Building and Fire Codes will NYC become one of the last local jurisdictions yet to migrate from development of their own self-written regulations to basing them on a model code.

Page Number: 52

Paragraph/Sentence: first paragraph, last sentence

Comment: changes to building construction regulations are not typically retroactive until an existing building undergoes renovation. As presented, the reader is under the impression that new code provisions would never apply to an existing building.

Reason for Comment: clarification and accuracy.

Suggestion for Revision: change sentence to read: "In general changes to building regulations will not apply retroactively to existing buildings that are not undergoing any renovation or major work. Existing buildings that are having work done will typically have the work being done covered by the code in effect at the time of the work and depending on the extent of the work the entire building could be required to comply with the code as if it were new construction."

Page Number: 54

Paragraph/Sentence: first paragraph

Comment: the report notes a comparison of the 2001 NYC code to the 1968 edition. It would be important to point out how the 1965 BOCA Basic Building Code had changed over the years and compared to the 2000 International Building Code, which took the place of the BOCA code.

Reason for Comment: three documents available in 1965 are mentioned and compared to the NYC code and then the old and new editions of the NYC code are compared. The latter comparison suggests that there was little change. There most likely was considerable change in the model codes over that same period and that should be highlighted.

Suggestion for Revision: Include a sentence indicating (after review and confirmation) that there were significant changes in the model codes during the same comparative period; changes that addressed new technology and building safety and then list some of the more important innovations.

Page Number: 55

Paragraph/Sentence: second paragraph, first sentence and last sentence

Comment: it is unclear which model building codes are being referred to. Previous text has referred to model codes in general, the BOCA Basic Building Code, etc. The text should be specific as to which model codes and what editions or make the statement more general as suggested below. The last sentence is also confusing as there are no Class 1B standards per se.

Reason for Comment: clarification.

Suggestion for Revision: revise to read as follows: "Model building codes typically classify…"Classes," and in some cases subdivisions within a Class." Also "The Port…..to provide the WTC towers with fire protection as required for Class 1B buildings under the NYC Building Code."

Page Number: 57

Paragraph/Sentence: fifth paragraph, last sentence

Comment: as occupant load is additive and would be expected to increase in lower stories as additional floors are added the codes need not refer to building height when the codes provide for total available egress width as a function of occupants served.

Reason for Comment: clarification

Suggestion for Revision: re-review the codes and as warranted correct the text to address the concept that as building height increases the occupant load would increase and the methodology for establishing required egress width would automatically account for an increased occupant load attributable to multiple stories.

Page Number: 57

Paragraph/Sentence: last paragraph, second sentence

Comment: it is noted that the 2003 edition of two codes are used and the 2000 edition of the IBC. The 2003 edition of the IBC was available at the time this work was performed and should have been used. Also delete the reference to NFPA 5000. The criteria for egress are found in NFPA 101 (Life Safety Code) and, as that document was previously referenced in the report, it should be a basis for comparative work on egress.

Reason for Comment: consistency and comparability.

Suggestion for Revision: any work that requires consideration of contemporary model codes should be based on the latest available documents and where multiple documents are used they should be comparable (e.g. all 2003). Also delete the reference to NFPA 5000 and replace it with a reference to the Life Safety Code.

Page Number: 58

Paragraph/Sentence: second paragraph

Comment: See comment to page 57 regarding reference to the Life Safety Code and comparability of editions of referenced documents (e.g. all 2003).

Reason for Comment: see comment to page 57

Suggestion for Revision: see comment to page 57

Page Number: 173

Paragraph/Sentence: first bullet

Comment: it is stated that the building was constructed with three independent means of egress but that the NYC Building Code would have required four. As noted on pages 51 and 52 the buildings were not required to comply with any building code but the Port Authority directed they comply with the NYC Building Code (2nd and 3rd drafts of what would become the 1968 NYC Building Code). Given that directive it is unclear how the building, as reported on page 173, could have been built with three instead of four independent means of egress.

Reason for Comment: inconsistency in the report.

Suggestion for Revision: while no specific language suggestions can be provided it is suggested that the report address why if the Port Authority required compliance with the NYC Building Code that in the case of independent means of egress the building was provided with only three instead of the required four means.

Page Number: 174

Paragraph/Sentence: first bullet and fourth under objective 3

Comment: the bullet indicates that the design and approval process produced buildings that were consistent with nearly all the provisions of the NYC Building Code and other building codes of the time. What are the other codes? Throughout the report mentions the New York State code, the BOCA Basic Code and other state and local codes. This can be confusing for the reader and should be clarified or a footnote added in the report that explains what NIST considers "other building codes" either in general or by specifically naming them. It also indicates that the design loads exceeded those of the codes. Which codes? The last sentence then refers to departures from the codes and standards. Which codes and standards? This seems to conflict with the previous sentence in the paragraph that indicates that the buildings were nearly consistent with the codes. The fourth bullet also refers to "other selected building codes of the day". Which ones?

Reason for Comment: clarification

Suggestion for Revision: provide the reader information on what "other codes" were considered and additional insight into where the buildings were not consistent with the provisions of the NYC Building Code and those other codes. NIST may want to consider including an article on the status of federal, state and local building code adoption and implementation in the late 60's and beyond that the reader can refer to for additional information. In having such an article, sidebar, appendix or document available then terms such as "other codes" could be clearly used and understood by the reader.

Page Number: 189

Paragraph/Sentence: fifth bullet

Comment: the report mentions that design drawings and other documents related to building approval are not normally required to be remotely stored from the building. This is not correct. Federal, state and local authorities having jurisdiction that are involved in building approval will have copies of design drawings and approval files. The second sentence adds nothing to the report other than to establish a baseline for expressing the performance regarding document retention. The inaccuracy of the sentence establishes the comparative baseline lower than it should be.

Reason for Comment: clarification

Suggestion for Revision: delete the second sentence.

Page Number: 189

Paragraph/Sentence: sixth bullet

Comment: the statement about a fire protection engineer still not required to be involved in the building design may be true with respect to the NYC Building Code, but that is unclear in the report. Contemporary model codes would require construction documents be prepared by a registered design professional, which is determined by state and local rule and would typically include a fire protection engineer on a building of this nature.

Reason for Comment: clarification

Suggestion for Revision: indicate that the statement applies to the current NYC Building Code or clarify it so it represents what is currently required by state and local building regulations.

Page Number: 191

Paragraph/Sentence: last sentence

Comment: the previous text refers to the differences associated with the 1938 and 1968 NYC Building Codes and their impact on the WTC design and by inference safety. The last sentence says these reductions are contained in current codes. Which ones? More importantly a reduction requires two reference points of comparison. Is the statement that current codes contain these reductions based on their comparison to the 1938 NYC Building Code, previous versions of those codes, or some other baseline? As written the statement would lead a reader to conclude that current codes are not satisfactory based on the 4 comparative points presented when in fact buildings are now considered as entire systems more today than in the past and there are numerous technologies available that make such reductions possible while ensuring safety to life. Consider fire escapes. Does their elimination as a requirement in new buildings mean such buildings were no longer safe?

Reason for Comment: the text is misleading

Suggestion for Revision: delete the sentence as it adds little to the report or if it is to be retained then provide specifics as to which codes are considered, the basis for comparison, and quantify exactly which and how many of the items in question are relevant.

Page Number: 192

Paragraph/Sentence: last bullet

Comment: it is noted that no code provision for fire testing existed. Which code? As previously noted the report has references to specific codes and codes in general. It is important in making statements to be specific as to the code in question. In this instance it is likely the NYC Building Code applies yet the more general term code is used, creating confusion. Where a generic "code" is intended then a footnote or other information as previously suggested that provides an overview of the "code situation" outside NYC at the time and today would be helpful to readers as they encounter more generic references to "code" in the report.

Reason for Comment: clarification

Suggestion for Revision: cite the specific code, which is assumed to be the NYC Building Code.

Page Number: 193

Paragraph/Sentence: first bullet

Comment: the current edition of the IBC is the 2003 and should be referenced as previously noted (as 2003 editions of other codes were referenced). Also the parenthetical (one of two current model codes) is misleading and unnecessary. The IBC is the only current model code. The other document that is available for adoption is a standard and not a model code. This, coupled with the reference in the bullet to the UBC, highlights the need for an appendix to the report or associated document that can explain the entire subject of codes and standards development, adoption, implementation and enforcement in general terms both in the late 60's and now. Availability of this information would allow the reader to more clearly understand the situation outside NYC rather than interpret "code", "contemporary codes", "model codes", etc.

Reason for Comment: consistency and accuracy

Suggestion for Revision: change 2000 to 2003 and delete the parenthetical statement about number of model codes.

Page Number: 193

Paragraph/Sentence: third bullet

Comment: the first sentence indicates that there are no inspection requirements for inspection of SFRM. This may be true for the NYC Building Code but the statement, coupled with previous references back and forth between specific code titles and more general terms such as "current codes" could lead the reader to conclude that no where are such inspections required. This is not the case as indicated in Section 1704.11 of the 2003 IBC.

Reason for Comment: the report is misleading and depending upon interpretation incorrect

Suggestion for Revision: change the first sentence to refer to the NYC Building Code by name as the source upon which the statement about lack of required inspections is based.

Page Number: 194

Paragraph/Sentence: second bullet

Comment: the term building code is not specific

Reason for Comment: clarification

Suggestion for Revision: refer to the NYC Building Code

Page Number: 194

Paragraph/Sentence: sixth bullet

Comment: the term current model building codes is not specific

Reason for Comment: clarification

Suggestion for Revision: as previously noted the report should be specific where possible. In this case either name those codes or provide in a separate appendix as previously suggested general information on code development, adoption, implementation and enforcement to assist readers who may not fully understand the subtleties of the U.S. building regulatory system. This is important for U.S. readers but even more important for readers outside the U.S. who are more likely used to a national code developed in a more governmental setting than our voluntary system and consideration of state and local government authority.

Page Number: 197

Paragraph/Sentence: title of section

Comment: the words "who is in charge?" will suggest different things to different people; especially the legal community and those outside the U.S. In addition, as previously commented the broad subject may be better conveyed as building regulations.

Reason for Comment: to present the U.S. system in an accurate manner

Suggestion for Revision: change title to read as follows: "Building Regulations"

Page Number: 197

Paragraph/Sentence: first paragraph

Comment: see comments to page 51 which includes the same text

Reason for Comment: see comments to page 51

Suggestion for Revision: see comments to page 51

Page Number: 197 and 198

Paragraph/Sentence: all of the text

Comment: the information is not presented in the correct order, includes information that is not relevant and has some errors that should be corrected

Reason for Comment: accuracy and clarification

Suggestion for Revision: Revise section 9.1 to read as follows:

"Building construction regulations for the .....hand.

The United ..... to development, adoption, implementation and enforcement of building construction regulations. In virtually...national building construction regulations. In the U.S. the private sector develops model codes and standards with active participation by the building regulatory community and government. These model codes and standards are adopted by state and local government, who are

granted the authority under the U.S. Constitution for such action, to govern building design, construction, operation and maintenance. In some states the adoption applies statewide while in others adoption may only apply to state-owned buildings with regulations for private sector buildings up to local government control. They are also adopted by Federal agencies to address Federal construction and in some cases are the basis for Federal rules that apply throughout the country (e.g. minimum energy efficiency of heating and air conditioning equipment). Once adopted, they are implemented by those responsible for building design and construction and enforced by authorized agencies of state and/or local government. Due to many factors in the public and private sectors Federal, state and local government building construction regulations have become increasingly uniform.

With some exceptions the building construction regulations adopted by Federal, state and local government are based on ..... Columbia adopt the ...Columbia adopt the...is adopted in ... all jurisdictions.

Model codes are developed under the auspices of private sector organizations such as the ICC. Proposals to update the model codes, submitted by individuals, organizations and any interested party, are published and made available for public comment at public hearings where a committee of balanced interests recommends a disposition on each proposal. The results of those hearings are published for public comment and a second hearing is held to discuss those proposals on which a public comment was submitted. The final disposition of all proposed changes is through a vote by federal, state and local government agency participating in this second hearing. The result of the process is published as a new edition of the code (every three years) or as a supplement to the code (18 months between each new edition). As covered above, Federal, state or local government who regulate building design and construction will adopt these model codes as a basis for their building construction regulations. Adoption typically lags publication of new editions of the model code by 6 to 18 months and may also involve amendment of the model code by the adopting entity. To a lesser and decreasing extent, federal, state and local government have developed their own unique building construction regulations until now no states and only a handful of local governments do not use the model codes as a basis for their regulations. The federal government role in this process has increased due to the National Technology Transfer and Advancement Act and most federal agencies with authority to adopt and implement building regulations adopt model codes pursuant to 40 USC Chapter 12 Section 619 or refer to the state or local code applicable where the federal building is located.

The model codes adopt by reference....developed under the auspices of ...coordinates the development of standards in the U.S.

In addition...that participate in the development and adoption of the model codes and standards on behalf of their constituents. These groups, as do the model code and standards developers, also provide training on building design and construction practice and the provisions of the model codes and standards.

Enforcement of the adopted building construction regulations occurs through the submission of plans and specifications and their review for compliance with adopted codes and standards by Federal, state or local government having authority for enforcement where the building is to be located. Compliance is further ensured through on-site inspection during construction by applicable Federal, state and local authorities as well as state and local licensing laws.

The ...NIST is...Commerce. NIST, as with other federal agencies who conduct research and/or participate with the voluntary sector in development of model codes and standards, does not establish building....develop model codes and standards, which....safety.

Rigorous enforcement of building construction regulations by the responsible agencies by well trained and supported agency staff is critical to ensure that what is intended in the model codes and standards is actually delivered at the initial point of occupancy of a building and during the life of the building. They in turn need a reliable conformity assessment system that validates the acceptability of testing labs and quality assurance agencies who act on their behalf. To facilitate implementation of the model codes and standards, the building design and construction community also need training and support. Unless those responsible for determining compliance are trained and adequately supported and those who are regulated have the same basis of knowledge the best model codes and standards, while admirable, are not put into practice and cannot protect the building and its occupants.

Page Number: 198

Paragraph/Sentence: last paragraph, second sentence

Comment: it appears that NIST views its recommendations as making buildings safer. It will be important to review the recommendations to determine which ones can be implemented and apply to existing buildings and which ones cannot.

Reason for Comment: recommendations related to building regulations typically apply to new buildings and existing buildings undergoing renovation or modification. The issue of building safety in existing buildings is difficult to address without building regulatory provisions, which are difficult to impose on existing buildings, or incentives that cause action in the absence of mandate.

Suggestion for Revision: clarify here the degree to which the recommendations apply to new and existing buildings and the manner in which NIST suggests they be implemented.

Page Number: 199

Paragraph/Sentence: first paragraph, first complete sentence

Comment: it appears NIST is recommending codes and standards developers consider the recommendations. With respect to changing model codes and standards, as noted above, the developers in reality oversee and provide a process where interested parties can come together to affect change. It is NIST and other interested parties who are the developers of the model codes and standards and through the processes of the sponsoring organization the recommendations for change can be accepted and implemented.

Reason for Comment: clarification

Suggestion for Revision: revise the text to make a call for all interested parties to work together in developing changes to model codes and standards based on appropriate recommendations.

Page Number: 201

Paragraph/Sentence: first bullet

Comment: the list of responsible communities is confusing as what is listed is not a community but an activity area related to achieving better buildings.

Reason for Comment: clarification and to facilitate implementation of the report recommendations

Suggestion for Revision: suggest changing responsible community to area of focus with the sub-bullets being improve professional practices and guidance, enhance provisions in model codes and standards, further adoption and enforcement of those model codes and standards, conduct research to provide a basis for future change in model codes and standards and their implementation, and develop and deploy education and training for all those involved with building design, construction, operation and maintenance

Page Number: 201

Paragraph/Sentence: recommendation 1, second line

Comment: nationwide adoption could be construed to mean preemptive federal requirements. In addition model codes and standards have been generally referred to throughout the document and should be referred to in this case. Model codes provide the basis for building regulations and standards are referenced in the model codes.

Reason for Comment: clarification

Suggestion for Revision: revise sentence to read as follows: "...development research and documentation to support change and enhancement to model codes and standards to implement the results of the research along with ..."

Page Number: 202

Paragraph/Sentence: first paragraph, section under national model codes

Comment: model codes should be referred to simply as model codes. The recommendation that state and local government should adopt and enforce the improved model codes is confusing as a jurisdiction would only need to adopt one model code. It has taken significant effort for the U.S. to get to where it is today with respect to building regulations. With minimal federal preemption the voluntary sector and state and local government are almost on the same page. Furtherance of the objectives of the WTC study will be ensured if all federal, state and local agencies work together and do not dilute the critical mass moving toward a truly national code in the U.S. Note also that incorporation of the reference standard in the model code would allow that standard, after coming out of the standards development process, to be subject to further modification through the model code process.

Reason for Comment: clarification and to facilitate implementation of the recommendations by focusing everyone's efforts on a singular set of model codes and standards.

Suggestion for Revision: revise to read as follows: "...conditions. Model Codes: the standards should be adopted in the model codes by mandatory reference to the latest reference to the standard with any necessary language to facilitate integration of the standard with the code. Federal, state and local agencies should be encouraged to adopt and enforce one singular model code and the referenced standards therein based on...intent."

Page Number: 203, 204, 206 and subsequent pages

Paragraph/Sentence: recommendation 2, last paragraph, last sentence, recommendation 3, last sentence, recommendation 5, last sentence, recommendation 6, last sentence, and numerous subsequent places in the report

Comment: that incorporation of the reference standard in the model code would allow that standard, after coming out of the standards development process, to be subject to further modification through the model code process. This could overly complicate and confuse the development and adoption of the standard.

Reason for Comment: to ensure the report provides appropriate recommendations

Suggestion for Revision: delete ", or incorporation of,"

Page Number: 205

Paragraph/Sentence: first paragraph

Comment: the recommendation that model building code committees review, develop and submit changes to the codes is not consistent with the processes by which the codes are developed. As such the recommendation has little chance of being implemented.

Reason for Comment: the model codes are developed with input from all interested and affected parties and in the case of the ICC process there is strong reliance on individuals, organizations and others to prepare and submit code changes as opposed to that being done by committee. The ICC does have the ability to establish ad hoc committees and has done so on many emerging issues. That being said all interested and affected parties must work together to develop, submit and support proposed changes to the codes. NIST should consider working with interested parties to actually generate appropriate code changes to accomplish the recommendations in the reports.

Suggestion for Revision: change to read as follows: "Interested and affected parties working cooperatively under the auspices of an unbiased third party organization such as the National Institute of Building Sciences (NIBS) should undertake....above and then adapt that work as proposed revisions to the national model codes and undertake the necessary steps to secure approval of those revisions."

Page Number: 206

Paragraph/Sentence: second bullet

Comment: the report states that SFRM inspection procedures are not required by codes. This is not true as previously noted. Chapter 17 of the International Building Code covers special inspections and Section 1704.11 specifically addresses SFRM. While the investigation may have determined that codes related to SFRM inspection might not have been enforced with respect to the WTC buildings, the data forming the basis for the report do not support NIST being able to make any broad statement that essentially reports, "existing standards of practice related to SFRM inspection and codes are not enforced".

Reason for Comment: accuracy of the report

Suggestion for Revision: "... they are not required by all codes (the 2003 IBC in Chapter 17 does require such inspections). Further.... recommendation"

Page Number: 206

Paragraph/Sentence: recommendation 6

Comment: add a new bullet to address in-situ monitoring of SFRM adherence and retention in place

Reason for Comment: technology exists by which building materials, products and systems can be continuously monitored to ascertain their performance when such materials, products or systems are not readily available for inspection.

Suggestion for Revision: add a new bullet to read: "Current and developing technology should be reviewed and research conducted with the intent of developing remote means to monitor and report on the in-situ condition of SFRM on an ongoing basis."

Page Number: 207, 208, 209 and subsequent pages

Paragraph/Sentence: first paragraph and recommendation 8, last sentence to recommendation 10, last sentence to recommendation 11 and numerous other locations in the report

Comment: the use of the term "national" to describe model codes is misleading. While the model codes are developed by organizations that have a national scope the use of the term conveys that as developed these are national documents. While they certainly address national needs and variables such as wind and snow load, the term national in our voluntary system is really placed on a code based on its level of adoption. These documents are simply model codes or model building codes where the subject is referring just to the building code. Also note that federal agencies are adopters of model codes.

Reason for Comment: accuracy and clarity

Suggestion for Revision: delete the term "national" where the term "model building codes" is used. Also change the last sentence to read as follows: "Federal, state and local....one of the model building codes."

Page Number: 207 and 208

Paragraph/Sentence: recommendation 9

Comment: NIST recommends performance-based standards and code provisions and then references a number of standards and standards organizations that should focus on that issue. Then NIST recommends that the model building codes adopt those performance standards. See previous comments on the issue of incorporation of standards into the model code and use of the term "national" when describing the model codes. The text does not recognize the ICC International Building Performance Code that provides performance-based code provisions already to address the subject issue. If NIST believes that code does not adequately address this issue then certainly, as suggested in other recommendations, interested organizations and individuals should work to develop and secure enhancements to that code. To recommend the creation of an additional, duplicative model regulation is not in the public's best interest.

Reason for Comment: the report fails to recognize an existing solution that is not included in a recommendation

Suggestion for Revision: revise the first sentence of the recommendation to read as follows: "NIST recommends the development of new and enhancement of existing: (1) performance....."

Revise the recommendation to recognize the ICC International Building Performance Code and recommend whatever enhancements NIST believes are necessary.

Revise the last sentence to read as follows: "Model Codes: The performance code should be adopted as an alternate method in the model building codes by mandatory reference to the latest edition of the

performance code. In addition the International Building Performance Code should be reviewed and enhanced if necessary."

Page Number: 211, 212 and subsequent pages

Paragraph/Sentence: last paragraph to recommendation 16 and recommendation 17 and subsequent places in the report

Comment: the report references NFPA 101 as a standard when it is a code entitled the Life Safety Code. As such it provides a model on the issue of egress that federal state and local jurisdictions can adopt if they so choose and should not be included as a standard but considered as part of the model building and fire codes. Also with respect to recommendation 17 there is an additional standard (ICC/ANSI A 117.1) that should be referenced with respect to design and egress for persons with disabilities; an issue mentioned in the report.

Reason for Comment: clarification

Suggestion for Revision: delete reference to NFPA 101 as a national standard and change the last paragraph of recommendation 16, 17 and subsequent recommendations as warranted to read as follows: "Model Building, Fire and Life Safety Codes: These documents should be updated and enhanced as warranted to so as to not restrict or impede building occupants from evacuation drills and to the degree possible support the conduct of such drills".

Delete NFPA 101 as an affected standard in recommendation 17 and add as suggested above to as a model life safety code. Also add ICC/ANSI A117.1 to the list of reference standards as it addresses access to building for persons with disabilities and is the logical source document for addressing how such individuals would be addressed in building evacuation.

Page Number: 211

Paragraph/Sentence: last sentence to recommendation 16

Comment: this appears to be the only recommendation where the issue of affected organizations is addressed and selected entities are listed. Why is this not the case with other recommendations? In reality there are many organizations that can and should take lead and secondary support roles in addressing all of these recommendations. Rather than list a few for this one recommendation it may be more appropriate to cover this issue in a general statement preceding all the recommendations. With respect to this particular recommendation we can think of a number of organizations that should be listed as being affected (either because they can take some action or would be affected by the actions of others). Recognize also that every person in the United States and many outside the U.S. will be impacted by the recommendations in this report.

Reason for Comment: clarification and consistency throughout the report

Suggestion for Revision: delete any listing of affected national organizations for this recommendation and include a general discussion on the subject of interested and affected parties and organizations and their roles at an appropriate place in the report.

Page Number: 218

Paragraph/Sentence: Group 8 on education and training

Comment: the focus of this group is on professional skills of building and fire safety professionals (engineers and architects). Certainly they can and do have a significant impact on the development and implementation of designs and technology to address many of the issues raised in the report. They can also affect change in codes and standards and to the degree to which they are retained during construction or required by code to be on-site they can have an impact on actual construction. The report also mentions code officials, the fire service and other individuals involved in implementation and enforcement of the codes and standards that the report addresses and suggests are improved. These individuals are not only responsible for initial design and construction but for the building as occupied, years after the design professionals are out of the picture. The building regulatory and fire service should also be addressed via enhanced education and training.

Reason for Comment: the report does not support a significant opportunity to enhance future building safety

Suggestion for Revision: add a new sentence to read as follows: "The skills of the building regulatory and fire service should be comparably upgraded to ensure they have the same baseline understanding as design professionals and the necessary skills to conduct building review, inspection and approval tasks for which they are responsible."

Also develop and include a new recommendation to address continuing education curricula and programs targeted at the building regulatory and fire service sectors.

Page Number: 222

Paragraph/Sentence: Table 9-2a

Comment: ICC/ANSI A 117.1 dealing with access to buildings for persons with disabilities is relevant and should be added. NFPA documents such as 1, 70 and 101 are not standards but are model codes that cover specific subjects that can be adopted and implemented directly.

Reason for Comment: accuracy and clarification

Suggestion for Revision: add ICC/ANSI A 117.1 to the list of standards. Move NFPA 1, 70 and 101 to the list of model codes.

Page Number: 224

Paragraph/Sentence: Table 9-2b

Comment: the International Building Performance Code is another model code that is relevant to the report and provides an opportunity to affect change

Reason for Comment: accuracy and completeness of the report

Suggestion for Revision: add International Building Performance Code to the table for groups 2 and 7 and recommendations 1-24, 26-29

Page Number: 224

Paragraph/Sentence: Table 9-2c

Comment: the ICC is affected by many more of the recommendations

Reason for Comment: accuracy

Suggestion for Revision: the ICC is in some way, as a publisher of model codes, developer of standards and provider of products and services in support of those codes to the entire building community, affected by all the recommendations and consideration should be given to listing ICC with other recommendations.

In reality many more organizations can and should be added to the report and through the public review process it is assumed they will step forward.

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Page Number: xxvi

Paragraph/Sentence: last bullet

Comment: the term national building and fire codes is misleading in that it suggests that the U.S. has such documents within the federal sector. As suggested under comments to Report Number NCSTAR 1, NIST should use the terms building code, fire codes, standards or model codes throughout the documents. Further explanation of how the U.S. system works regarding development, adoption, implementation and enforcement of these documents is also needed for both U.S. and foreign readers that may not fully understand the U.S. system. NIST is encouraged to use "Getting Building Technology Accepted", produced for and available from the U.S. Department of Housing and Urban Development as a basis for this needed general treatise on the subject.

Reason for Comment: clarification and to enhance the application and intent of the reports by entities who may not fully understand all the nuances of the U.S. system.

Suggestion for Revision: delete "national" and use the term "model building and fire codes, voluntary standards, and practices" throughout when referring to the broad group of documents that are the target for change pursuant to the WTC reports.

Page Number: xl

Paragraph/Sentence: first full paragraph

Comment: It is noted that Section E.3 provides information on codes in effect during the 1960's and compares those codes to the NYC Building Code of the time. This establishes as basis for comparison amongst different documents of the time. Then certain reference standards are included in the comparison. Finally the comparison is updated as to the then and 2001 NYC Building Code and certain reference standards. Since the "jump" is made with respect to comparison of certain reference standards there should also be a "jump" made for contemporary model building codes. It is suggested that a comparison with the 2000 or 2003 International Building Code also be included as a basis of reference with the model building codes of the time (e.g. BBC and UBC referenced in the document).

Reason for Comment: completeness of the document and to address comparability of current and past model codes with the companion comparisons for NYC codes and reference standards.

Suggestion for Revision: the comparative work is not complete and when completed should be appropriately referenced and highlighted in the report.

Page Number: xlvi

Paragraph/Sentence: first paragraph, second sentence

Comment: it is not normal practice to apply building code changes to existing buildings when such buildings are not undergoing renovation, repair, and other changes. It is, however, a requirement in most codes that existing buildings undergoing renovation, repair, addition, etc. meet certain provisions of the codes based on the nature of the work being undertaken in the existing building. This may not be clearly conveyed as currently written in the report.

Reason for Comment: clarification

Suggestion for Revision: revise second sentence to read as follows: "...changes to existing buildings not undergoing renovation, repaid, addition or other change, but the ...."

Page Number: xlvi and 149

Paragraph/Sentence: fourth paragraph, last sentence and fourth paragraph, last sentence

Comment: a reference is made to requirements for voice systems and the text infers that such requirements appeared in national standards. Standards typically provide guidance on product and system design, construction and performance. Codes would typically indicate if and to what degree such systems were required and mandate a level of performance. In addition, as previously suggested, the term national may be misinterpreted by those familiar with the U.S. system.

Reason for Comment: clarification

Suggestion for Revision: revise the last sentence to read: "Standards for voice systems were first developed in the early 1980's and requirements for such systems first appeared in model codes in the mid 1980's, at the...."

Page Number: xlviii

Paragraph/Sentence: third paragraph, last sentence

Comment: it is not clear which "code" is being referred to in the text. Since the terms code, model code, national building code, NYC Building Code, etc. are used throughout the document it is important that a clear convention be established so there is no confusion.

Reason for Comment: clarification

Suggestion for Revision: specify the "code" being referred to (which is assumed to be the NYC Code).

Page Number: xlviii

Paragraph/Sentence: fourth paragraph, first sentence

Comment: as previously noted there are instances where existing buildings are covered retroactively by the building code.

Reason for Comment: clarification

Suggestion for Revision: revise to read as follows: "...retroactive requirements or when the existing building may have renovation or repair work causing application of the adopted and current building and/or fire codes to the existing building."

Page Number: xlix

Paragraph/Sentence: second paragraph, last sentence

Comment: the name of the firm is Jaros, Baum and Bolles

Reason for Comment: typo

Suggestion for Revision: change Guam to Baum

Page Number: lv

Paragraph/Sentence: finding 16, first and second sentence

Comment: the text is incorrect in indicating that inspection procedures do not exist in codes. Chapter 17 of the 2003 IBC addresses special inspections and Section 1704.11 covers sprayed fire-resistant materials including an assessment of structural member surface conditions, application, thickness and density. The text is also incorrect in stating that provisions are not available to address installed thickness and variability compared to that specified in the plans and specifications.

Reason for Comment: clarification and accuracy

Suggestion for Revision: change the first sentence to indicate (if warranted) that more rigorous provisions beyond those in current model codes are needed (based on an assessment covered in the report indicating why such requirements such as those in Section 1704.11 of the IBC are not rigorous enough. If such data do not exist to show how these provisions are inadequate or not rigorous enough then delete the second sentence.

Page Number: lv

Paragraph/Sentence: finding 17

Comment: the ICC International Performance Code for Buildings and Facilities does address structural design and includes consideration of the magnitude of different events including technological hazards associated with fires and explosions. To infer in the report that no such performance criteria exist is misleading.

Reason for Comment: clarification

Suggestion for Revision: mention the ICC Performance Code, cover any limitations that NIST feels the document has, and provide recommendations for enhancement of the code to address NIST's concerns.

Page Number: 2

Paragraph/Sentence: second bullet

Comment: BOCA is Building Officials and Code Administrators International, now consolidated with the other 2 U.S. model code organizations at the International Code Council (ICC)

Reason for Comment: clarification

Suggestion for Revision: change conference of America to code administrators international.

Page Number: 3

Paragraph/Sentence: last paragraph

Comment: the term "codes" is used throughout and it is not clear which codes are being referred to in specific or general terms.

Reason for Comment: clarification

Suggestion for Revision: throughout the reports where specific codes (e.g. NYC Building Code) are the subject of the text then use the name of the specific code. Where the term is broader such as model codes then use that term and if the intent of the text is to apply to all codes or codes in general then use that term. Explain this distinction in a footnote in each report the first time any of these terms are used or alternatively include a discussion on the topic in the introductory material to each report.

Page Number: 4

Paragraph/Sentence: second paragraph, first sentence

Comment: federal, state and local government adopt codes

Reason for Comment: accuracy

Suggestion for Revision: change to read as follows: "....adopted by federal, state and local authorities establish..."

Page Number: 37

Paragraph/Sentence: third paragraph, first sentence

Comment: the model code organizations consolidated and amalgamation does not appropriately describe what occurred. State and local jurisdictions also adopted their codes, and the subsequent ICC Codes. Stating that state and local codes were patterned after these model codes can convey to someone not familiar with the situation that state and local agencies did not really adopt these model codes. Also of note with respect to adoption of model codes throughout the documents NIST regularly refers to state and local agencies but rarely federal agencies. It is important that NIST convey to the reader that federal agencies such as GSA, DOE, NASA, DoD, and others adopt these model codes and standards as a basis for regulations covering their own buildings.

Reason for Comment: clarification

Suggestion for Revision: change amalgamation to consolidation and revise the sentence to read as follows: "....most state and local government agencies adopting building codes adopted one of the three model building codes and now adopt the ICC Codes which have taken their place pursuant to the consolidation."

Page Number: 43 and 141

Paragraph/Sentence: third paragraph, second sentence and second paragraph, third sentence

Comment: the BOCA BBC was adopted by localities around New York but was also adopted by some states at the state level. Readers need to understand that some states have state adoption authority and referral only to local adoption is confusing.

Reason for Comment: clarification and accuracy

Suggestion for Revision: change the second sentence to read as follows: "...typically adopted by state with state code adoption authority and local jurisdictions...."

Page Number: 54

Paragraph/Sentence: last paragraph

Comment: it is noted that the comparative discussion is focused on the NYC and three other building codes of the time and then also the 2001 NYC code. This provides a good basis for comparison for "now and then" for the NYC code and across codes of the 1960's. It leaves open a question about how those other codes (NYS, BOCA and Chicago) have changed over time as well. It is suggested that NIST also look at how the BOCA code and NYS code of the time compare with the 2000 IBC, which has taken the place of the BOCA code and has been adopted by the state of New York.

Reason for Comment: completeness of the report

Suggestion for Revision: add details in the report on how the BOCA and New York state codes of the day compare with the 2000 IBC.

Page Number: 142 and 144

Paragraph/Sentence: third paragraph, first sentence and last paragraph, last sentence

Comment: the use of the term national model codes is possibly confusing to readers unfamiliar with the nuances of the U.S. system. National can suggest that these documents are developed by the U.S. government or that they have some special standing. Note the first sentence of the next paragraph refers to these as model building codes and the sentence noted above on page 144 refers to national model building codes.

Reason for Comment: clarification and consistency

Suggestion for Revision: revise sentence to read as follows: "bore on the model building codes."

Page Number: 143

Paragraph/Sentence: fourth paragraph, second sentence

Comment: a parenthetical comment is made about poor record keeping associated with tracking changes to codes. NIST likely reviewed this issue with respect to NYC but did not likely review how BOCA for instance kept records. As presented one could interpret the statement as an inappropriate and unsubstantiated assessment of how the model code organizations kept records.

Reason for Comment: clarity

Suggestion for Revision: revise the sentence to read as follows: ".... (record keeping associated with the development and maintenance of codes and standards in New York City was...."

Page Number: 145

Paragraph/Sentence: third paragraph

Comment: it is noted that the 2003 IBC is referenced. Other places in the report refer to the 2000 edition of the IBC. As previously commented, given the timeframe of the report the 2003 IBC should have been used exclusively by NIST. Citations of different years mean the report is inconsistent in its treatment of current codes.

Reason for Comment: consistency and accuracy

Suggestion for Revision: base all work in which the IBC or other ICC codes are relevant on the 2003 edition of those codes throughout the reports or explain where the 2000 editions are used why they are used instead of the 2003 editions.

Page Number: 145

Paragraph/Sentence: second paragraph

Comment: the document refers to Section 703.3 of the IBC and lists 3 alternative methods for determining fire resistance. The IBC actually contains 5 such methods and all should be referenced.

Reason for Comment: accuracy

Suggestion for Revision: Add two new bullets as follows: "engineering analysis based on a composition of building element designs having fire-resistance ratings determined by ASME E 119" and "alternative protection methods as allowed by the IBC under alternative methods and materials when approved by the code official"

Page Number: 153

Paragraph/Sentence: last paragraph, first sentence

Comment: the text refers to the IBC and NFPA 5000. It is noted elsewhere in the report that both the 2000 and 2003 IBC are referenced as well as the 2003 NFPA 5000. In this instance no edition date is presented, leading to reader confusion over which edition of the IBC is relevant.

Reason for Comment: clarification and consistency

Suggestion for Revision: cite the edition year of each document and for consistency throughout the document base the report, analysis and related findings to the 2003 IBC.

Page Number: 157, 158, 160 and 164

Paragraph/Sentence: last paragraph on page 157, first sentence in first and second paragraphs on page 158, last paragraph on pages 160 and 164, and first paragraph on page 165.

Comment: the text suggests that ASME 17.1 covers elevator design and operation in all building codes. While this is likely true it should be noted that there are different editions of ASME 17.1 that could be adopted and there are no data provided that indicate that all building codes, which we assume NIST intends to mean federal, state or local codes, adopt ASME 17.1. In addition NIST again refers to elevator and building codes. Having referred throughout the document to national model codes, model building codes, and specific building codes like the NYC Building Code, the term "building codes" is not specific enough. The use of the term "building codes" continues in other paragraphs and should be clarified as to which codes are addressed (e.g. model codes, specific codes, or as a general statement to refer to federal, state and local building codes). If the latter then data indicating a research basis for such a broad statement must be provided and if no data exist then specific codes and/or model codes should be cited. On page 160 the term "many other codes" is used and it is not clear as to the scope of that statement (e.g. federal, state and local, model codes, or other documents). On page 164 the term "codes" is used and it is assumed the report means the NYC codes but one could also conclude that the report refers to codes in general. The report needs to be specific when referring to a particular code or codes and when the report is referring to codes in general it should have introductory materials, as previously suggested, so the reader has a clear understanding of scope when a general statement on codes is made. On page 165, first paragraph, the term "all current building codes" is rather broad. It is likely NIST meant model codes as opposed to all federal, state and local codes in effect in the late 1960's. This needs to be clarified as discussed above.

Reason for Comment: clarification

Suggestion for Revision: revise sentence on page 157 to read as follows: "...design and operation in the vast majority of buildings via its adoption in federal, state and local building regulations." Revise first sentence in first paragraph on page 158 to read as follows: "The vast majority of elevator and building codes in effect at the federal, state and local level require..." Revise second sentence in second paragraph on page 158 to read as follows: "The model building codes in the U.S. as well as codes such as the NYC Building Code...." Also clarify what is intended by "many other codes" on page 160 and "the codes" in the last sentence on page 164. Also clarify "all current building codes" on page 165.

Page Number: 165

Paragraph/Sentence: last sentence

Comment: it is unclear what code is being referred to when the statement about no code requirements is made.

Reason for Comment: clarification

Suggestion for Revision: revise to refer to NYC Building Code (which is assumed to be the subject as opposed to codes in general).

Page Number: 167

Paragraph/Sentence: fourth paragraph

Comment: a statement is made about Port Authority inspections and surveys and compares them to requirements in New York City and other codes and practices. This is a comparison of apples and oranges and inappropriately suggests that "other codes" are inferior. The Port Authority is in essence the building owner and regardless of codes and practices would logically want to inspect and survey these buildings on their own above and beyond any state or local requirements. In addition the highly visible nature of the buildings suggests that any owner, regardless of location or codes, would likely undertake such activities. Note also "requirements in NYC" is not specific as to codes but is general enough to cover many other requirements and law beyond codes.

Reason for Comment: clarification and accuracy in making comparisons.

Suggestion for Revision: revise sentence to read as follows: "...in New York City and in other localities with similar buildings, and generally ...."

Page Number: 168

Paragraph/Sentence: last sentence

Comment: the term "building code standards" is undefined and given previous comments about the use of specific and general terms to address codes is confusing.

Reason for Comment: clarification

Suggestion for Revision: cite the specific "building code standards" to which the comparative statement and subsequent points apply. If there is no specific document but the statement is attributable in general to codes of the day then state so in the report. Also do not use the term "building code standards" unless referring to specific standards referenced in and part of the building code.

Page Number: 180

Paragraph/Sentence: finding 4

Comment: the statement about document retention should be clarified and supported with documentation. Section 106.5 of the 2003 IBC does address retention of construction documents and requires 180 day retention or as required by state or local law. Section 105.4.6 of the 2003 IFC requires retention of construction documents until final approval of the covered work is completed. Section 106.5 of the 2003 IEBC also addresses the issue of retention, requiring one set of approved documents be retained by the code official for the period required for retention of public records. Clearly these documents and we are sure others, address retention of documents. While maybe not as long at NIST would prefer or was warranted for the WTC, a statement that state and local jurisdictions do not require retention of documents would not appear to be substantiated unless NIST has done the required research of all state and local laws and regulations to support such a statement.

Reason for Comment: statement made concerning state and local requirements for retention of records is in error and does not appear to be substantiated. This is then portrayed against the situation regarding record retention with the WTC and essentially makes all state and local government look significantly less competent that the Port Authority. The report only need address the findings of record retention by the Port Authority and addressing how state and local government or the private sector address document

retention is not necessary. Moreover we cannot find any data submitted by NIST to substantiate the statements concerning state and local government.

Suggestion for Revision: Delete the first three sentences and simply report the finding related to the Port Authority. If that is not acceptable then revise the first two sentences to read as follows: "Requirements for retention of construction documents vary from state to state and sometimes within states. Such documents ...."

Page Number: 183

Paragraph/Sentence: finding 14

Comment: reference to the IBC is not consistent throughout the NIST report. As the 2003 edition of the IBC was available and is used as a reference elsewhere in the report the 2003 edition should be referenced instead of the 2000 edition.

Reason for Comment: consistency and accuracy

Suggestion for Revision: change 2000 IBC to 2003 IBC

Page Number: 184

Paragraph/Sentence: finding 16

Comment: NIST incorrectly infers that as-applied fire protection thicknesses are not the same as those specified such that what is anticipated in the design is actually delivered in the building. NIST also indicates that in-service inspection requirements are not available. The IBC in Section 1704.11 provides criteria for special inspections of sprayed fire-resistant materials intended to ensure that what is anticipated based on the design is actually delivered in the building. Section 703.1 of the IFC also addresses the maintenance of required fire-resistance ratings of construction. Finding 16 is somewhat misleading in that it infers nothing is available to address these issues. While possibly not as rigorous and NIST would like, the IBC and IFC do address these issues. As such the report is misleading and makes the current situation seem worse that it really is.

Reason for Comment: inaccuracy

Suggestion for Revision: finding 16 should be rewritten to indicate that the issues addressed in the finding are covered in current model codes but based on the findings of the WTC investigation enhancements to those codes and others addressing those issues would be beneficial.

Page Number: 189

Paragraph/Sentence: reference to BOCA

Comment: BOCA is incorrectly spelled out

Reason for Comment: accuracy

Suggestion for Revision: change to Building Officials and Code Administrators from Building Officials Conference of America

Report Number: NCSTAR 1-2 Baseline Structural Performance and Aircraft Impact Damage Analysis of World Trade Center Towers

Page Number: li

Paragraph/Sentence: first bullet, second sentence

Comment: a reference is made to building codes of the time. It is not clear, having read the other documents associated with the WTC report what documents are being considered or if this is just a general statement. As the bullet addresses comparative analysis NIST must have based the analysis on some specific "building codes of the time". For this reason the text should be clarified to identify the codes upon which the statement is based.

Reason for Comment: clarification

Suggestion for Revision: add a footnote or parenthetical statement indicating which building codes the statement is based upon.

Page Number: liii

Paragraph/Sentence: first paragraph, first sentence

Comment: the report indicates that "current building codes do not specify a drift limit for wind design" but does not provide any specifics as to which codes (e.g. state, local, model, etc.). As previously noted the use of the terms codes, model codes, building codes, national codes, etc. are used repeatedly and interchangeably throughout the report and yet they can and do have different meanings. The next sentence of the first paragraph then refers to ASCE 7 and discusses drift limits related to that document. As ASCE 7 is adopted by reference in "current building codes" the statement in the second sentence would seem to contradict the statement in the first sentence.

Reason for Comment: clarification

Suggestion for Revision: revise the first sentence so that it is specific as to which building codes do not address drift limit and in discussing ASCE 7 on this topic note that model building codes such as the IBC adopt by reference ASCE 7 such that anything relevant to ASCE 7 would, by reference, be relevant when discussing the IBC.

Page Number: 51 and 295

Paragraph/Sentence: third paragraph and finding 1

Comment: BOCA is Building Officials and Code Administrators and as the sentence addresses codes the title of the relevant BOCA code should be included.

Reason for Comment: clarification

Suggestion for Revision: change Building Officials Conference of America to Building Officials and Code Administrators (BOCA) Basic Building Code

Page Number: 57

Paragraph/Sentence: listing of references

Comment: as the NIST report refers to the International Building Code it should also be included in the list of references

Reason for Comment: completeness of the report

Suggestion for Revision: add the following reference: "International Building Code, International Code Council, Falls Church, VA, 2003."

Page Number: 64, 91 and 296

Paragraph/Sentence: second paragraph, first sentence on page 64, first paragraph, third sentence on page 91 and finding 5 on page 296

Comment: the term "current building codes" is used and is a very general non-specific term. As previously commented such terms need to be qualified so readers can understand if the statement is related to one or more specific codes or just codes in general and if the statement applies to model codes or actual federal, state and/or local codes.

Reason for Comment: clarification

Suggestion for Revision: identify the specific building codes NIST reviewed and upon which the statement is made or if the statement is intended to generally apply to building codes as a whole without citing any specific codes then include a footnote that clarifies that for the reader.

Report Number: NCSTAR 1-4 Active Fire Protection Systems

Page Number: 32

Paragraph/Sentence: fourth paragraph, last sentence

Comment: a reference is made to the "model code" but the specific model code is not referenced. Earlier in the report references are made to the NYC Building Code and NFPA standards related to sprinklers and standpipes. While the term "codes and standards" is used as well, it is used in very general terms. Up to this point in the report the reader has also not been made aware that model codes, such as the BOCA Basic Building Code applicable at the time of WTC construction or the current ICC International Building Code, exist, how they are used as a basis for building regulations and the degree to which the refer to documents such as NFPA 13 and 14. The term "model code" at this point is confusing and should be replaced with a specific reference. In addition, in doing so, other parts of the report leading up to this section should at least introduce the concept of a model code and advise readers that such codes reference NFPA standards such as 13 and 14, and through those references such standards are applied in building regulations.

Reason for Comment: clarity and to make the report complete with respect to its treatment of codes and standards

Suggestion for Revision: revise the sentence in question to specifically address the model code by name. Also add descriptive text as appropriate in prior portions of the report to explain the difference between a model code and a standard, what model codes and standards were/are available to address active fire

protection, and that through model codes and their reference to standards building regulatory agencies derive the basis of their building regulations. The fourth paragraph on page 45 covers this issue. NIST should consider including such information at the beginning of this report, other applicable project reports and the main WTC report. This paragraph also addresses the issue of conformity assessment, a critical part of ensuring code compliance and building and system performance but an issue that is not adequately addressed in the reports at times when it is relevant.

Page Number: 45

Paragraph/Sentence: fifth paragraph, first two sentences

Comment: the text confuses installation, conformance to product standards, code requirements.

Reason for Comment: clarification

Suggestion for Revision: revise the first two sentences to read as follows: "The ...is dependent upon the standards covering the design and performance of the fire alarm system, the testing and quality assurance activities associated with ensuring compliance with those standards, and the degree to which the installation is in accordance with those standards, manufacturer's direction and applicable codes."

Page Number: 71

Paragraph/Sentence: last paragraph

Comment: ASHRAE is incorrectly named. In addition ASHRAE has a number of Handbooks and the specific handbook should be referenced.

Reason for Comment: editorial and clarification

Suggestion for Revision: change refrigeration to refrigerating and cite the specific ASHRAE Handbook being referenced in the text.

Page Number: 71

Paragraph/Sentence: entire section 5.1.2

Comment: the report does not include any discussion of how model codes have played a role in fostering the introduction and use of smoke management systems. As these model codes, which reference a number of the standards noted in the report, serve as the basis for building regulations and contain specifics as to when, where and how to install such systems their contribution should also be noted. Moreover, the model codes, unlike specific standards, address the entire building and effectively integrate smoke management with the myriad of other building design and construction issues that affect building safety and performance.

Reason for Comment: the report is missing needed information

Suggestion for Revision: add a new paragraph noting the existence of the model codes, how they include references to standards, how they serve as a basis for federal, state and local codes and what their contribution over time has been with respect to fostering the installation and acceptance of smoke management systems.

Page Number: 73

Paragraph/Sentence: first sentence

Comment: the NYCBC is not a model building code and should not necessarily be compared to one. The purpose of the sentence is to convey the concept that the NYCBC differs from other building codes (e.g. state or locally adopted building regulations) in that local laws in NYC can apply building code provisions retroactively to existing buildings. If there is a need to address how model building codes address the issue of retroactive treatment of existing buildings then an additional sentence or discussion should be added, possibly in the main WTC report. As the purpose of the sentence is to focus on how NYC compares with others the appropriate basis for comparison is with building codes at the state and local level as opposed to model building codes. As information the ICC International Existing Building Code and ICC International Fire Code provide criteria applicable to existing buildings.

Reason for Comment: clarification

Suggestion for Revision: delete the word "model".

Page Number: 85

Paragraph/Sentence: third paragraph

Comment: the text refers to a requirement for exhaust to be the greater of six air changes per hour or 1 cubic foot per minute per square foot of floor area. The text incorrectly indicates that the latter at 48,000 cfm would be the requirement. Given the floor area and an assumed 10 foot height the volume of each floor was on the order of 480,000 cubic feet. In order to achieve 6 air changes per hour the exhaust rate would have to be 80,000 cfm (480,000/6). Since 80,000 cfm is greater than 48,000 cfm the former would apply. Note that this comment also apples to page xl of the 1-4D report and the third line of the relevant paragraph in that report incorrectly shows floor area as 40,000 square feet.

Reason for Comment: technical accuracy

Suggestion for Revision: correct the paragraph using the correct code-required exhaust rate.

Page Number: 88

Paragraph/Sentence: last sentence

Comment: the text states that best practices in smoke management design are enforced in many jurisdictions in the U.S. There is a significant difference between best practice and minimum code and it is doubtful that local jurisdictions would require best practice design when they have adopted and enforce building regulations, unless such regulations were written to say "designers shall use best practice in the design of smoke management systems."

Reason for Comment: text incorrectly suggests that local officials require best practice as a basis for building regulations or in the absence of building regulations simply require best practice.

Suggestion for Revision: delete the words "enforced in many jurisdictions in the United States" and replace with "considered relevant".

Report Number: NCSTAR 1-4D Smoke Management Systems

Page Number: 5 and 108

Paragraph/Sentence: Section 2.1 in general and Section 9.2.1 in general

Comment: the report refers to codes as defining the objectives of smoke management systems and then lists and discusses specific standards and guideline documents related to the subject. As the NIST reports refer to codes and model codes in a number of other instances, the absence of any discussion on the relevance of Section 909 of the IBC dealing with smoke management systems would appear to be a significant omission in the report. For instance the presentation on the exhaust method suggests that the "model building codes" have adopted the NFPA 92B provisions. Section 909.8 of the IBC covers the exhaust method and does not adopt NFPA 92B. It may be better to suggest that standards such as NFPA 92B form a technical basis for model codes and can either be adopted by reference and through the code integrated with provisions covering other issues or if not adopted by reference can and often do form the basis for the provisions in the model codes. It is unfortunate that this section of the report discusses the exhaust, pressurization and airflow design methods of smoke management and not once refers the reader to Section 900 of the IBC, which forms the basis for "building codes enforced in the United States" (see next comment).

With respect to current practice, which is the timeframe in which the presentation in section 2.1 is set, the IBC by virtue of its adoption at the federal, state and local level should be addressed in this report.

Reason for Comment: address a significant omission in the report relating to current practice concerning smoke management systems.

Suggestion for Revision: include in the report as applicable a discussion on the provisions in the IBC on smoke management and their relevance to building design and operation as well as a discussion on how the model codes are developed and the different ways they rely on reference standards.

Page Number: 10 and 11

Paragraph/Sentence: last sentence on page 10 and first sentence on page 11

Comment: a general reference to building codes enforced in the U.S. is made but no specifics are provided as to what building codes. As these building codes are based on model codes, the report would be clearer on this point if it covered the model codes and the adoption of those codes by federal, state and local government.

Reason for Comment: clarification

Suggestion for Revision: add the following after United States: "(which are generally based on the IBC)"

Page Number: 17

Paragraph/Sentence: second and third paragraphs

Comment: certain standards are referenced with respect to maintenance of smoke removal systems. Unfortunately the International Fire Code is not mentioned and should be referenced. Section 909.21 of the 2003 IFC addresses the maintenance, testing, record keeping, etc. associated with smoke removal

systems in existing buildings and should be addressed in the report. The third paragraph, also suggests that the referenced standards as guidelines were not written into the model codes. This may be true but the absence of any treatment of the IFC as suggested above, while supporting the report's statement that maintenance and testing is not generally required by jurisdictions, means the report is totally incorrect.

Reason for Comment: the report is not complete

Suggestion for Revision: add discussion on page 17 of the report to address how the IFC addresses maintenance of smoke management systems. Also change the third paragraph completely to advise the reader that where the IFC is adopted there are provisions that jurisdictions can and do adopt to address maintenance of smoke management systems.

Page Number: 21

Paragraph/Sentence: fourth paragraph, third sentence

Comment: it is noted that the BOCA code was selected since it covered the majority of the NE US until 1999. This statement is misleading and leads the reader to ask – what happened after 1999?

Reason for Comment: accuracy of the report

Suggestion for Revision: change the third sentence to read as follows: "The BOCA code was selected for comparison because this code was the predominant code adopted by state and local government in the North East. The last edition of the BOCA code was published in 1999, and is being replaced by adoption of the International Building Code, now the primary basis for building codes throughout the U.S."

Page Number: 23

Paragraph/Sentence: first paragraph, first two sentences

Comment: the BOCA, ICBO and SBCCI codes are inanimate objects and cannot do anything as suggested by the text. The report is misleading and does not convey exactly what happened with respect to the model codes and the organizations that sponsored them.

Reason for Comment: correct errors in the report

Suggestion for Revision: change the second sentence to read as follows: "The model code groups formed the International Code Council (ICC) and proceeded to develop one singular family of model codes for the United States that would replace their individual model codes. The first complete set of ICC International Codes was completed in 2000 and replaced at that time the three model codes developed by the founding members of the ICC (BOCA, ICBO and SBCCI). In 2003 the three founding members of ICC consolidated their operations as the ICC. Since that time the ICC Codes have been updated every 18 months and federal, state and local government that had widely adopted one of the three model codes have adopted the ICC Codes as they have updated their building and fire regulations.

Report Number: NCSTAR 1-6 Structural Fire Response and Probable Collapse Sequence of the World Trade Center Towers

Page Number: 14

Paragraph/Sentence: last paragraph

Comment: the terms building codes, current codes and some codes are used in the paragraph but it is unclear which codes. The statements made in the report about fire ratings are very important and the manner in which the report describes the reduction of required fire ratings necessitates that the specific codes upon which the statements are derived be referenced.

Reason for Comment: clarification and technical accuracy

Suggestion for Revision: delete the terms building codes, current codes and some codes and replace them with a reference to the specific codes upon which the presentation on reduction in required fire ratings are based.

Page Number: 15

Paragraph/Sentence: second paragraph, first sentence

Comment: it is reported that the architect selects establishes fire ratings, thermal protection, etc. requirements. While correct the text leaves the reader with the idea that when that is done the work is completed and construction proceeds. After the architect or registered design professional prepares the design and specifications, they are subject to review by the appropriate building and fire authorities who will either approve what has been selected or advise the architect of changes needed to achieve code compliance.

Reason for Comment: increase accuracy of the report with respect to the building design and approval process.

Suggestion for Revision: add a new sentence after the first that reads as follows: "Subsequent to that selection by the architect or registered design professional the authority having jurisdiction (code official, fire service, etc.) will review those selections as part of the building regulatory process and where necessary advise of needed corrections to address code compliance issues."

Report Number: NCSTAR 1-6A Passive Fire Protection

Page Number: xxxi

Paragraph/Sentence: third paragraph, first sentence

Comment: the term U.S. building regulations is used and then later in the executive summary the term building codes is used. While related these are not necessarily the same. Readers, especially those unfamiliar with building codes, standards and regulations as well as non-U.S. readers unfamiliar with the "U.S. system" can be easily confused and mislead if the correct terminology is not used throughout the report. For instance on page xxxii, first paragraph, a reference is made to a non-specific term "building codes". It is assumed that the authors intend to make a general statement and that building codes applies to federal, state or local building codes that are law. One, however, could also assume this refers to the model building codes, or some specific building codes. Following the statement on page xxxi referring to building regulations enhances the need for clarification and consistency on this issue.

Reason for Comment: clarification

Suggestion for Revision: the NIST report should include a general overview and discussion on how codes, standards, etc. are developed, adopted, implemented and enforced in the United States. This

overview can then be referred to as needed throughout all the NIST reports as necessary to address the many and varied ways in which codes, model codes, standards, building codes, building regulations and other terms are relevant to the information in the reports.

Page Number: xxxii and 7

Paragraph/Sentence: third paragraph and last paragraph

Comment: the terms building codes, current codes and some codes are used in the paragraph but it is unclear which codes. The statements made in the report about fire ratings are very important and the manner in which the report describes the reduction of required fire ratings necessitates that the specific codes upon which the statements are derived be referenced.

Reason for Comment: clarification and technical accuracy

Suggestion for Revision: delete the terms building codes, current codes and some codes and replace them with a reference to the specific codes upon which the presentation on reduction in required fire ratings are based.

Page Number: 5

Paragraph/Sentence: last paragraph

Comment: the term "model building codes" is used but it is unclear what documents NIST used in the investigation and upon which the report is based.

Reason for Comment: clarification

Suggestion for Revision: cite the specific documents that NIST considered in the work either here, and other places where the term is used or in the suggested presentation and discussion on U.S. codes and standards development, adoption, etc. previously suggested.

Page Number: 6

Paragraph/Sentence: third paragraph, last line

Comment: an NFPA standard is referenced. Which one?

Reason for Comment: clarification

Suggestion for Revision: identify the specific NFPA standard to which the report refers.

Page Number: 6

Paragraph/Sentence: last paragraph

Comment: the report, in addressing building code requirements, mentions the historical BOCA and SBCCI documents but does not mention the IBC that supersedes those legacy documents and is used as a basis for virtually all U.S. building construction regulations.

Reason for Comment: the report should be complete in reporting information on current building codes.

Suggestion for Revision: add similar text with respect to the requirements in the 2003 IBC.

Report Number: NCSTAR 1-7 Occupant Behavior, Egress and Emergency Communications

Page Number: 24

Paragraph/Sentence: third paragraph, first sentence

Comment: the text refers to two model building codes, one by name of the code and the other by the name of the organization sponsoring the code. It is appropriate and correct when referring to such documents to refer to them by title and publisher.

Reason for Comment: clarification and for consistency throughout all NIST reports associated with the WTC investigation

Suggestion for Revision: refer to the IBC and the ICC 2003 International Building Code (IBC) and add "ICC International Code Council" to the list of acronyms in the report.

Page Number: 34 and page 35

Paragraph/Sentence: third paragraph, last sentence

Comment: the use of the term U.S. building codes is misleading and could be misinterpreted by those unfamiliar with the U.S. system that the United States promulgates building codes. See previous comments on other portions of the NIST report that raise the same issue and propose solutions.

Reason for Comment: clarification

Suggestion for Revision: revise sentence on page 34 to read as follows: "....Escalators, which is adopted by reference in the model building codes and through adoption of those codes, or the ASME standard directly, by federal, state and local government agencies forms that basis for the design and operation of elevators." With respect to page 35, the text must be more specific as to what is meant by U.S. building codes or cite the specific codes to which the text is intended to refer.

Page Number: 43

Paragraph/Sentence: section 2.5, second sentence

Comment: the text refers to codes adopted by local jurisdictions. While partially true it does not fully describe the U.S. situation and is therefore misleading. In some instances the adopting entity is the federal government for federal buildings. Interestingly this includes NIST with administration and compliance with the codes addressed by the NIST Plant Division. This also includes state government where states have preemptive authority over local government. Lastly, where of a non-federal nature and not preempted by state government, local government would be the adopting authority.

Reason for Comment: clarification

Suggestion for Revision: revise the sentence to read as follows: "...building codes adopted by federal, state and local government establish..."

Page Number: 44 and 45

Paragraph/Sentence: fourth paragraph, first sentence and first paragraph, third sentence

Comment: the text on page 44 is not clear as to which building codes and should either be specific as to which codes or if a more general statement than report that as well, nothing also that building codes include federal, state and local codes. On page 45 the text refers to "most current codes". It is assumed the intended scope is building codes and as with the text on page 44, the term "most" is undefined.

Reason for Comment: clarification

Suggestion for Revision: cite the specific building codes upon which the report based the measure "some" on page 44 and change page 45 to building codes and cite the specific building codes upon which the report based the measure "most".

Page Number: 45

Paragraph/Sentence: section 2.5.4

Comment: reference is made to the 2000 IBC. Other parts of the NIST reports reference and are based on the 2003 IBC. For consistency and based on the availability of the 2003 IBC at the time the reports were developed the reports should uniformly refer to and rely on the 2003 IBC.

Reason for Comment: uniformity and accuracy throughout the reports

Suggestion for Revision: revise the text in section 2.5.4 and other relevant portions of the report based on the 2003 IBC.

Page Number: 47

Paragraph/Sentence: section 2.5.5

Comment: reference is made to NFPA 5000 and NFPA 101 with the text citing various applicable sections but is not specific as to which document. A review of NFPA 5000 indicates that the referenced sections do not exist or do not contain the materials presented in the report. The text in the report is based on NFPA 101 and as such a reference to NFPA 5000 is incorrect and unwarranted unless the text indicates that NFPA 101 is the source document and NFPA 5000 simply references or reproduces the egress provisions of NFPA 101. Note also that further text in Chapter 2 references appropriately NFPA 101 and not NFPA 5000. As NFPA 5000 has no basis as a source document for egress provisions and based on the egress issue being addressed within NFPA 101 the reference to NFPA 5000 is unwarranted.

Reason for Comment: accuracy

Suggestion for Revision: delete the reference to NFPA 5000.

Page Number: 47

Paragraph/Sentence: section 2.5.6

Comment: the comparison of NFPA 101 and the IBC may not be based on the appropriate edition of the IBC and the report therefore does not present an appropriate, current or valid comparison. The text in

section 2.5.4 references the 2000 edition, the text in this section simply refers to the IBC and then table 2-3 refers to the 2003 IBC.

Reason for Comment: technical accuracy

Suggestion for Revision: revise the comparison using the 2003 IBC as a basis and if the comparison was based on the 2003 then the report should reference the 2003 IBC throughout, not only in report 1-7 but in all the NIST WTC reports.

Report Number: NCSTAR 1-8 Emergency Response Operations

Page Number: xxxvii

Paragraph/Sentence: second bullet

Comment: the text refers to the purpose of the effort as identifying issues that need to be addressed in codes. A review of report 1-8 indicates that there is only one mention of codes on page li (see below). This leads the reader to expect to see in this report some specific items that are either not currently addressed in codes and should be addressed or are addressed but not as rigorously as the authors would like. These comments assume the term codes refers to building codes, fire codes and other regulations.

Reason for Comment: the stated purpose of the report was not completely fulfilled.

Suggestion for Revision: list out those issues that relate to emergency response operations that should be addressed by codes or delete codes from the scope of the report and change the second bullet to read as follows: "identifying issues related to emergency response operations that should be addressed through changes to policy, practices, guidelines and other means of affecting enhanced emergency response operations."

Page Number: li

Paragraph/Sentence: second bullet under command and control

Comment: the text refers to the availability of effective codes as a key issue in addressing command and control. The term codes should be further defined. A review of the ICC International Fire Code shows that Section 509 addresses the establishment of a fire-command center for fire department operations in buildings. This portion of the report seems to be focused on the establishment and operation of a command center once a building issue necessitates one be established. The availability of the location and facilities with which to establish and operate such a center is covered by codes. The actual processes by which such a center is established and operated may not be specifically addressed in code.

Reason for Comment: clarification

Suggestion for Revision: change the term "codes and protocols" to "guidelines, procedures and protocols."