A Survey of Code Officials on Performance-based Codes and Risk-based Assessment

by Charles W. Van Rickley

Introduction

Is the United States code enforcement community ready for performance-based codes or risk-based decisions for fire- and life-safety issues? This question is becoming critical as our nation faces increasing competition in the international marketplace. Many other countries throughout the world are in a transition to performance-based fire- and life-safety codes, including Australia, Canada, Finland, France, New Zealand, Norway, Sweden and the United Kingdom. Several countries are moving more rapidly and are further along in the transition than the United States. The United Kingdom, for example, recently reduced its building code from 310 pages to 23 pages. A substantial part of this reduction was accomplished by applying a performance-based format instead of its previous prescriptive code format.

How will these changes in code philosophy and technology impact the construction time and costs of new retail, commercial or industrial buildings in the United States? How will building and fire officials' roles change, and what will be the role of agencies such as the Building and Fire Research Laboratory of the National Institute of Standards and Technology, the National Fire Protection Association, the Society of Fire Protection Engineers, the model code organizations, and similar groups?

The Building and Fire Research Laboratory's Fire Safety Engineering Division (FSED) conducts research on the measurement, prediction and simulation of fires. This research can provide the basis of enabling technology for the future of performance-based codes and standards and risk-based fire- and life-safety decisions. The division is sponsoring a project to address the question of its role in this code-philosophy transition.

Method

A survey was administered at the 1995 annual conferences of BOCA, ICBO and SBCCI. The questionnaires were distributed at the final fire- and life-safety code development hearings for each group.

The survey was structured to estimate the status of the following aspects of performance-based codes and risk-based analysis:

Aspect A—What is the position of the code enforcement community on per-

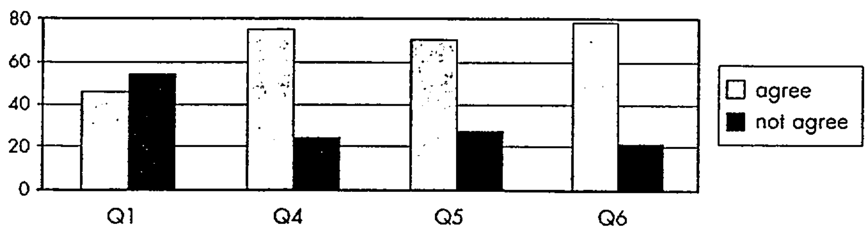

FIGURE 1—ASPECT A—POSITION ON PRESCRIPTIVE VERSUS PERFORMANCE-BASED CODES

The Survey

Performance-based Codes and Risk-based Decision Making

Scale:

Questions 1 through 10: *Strongly Agree, Agree Somewhat, Neither Agree nor Disagree, Disagree Somewhat, Strongly Disagree*

Question 11: *Daily, Weekly, Monthly, Yearly, Never*

Questions:

1. Prescriptive codes, as they are now written, cannot be appropriately applied to all buildings or occupancies.
2. Currently available computer fire-prediction models are adequate to support performance-based fire- and life-safety codes.
3. I am comfortable using currently available fire-prediction models to evaluate performance-based design specifications.
4. Prescriptive building and fire codes, as they are currently written, are necessary to ensure reasonable levels of fire protection and life safety.
5. Performance-based codes are necessary to provide reasonable levels of fire protection and life safety in our rapidly changing environment.
6. Performance-based codes should require plan review and code enforcement personnel to be certified by a recognized agency.
7. I am comfortable specifying a number for acceptable life loss as a part of risk-based analysis for building construction.
8. The basis for building design decisions should be the potential risk to building occupants.
9. The basis for building design decisions should be the potential risk for fire-suppression personnel.
10. The basis for building design decisions should be the potential risk to adjacent occupancies.
11. How frequently are you called upon to rely on computer fire models in your decision process for equivalent alternatives to fire-protection and life-safety code requirements?

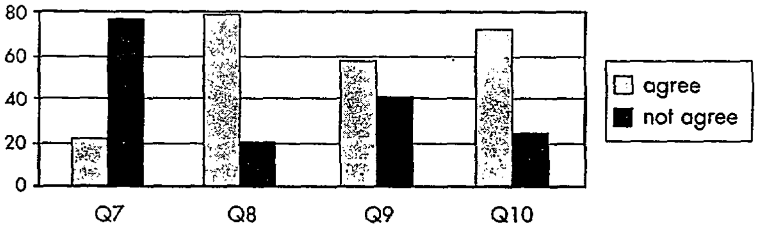

FIGURE 2—ASPECT B—THE CURRENT ROLE OF RISK-BASED ANALYSIS

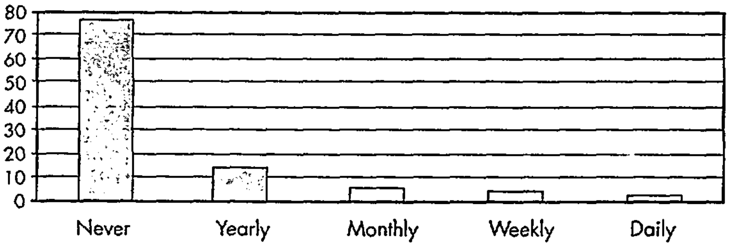

FIGURE 3—ASPECT C—FREQUENCY OF COMPUTER MODEL USE

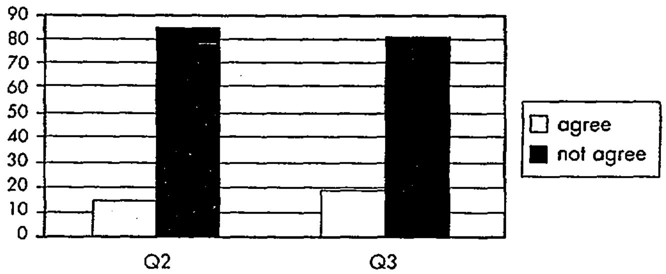

FIGURE 4—ASPECT C—ADEQUACY OF COMPUTER MODELS, Q.2, AND COMFORT WITH COMPUTER MODELS, Q.3

formance versus prescriptive fire-safety codes? (Questions 1 through 6)

Aspect B—What is the role of risk-based fire-protection analysis in the United States today? (Questions 7 through 10)

Aspect C—Are computer fire models being used in the real world to design, support or evaluate equivalent alternatives? If so, by whom and, if not, why not? (Questions 2, 3 and 11)

A background item identified the respondent's function: building official, fire official, industry representative, design professional or other. Building and fire officials were asked to identify their jurisdiction by population category and indicate the size of both their code enforcement and plan review or engineering staff to determine if community size affected their response.

Of 800 questionnaires distributed, 346 were completed, resulting in a response rate of 43 percent. The survey used five scale points: strongly agree, agree somewhat, neither agree nor dis-

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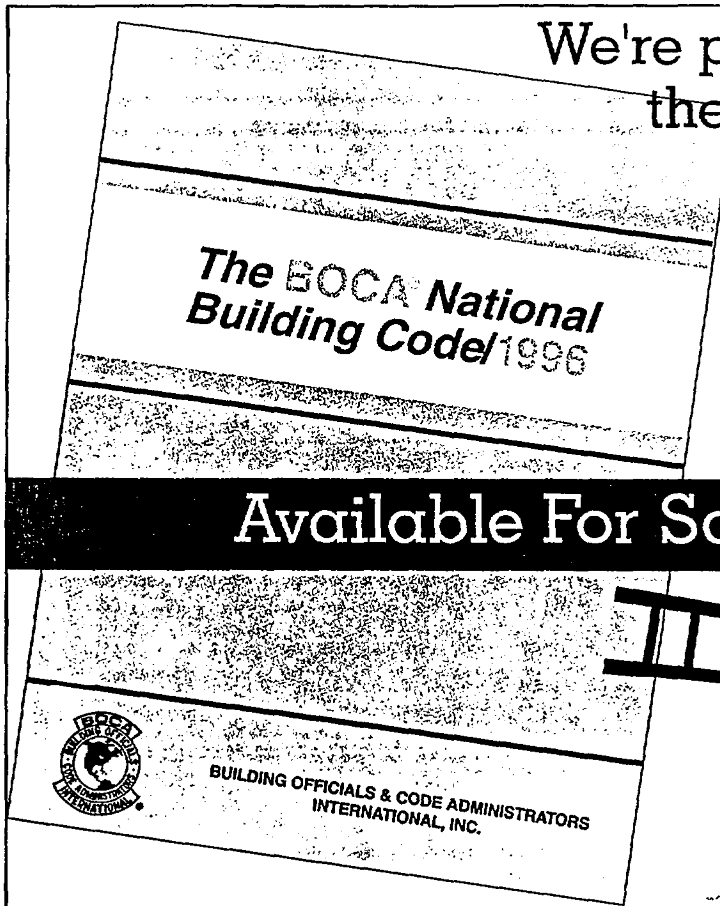

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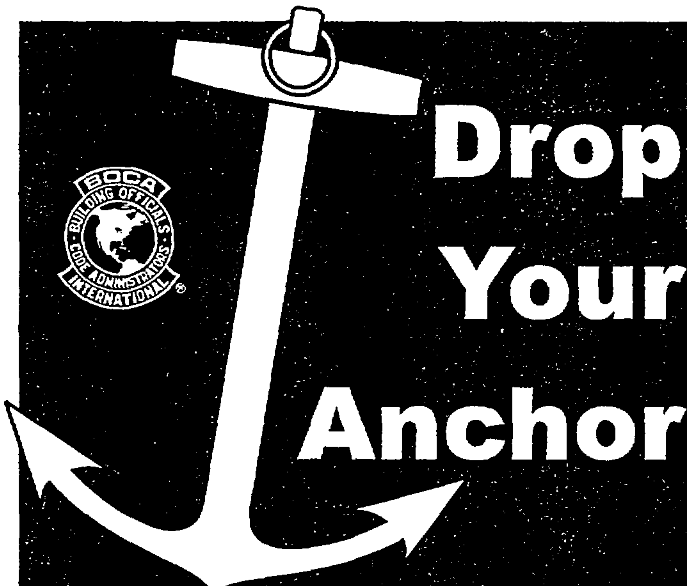

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agree, disagree somewhat and strongly disagree. The percentages responding to each of the five scale points were calculated, then aggregated into a two-point distribution of "agree" (strongly agree + agree somewhat percentages) and "disagree" (neither + disagree somewhat + strongly disagree percentages). For this analysis, only the responses of the two most represented groups, building officials (n = 236) and fire officials (n = 36) were used (total = 272).

Results

Percentage responses to questions 1 through 6 (Q.1-6) are shown in Figure 1, and Q.7-10 are shown in Figure 2. Respondents generally were in strong agreement (Q.4-6 and 8-10) or in strong disagreement or neutral (Q.2, 3 and 7). Responses were equivocal only on Q.1 and Q.9.

Regarding Aspect A (position on the two types of codes), there was strong agreement on the necessity of both performance and prescriptive codes; prescriptive as the code is currently written (Q.4), but performance based for a rapidly changing environment (Q.5). There was also strong agreement on the need to require certification of plan review and enforcement personnel for performance-based codes (Q.6).

Regarding Aspect B (the current role of risk-based analysis), building and fire officials were not comfortable specifying a number for acceptable life loss. They were in strong agreement on basing building design decisions on potential risk to occupants (Q.8) and risk to adjacent occupancies (Q.10), and in mild agreement on basing design on the risk to firefighters (Q.9).

Regarding Aspect C (the use of computer models), there appears to be little use of computer fire-prediction models at this time. On Q.11, frequency of use, 74 percent responded "never." Furthermore, the highest responses on a single scale point on Q.2, adequacy of current computer models, and Q.3, comfort with current computer models, were on the neutral scale point (neither agree nor disagree), with 56 percent on Q.2 and 47 percent on Q.3. This suggests a lack of awareness of the availability or adequacy of current computer models. This response rate on the neutral point was unique to these two questions. For the other nine questions, the neutral point was quite low, ranging from 8 to 21 percent.

Conclusions and Recommendations

There is an urgent need to develop codes that contribute to reducing the building construction time line while maintaining acceptable levels of life safety.

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As the responses to Aspect A and Q. 4 and 5 seem to indicate, further investigation is needed to determine specifically where the building and fire officials believe performance-based codes will fit into their requirements to provide reasonable levels of fire protection and life safety in their communities.

The format of Aspect B should be restructured and resubmitted to determine a priority order. Countries such as New Zealand and Australia have established their design basis priorities as follows: (1) evacuation of occupants, (2) providing reasonable time for firefighter operations and (3) protection of neighboring property.

The responses to Aspect C indicate a need to review existing computer fire-prediction models as well as develop and validate additional models to support the designs and concepts which will be generated through performance-based building analysis. These models must be usable by both design professionals and code enforcement personnel with various levels of computer skills.

Of the 346 respondents completing the questionnaires, 50 (14 percent) provided their names and addresses, indicating that they were interested in further discussion of these subjects. A workshop comprising the interested respondents and appropriate representatives of the organizations mentioned at the beginning of this article would explore the issues involved in the code transition, identify specific areas of concern, define methods and time lines to address these concerns, and develop a unified plan to move forward in this important change in code philosophy. ■

Acknowledgments

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