METHODS FOR DEVELOPMENT OF BUILDING CODES AND DISASTER RECOVERY MEASURES

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ABSTRACT: The reduction of the impact of an earthquake disaster involves planning for mitigation of earthquake effects both before and after the seismic event. Building codes provide the basis for implementation of pre-event measures to minimize the impact of an earthquake. Planning can also facilitate recovery after such an event and minimize long term impacts upon society. The paper will suggest methodologies to be used in the development of building codes which can encourage the use of local building practices while developing safer standards for construction. The discussion will focus on the processes used in the United States to formulate building codes and on the application of these processes to formulation of codes appropriate for developing nations. The paper will also explore disaster recovery through the training of personnel to perform post earthquake evaluation of damaged structures to ascertain levels of damage and suitability for occupancy.

1 INTRODUCTION

The disaster mitigation methods to be described are two fold in nature. The first, development of building codes and standards, involves pre-event planning directed toward minimizing the effects of a seismic event. The second, post-earthquake evaluation, is directed toward minimizing the long term effects of an earthquake upon society. The processes described here are those used to get engineering knowledge and experience from the world of ideas into the world of practice.

The paper focuses upon the processes used in the western United States for the development of building codes and for post earthquake evaluation. These programs must be tailored, of course, to the particular requirements of each individual society and locale to be truly effective. I do not presume to tell local jurisdictions in developing nations which detailed code or evaluation requirements are best for them to utilize. This is, and must remain, a local issue governed by local building practices, local materials and local social and political concerns. This is the fundamental aspect of the successful U. S. practices I am describing. They are locally or regionally based. There is no national building code the United States.

1.1 The Code Development Process

The code development process I will describe takes place in a political atmosphere which many technically oriented people shun. By politics I mean the dialogue between competing interest groups or ideas. It is something which most architects and engineers feel should be divorced from the technological imperatives which govern our professional lives. However, the design and construction criteria which implement technological developments must go through a process of testing, discussion, debate and codification in order for them to have maximum beneficial effect upon society. This deliberative process is political in nature. It can feel drawn out and self-serving at times. It can also be very frustrating. Thus the description as politics. However, I feel this process is the best way to get the beneficial experiences of designers, researchers, builders and regulators implemented in the everyday world.

The U. S. model described will certainly require modification to be of maximum use in developing nations. "Each of the model groups describes its code as "performance based" (that is code compliance is judged by the manner in which the building component functions), as opposed to requiring "prescriptive", technically detailed, methods and materials." (AIA, 1991). It can be argued that model codes for developing nations should play a role in dissemination of technical information and improvement of building practices. These goals may best be served by prescriptive codes which describe in detail procedures and practices leading to safer buildings. For developing nations this "cookbook" approach will probably lead to a larger number of buildings of a higher quality than a less prescriptive approach where each experienced designer is given more freedom to be creative. This is a factor for code development agencies in developing nations to keep in mind when designing their code process. Where an experienced, licensed design professional is involved there should be more freedom to innovate within the parameters set by the code. Where the goal is a broader social one, to increase the quantity of higher quality structures, then a prescriptive code is probably best. This is especially true where there are many structures constructed without input from design professionals.

Codes and standards are the mechanism whereby technological advances can be applied to actual construction. The code development process must be structured to facilitate the implementation of new technologies. At the same time new standards must not be allowed to make construction so complicated and costly that the costs to society outweigh the benefits of new technologies. Existing local materials and methods must be integrated with new technologies to allow cost effective technology transfer to take place. The codes must use rational methods in the development of criteria for the quality of construction. There is no way to put

a price on a life saved or lost, but levels of safety must be set to achieve the greatest good for the greatest number of the members of society the regulations are designed to protect. Building perfect buildings which only a tiny percentage of society can afford is not a viable social goal.

1.2 Model code organizations

There are three major code development bodies in the United States. These groups and their respective model codes are: The International Conference of Building Officials, publishers of the Uniform Building Code; The Building Officials and Code Administrators International, publishers of the National Building Code; and the Southern Building Code Congress International, publishers of the Southern Building Code. Each incorporates the word "international" in its title and there is precedent for the use of these codes in other countries. For example, the Uniform Building Code has been published in Portuguese, Spanish and Japanese. It has had an influence upon the national codes of Japan and Brazil and has been adopted as the State Code of El Salvador.

Each group publishes a "model" code which serves as a recommended model for adoption by local and/or state agencies. None of these codes has any force of law in and of themselves. They gain their effectiveness through adoption by local governmental bodies which give the codes the full force of law. Building codes are legal documents enforceable under the police powers of the state. The basis for their promulgation and adoption is the protection of public health, safety and welfare. Each local agency has the power to adopt, reject or modify any section of the model code as they see fit to suit local conditions.

"The three model code organizations, ... were initially established to enable building officials and their respective jurisdictions to seek solutions to common problems and to satisfy common needs on a regional basis" (AIA, 1991).

The model codes consist of building codes along with mechanical, plumbing and fire codes and their accompanying technical standards. We will focus on the development of building codes, but the process is applicable to the development of any type of code or standard.

1.3 The code development process in detail

The code development processes of each of the three model code organizations are similar in form. They typically operate on a three year publication cycle. I will be discussing a conceptual process based upon that of the International Conference of Building Officials. I am familiar with this process from serving as one of three appointed representatives of the American Institute of Architects to the code development process for the Uniform Building Code.

The International Conference of Building Officials is a private, "non-profit service organization owned and controlled by its member cities, counties and states."(AIA, 1991). This body is responsible for administering a code development process which generates a "model building code" for review and adoption by local and state governments.

The process is not solely a governmental one. It is a unique blend of private industry, the building design professions, testing and standards agencies (both public and private), the construction industry and governmental regulators.

The Uniform Building Code has developed over a number of years, first being published in 1927. It was a slender volume when first published. Today's 1991 UBC has over one thousand pages, along with an equally large set of Standards. This growth reflects the explosion of technology and also the growth of a social policy which believes that rationally derived design criteria should set the minimum standards for protection of public health and safety.

The model code organization has a staff which assists the membership in the development and maintenance of the code. The staff administers a process which is developed by the membership.

Each of the sections of the code has been crafted to address a specific concern of a code writer. It is essential to understanding the process to realize that any individual can' propose a code change. Sections are added and modified on a piece by piece basis. The code grows by accretion. No specific credentials are required of a code change proponent. A governmental official, a consulting professional, a materials researcher, or a licensed practitioner approaches the process with nominally the same standing as any other individual. The price of admission is an interest in the code, knowledge of the code change process and a certain degree of literary ability. This does not mean that code changes can be arbitrary or capricious. Each proposed change is subjected to scrutiny and public debate before adoption into the code. This open process weeds out the proposals which are not rationally based or which are obviously self serving. It also must be recognized that status, training, expertise and notoriety do have a marked influence on the success or failure of any proposal. A well known design professional, or a ranking government official has, in fact, a better chance of getting a code change adopted than does the man-on-the street. The rules of behavior which govern all human institutions of course apply to this process.

A generalized code change process is depicted in Figure 1. Proposed code changes must first be submitted to the staff of the model code organization for publication as a proposal. Proposals must meet minimum format criteria set forth by the organization. There is a deadline for submittal. The proposed changes are published by the organization for distribution to members and other interested parties for review well before hearings are scheduled. This review time is essential. It allows time for various groups and individuals to consult with each other
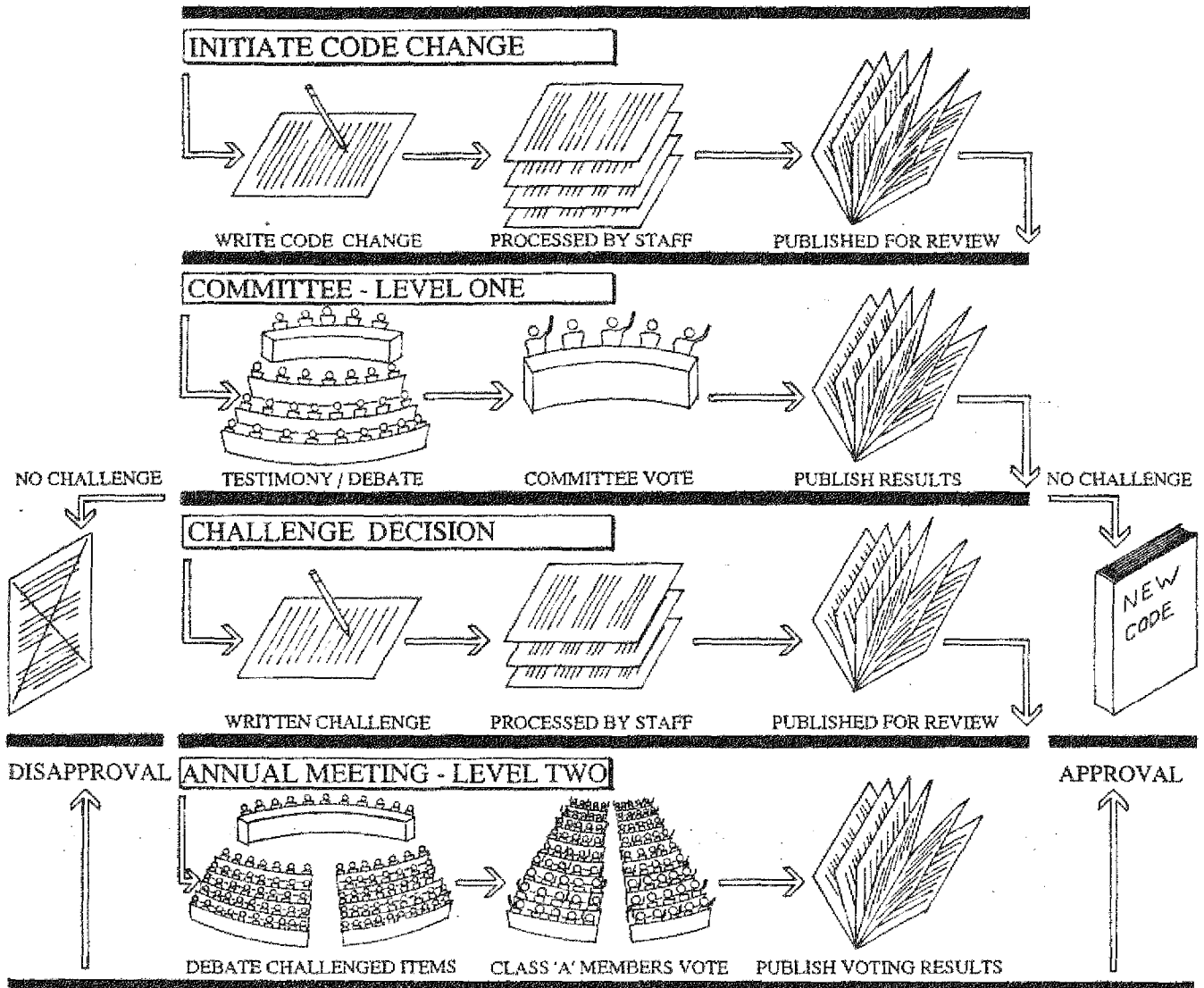
SCHEMATIC DIAGRAM OF THE CODE CHANGE PROCESS

INITIATE CODE CHANGE

WRITE CODE CHANGE   PROCESSED BY STAFF   PUBLISHED FOR REVIEW

COMMITTEE - LEVEL ONE

NO CHALLENGE   TESTIMONY / DEBATE   COMMITTEE VOTE   PUBLISH RESULTS   NO CHALLENGE

CHALLENGE DECISION

WRITTEN CHALLENGE   PROCESSED BY STAFF   PUBLISHED FOR REVIEW

DISAPPROVAL   ANNUAL MEETING - LEVEL TWO   APPROVAL

NEW CODE

DEBATE CHALLENGED ITEMS   CLASS 'A' MEMBERS VOTE   PUBLISH VOTING RESULTS

Figure 1

regarding the proposals. This leads to a certain amount of political give and take and intrigue. However, this open process, with alliances and consultations is key to the success of the process as it leads to a beneficial balancing of political interests and forces.

The committees who review code changes are made up of what are called Class 'A' members by ICBO. These are building officials from the public sector. They are government employees, almost always on the local level, from cities or counties. These members are selected by their peers, not by any government

agency, and serve without compensation for set terms. They are chosen to represent a balanced geographical cross section of the membership area. In ICBO the United States is divided up into three bands running east and west. The actual subdivision is not critical, but dividing the representation areas is important. This division distributes representation across various geographic, social and political areas. It gathers input from areas where construction techniques and concerns may differ and makes the code more generally applicable. This allows inclusion of regional construction expertise for the

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benefit of all code users.

The committees are broken down into specialties. Those most critical for implementation of a development program are: Administration, dealing with format, scope of coverage and procedures for enforcement; Fire and Life Safety, dealing with fire resistive construction and exiting; Lateral Design, dealing with seismic and wind design criteria; and General Design, dealing with building type classifications, definition of occupancy groups and all other broad categories.

Code change proposals are subdivided among the committees based on the content of the proposed code change. This allocation of changes allows for the orderly processing of changes in minimum time. The committees meet at a specified time and place. This allows the proponents of the code changes to attend committee meetings along with others interested in supporting or opposing the changes.

The committee hearings are open to the public. The ICBO committees operate under Robert's Rules of Order, a generally accepted set of rules governing procedures for debate in "deliberative assemblies". It is based on the democratic principals of decision by majority while respecting the rights and privileges of minority views. A chairperson is chosen from among the members of the committee. The chair is a non-voting member. This person serves as the moderator of the debate under the rules of order. The committees generally have an uneven number of voting members to avoid having tie votes. The committee hears public testimony regarding the merits and demerits of proposed changes. Committee members may ask questions or make statements regarding the changes at any time during the debate.

Debates often get impassioned and heated. The chairman may have to resort to the rules of procedure to moderate debate and to keep the comments focused on the actual scope of the revision. New information will often be put forth during debate and the proposals amended. These amendments may come from the proponent of the change or from the floor of the meeting. A well reasoned, well presented argument can sway committee members to change their minds from a previously held position. Presentation of complicated or controversial changes will often be postponed until a separate meeting of debate attendees can be convened to work out new language to present to the committee for review. These ad hoc subcommittee meetings carry out much of the code development for complicated issues.

The staff publishes the results of the committee votes on proposed code changes. A tabulation of the committee's disposition of the changes is forwarded to the same interested parties who received the initial proposals. The usual dispositions are "approval", "approval as revised", or "disapproval". There is another category for "further study", but this is seldom used as its use is discouraged. The organization's staff is not large enough to support the research needed for further study. Further study items are usually referred to ad-hoc committees made up of people interested in the subject of the proposed change. These groups draft proposed changes for submittal for committee review. Often these ad-hoc groups are formed to develop code change proposals without any formal 'further study' directive. These groups usually consist of representatives from each of the constituencies interested in the code change process. This makes these proposals particularly broad based. Any necessary compromises are made during the development of the proposals in advance of their introduction.

After publication of the committee reports there is a period for challenges to the decisions made by the committees. The challenges may be written by any person. Again there is no exclusion of persons, or required pre-qualifications to challenge an item.

If the decisions are not challenged the committee decisions stand as published. Approved changes are published in the next yearly supplement

to the code or in the new edition if it is the third and final year in the code change cycle.

Challenges are due by a date certain. This allows time for them to be collated into a publication to be forwarded to the same mailing list as the other distributions. The challenged items are put on the agenda for debate at the annual business meeting of the organization. This is the yearly gathering of organization members where the normal convention business of election of officers, educational programs and fellowship takes place. Several large blocks of time are also set aside for debate of the challenged items.

Attendees are required to register and to wear badges showing to which category of registration they belong. Only Class "A" members wearing proper credentials are allowed to vote. Each speaker must identify themselves and which organizations they represent, if any. Here too, as at the committee hearing level, the intent is that the process be conducted in an open and public forum. The debates are fully open to the public. In the case of ICBO there are usually four hundred or five hundred Building Officials in attendance at these sessions. Only those so called Class 'A' members, public employees, as noted above, can vote on the changes. Votes take place openly; by voice, by a show of hands, or by standing for a count where a majority is not obvious without a tally. See Figure 2.

There is a complex weighing system for voting which is designed to reinforce the decisions of the committees. This system also is weighted toward not changing the code. The presumption is that the existing code should be changed only with good cause and with a clear majority of the committee members and the general membership approving of the change.

The foregoing describes the code change process in general terms. Every code revision will go through the steps I have described and will have been exposed to review in published form at least twice; three times for those

CODE CHANGE VOTING CRITERIA

Figure 2

changes that are challenged. The change will also have been debated in an open public forum once and perhaps twice. The changes will have been scrutinized carefully and debated at length. This complex process, developed over a long period of time works well in the sense that it produces codes which have gained wide acceptance. This acceptance appears to be growing with every passing year. Why does it work and how can it be improved?

1.4 Checks and Balances

The system is a blend of technical and political considerations. The players in this political drama hold the key to the success of this process. They counterbalance each other in a delicate way to keep any one group from gaining

control over the process. See Figure 3.

CHECKS AND BALANCES

NEW TECHNOLOGY
GOVERNMENT
STRUCTURAL STEEL
DESIGN PROFESSIONALS
CONCRETE   MASONRY
NEW MATERIALS
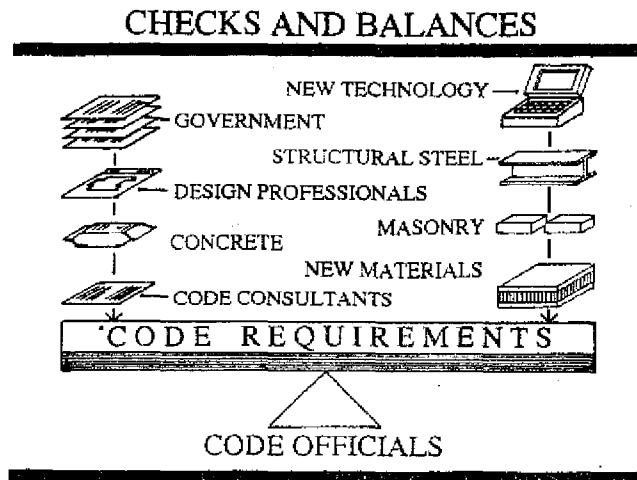CODE CONSULTANTS
CODE REQUIREMENTS
CODE OFFICIALS

Figure 3

The staff does not write the code. This is a key point to keep in mind. The code development process is decentralized. There is no single centralized directorate generating the actual language of the code.

The documents published for sale by the organization are not laws until they are adopted. Once adopted the publications become necessary for practitioners and governmental agencies. This creates a symbiotic relationship which allows this non-governmental organization to function as a clearing house and publisher for documents whose ultimate end is to become official regulations. Unless the documents are adopted into law they have little value to design professionals and others in the building industry. It is thus in the interest of the code organization to publish a code acceptable to local governments. Sales of these documents provide funds to the organization. It is also in the interest of the government to support the code development process because it gives the government access to vast technical resources in the building industry which it would otherwise have to pay to tap. There is a strong mutual self interest on the part of the model code organization to produce a product which is desired by governmental agencies and of the government to keep its access to

information. Professional organizations support the process in order to have direct input into codes which set the parameters for design and construction. There is also a strong interest on the part of design professionals to have a truly uniform set of design guidelines. This makes it possible for an architect or engineer to keep abreast of building requirements in many various jurisdictions when they have all adopted essentially the same code. The same incentive exists for materials suppliers and testing agencies who gain a wider potential market for products which can be demonstrated to meet a broadly adopted code. One test opens up many markets if it meets the criteria of a widely adopted model code. There are strong normative pressures which bring together each of these groups and keep them involved in the development process. This may sound idealistic or altruistic, but this process survives and functions precisely because it is not. Enlightened self interest along with a combination of mutual respect and wary watchfulness bind together the parties to the process.

Notwithstanding the fact that any one individual can submit a code change, a review of a recent list of typical code change proponents reveals a preponderance of groups and representatives of groups along with the types of experts one would expect to be involved in code generation. See Table 1. Note that almost every one of those listed can be identified as having a point of view represented by some larger organization.

This is a process where decisions can have major monetary impacts on the construction industry. How does the system work to prevent groups with large financial resources from dominating the process? This domination could take an overt approach in the form of overwhelming documentation, numerous testifiers or creation of confusion and doubt about a competing product. It could also take the form of less visible and less savory practices such as gifts or outright bribery. How is the system set up to minimize the effect of these