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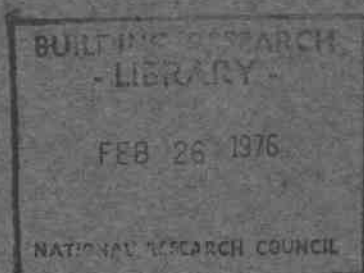
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TOWARD ENLIGHTENED BUILDING SAFETY CONTROL

ANALYZED

by R. S. Ferguson

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NATIONAL RESEARCH COUNCIL OF CANADA
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TOWARD ENLIGHTENED BUILDING SAFETY CONTROL

by
R.S. Ferguson

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TOWARD ENLIGHTENED BUILDING SAFETY CONTROL

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ABSTRACT

Building safety control is an institutional delivery system involving more than building and spanning the era of man. The early development of the National Building Code of Canada is referred to as an example of a system aimed at safety through knowledge of performance. Three difficulties which have prevented the complete achievement of this goal are discussed. The goal is restated and, looking to the future, a hypothetical case is followed to illustrate what the implications are if such a system could be totally applied.

VERS UN SYSTÈME ÉCLAIRE DE SÉCURITÉ DANS LES ÉDIFICES

par R.S. Ferguson

RÉSUMÉ

La sécurité dans les édifices est un secteur spécial qui dépasse le bâtiment comme tel et couvre l'histoire de l'homme. Les débuts du Code national du bâtiment du Canada sont considérés comme l'exemple d'un système visant la sécurité par une connaissance du rendement. L'auteur examine trois difficultés qui ont empêché d'atteindre ce but pleinement. Celui-ci est redéfini et un cas hypothétique, projeté dans l'avenir, sert à montrer les répercussions de la pleine mise en oeuvre d'un système de ce genre.

TOWARD ENLIGHTENED BUILDING SAFETY CONTROL

by

R.S. Ferguson

The word enlightened means, in the context of this paper, "to have knowledge of," so the subject relates to knowledge and its application to building safety control. In the narrow sense, this could mean, for instance, applying what we know about the behaviour of fire to legal rules on fire resistance, but it can also mean standing aside from these important continuing tasks to get to know something about the whole field of building safety control of which legal rules on fire resistance are but a tiny part. Now is an appropriate time to pause and view the broad picture. Where have we been? Where are we now? and Where are we going?

The subject of building safety control is both broad and deep. In the broadest sense, it refers to institutions whose purpose is to achieve safety. Institutions are seen today to be social delivery systems. In the case in question, they deliver society's goal of building safety to the people. The building code is an instrument or vehicle. It is part of the delivery system which includes standards, bylaws, administrative procedures, law courts, research, and other social instruments.

In considering this system, it can be of value to examine each one of these instruments separately. Thus, consideration of a code or building department procedures can smooth the process of achieving safety, but to be unaware of the system of which these are but parts, greatly curtails the field of action where improvement can take place.

It is obvious, for example, that an application form for a building permit must relate to the content of the bylaw, the records which the authority needs, and other aspects of the system. In fact, it is less as themselves and more as parts of the system that these instruments make sense.

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A code can be considered in this light, by itself but we must always be cognisant of how it fits into the total system. We can also recognize that a code is not "the" instrument but one of several instruments. We may then ask, What can each of these instruments do? Which instrument is most efficient for a particular purpose? When you garden you have shovels, hoes, rakes, forks, picks, etc. To achieve your goal you may need all of these but, for specific tasks, you will select specific tools, applying your knowledge of their capabilities and limitations. Similarly, it is important to know the capabilities and limitations of law, knowledge, and skill, as these can be applied in codes, standards, specifications, and procedures, which are the vehicles used by the delivery system for building safety control.¹

The subject is broad also in the sense that it must deal with more than building. It is the control of the environment, of which buildings are only parts. To be unaware of how buildings relate to each other and to other things in the environment, greatly curtails the likelihood of success in achieving the goal of safety. At present, one civic department may control roads, another sewers, and another buildings, yet these are man-made and not God-given categories. They can be changed. No one wants change for change's sake, but the goal should be paramount, and these social organizations must be seen as instruments to achieve it and not as obstructions blocking the way.

The subject is deep in that it spans the era of man. The problem of safety arises because man, as the anthropologists put it, is set apart from nature. It is recognized today that it is knowledge which sets him apart. Knowledge is the source of his power to change nature, and any and every change makes his state of being or existence either more or less safe. He does not know everything, so, while he will obviously, within his limits of knowledge, choose a safe course, he may still be undone by nature.

Knowledge grows with time. It is self-evident that at one time there was none. It is possible, however, that very early in his conscious existence man recognized the power that knowledge gave him to change, and hence to control, nature. The Bible story is that in the beginning God created the earth but on the next page God is quoted as saying "Now that man has eaten of the tree of knowledge he has become like one of us." If not creating, he is at least changing the earth.

Thus, knowledge has separated man from nature. The process has been gradual. As knowledge increases, the separation increases and for an ever growing range of phenomena, acts of man replace acts of God. The separation not only frees him to act but forces him to act, to fend for himself. He must clothe himself, grow food, and build, and in seeking ways to do these better, must seek new knowledge and apply it and therefore undertake to a much greater degree, a number of specialized activities that are essential to survival. Building safety control has become one of these.²

Thus, while building safety control has become a specialty, it is not simply a question of writing requirements in a law. It is the achievement of the state of shelter that is adequate for man. The questions to answer are: Shelter for what? From what? With what?, and For how long? The answers to these depend on the extent of knowledge, and because knowledge increases with time, there are different answers for different historic times. Knowledge creates the state of society from which demands for shelter come, and it also creates the means by which these demands are met. For any time and place, it is possible to marshal the knowledge resources and so document the shelter situation.

The idea of documenting all the knowledge on any subject is not new. There are encyclopedias. Also, library search and digest of relevant knowledge is always the first task of a researcher embarking on a particular study. It is less common, however, in the building practice field, to undertake such a task for a wide and deep subject such as building control. The stimulus to do it is the end goal. In Canada after World War II there was a stimulus to prepare a performance or knowledge-based code and at that time the available knowledge was brought together to achieve this goal.

The result of this effort was a building code that in both its form and content differed from building codes in other areas. It was not all different. Much of the traditional approach was retained. The philosophy and some examples of important differences have been reported.³

This effort did not fully succeed for several reasons. First, while the goal was performance, there was another and equally important goal -- that of developing a code of immediate and practical use. Hence, the code had to fit the prevailing system which was not well integrated, and moreover involved different groups and authorities that were to a degree estranged. There was a tendency to concentrate on the parts at the expense of the whole, and, indeed, there really was no conception of a system as is envisaged today. Design offices designed, but this group was not educated in all aspects of safety, which was regarded as the special interest of authorities. Again, control was by municipal authority whose instrument was law. Municipalities were limited by what it was possible to do under law, and the mechanics of law as an instrument prevented it from being the universal tool. They were also limited because their power was delegated. They could control only those specific subjects that enabling legislation permitted. Also, the municipal agencies for building, fire, health, and planning control had separate and partially overlapping interests, and the authority under which each operated came from a different source, -- a different provincial Act.

Second, individuals in each group involved in building control received their training and experience or got their knowledge in different ways. The know-how of plumbers, architects, engineers,

building control officers, and many others was utilized, but few if any had the broad goal of, or experience with, performance since their necessity was the specific operations in which they were involved. Training and experience involve a lifetime, and that is the period to consider if any broader goal for building control, such as performance or a system, is to be achieved.

Third, although readily-available knowledge was harnessed in the interests of performance after World War II, it was found that in one major area, building use, the knowledge that was needed was, for various reasons, either not easily accessible or not in a form that it could be applied to the purpose. Some of it had been gathered for special reasons, e.g., insurance that did not jibe with code purposes. The groups most qualified to get the information (social scientists) were not involved with building safety and, in short, no system had been developed which could deliver this knowledge in a form useful for application to building safety control.

Over the last twenty-five years, all of these situations have altered. They are still essentially as they were, but there is a better understanding of the problems that they cause and many individuals have dreams of an integrated approach. These are the incentives that in time will topple the barriers that obstruct change.

Another major incentive is the evolution of society and the attempts of the building industry to reflect the aspirations and house the complex agglomerations of human activities which characterize modern life. These need to be controlled, but a somewhat different vehicle of control, perhaps a new model, is indicated.

This is neither the time nor the place, nor am I the one to say what a new or modified system should or could be. It is evident that anything new in the way of control must involve all those who are concerned. It is vain to think that any one person could devise a system of the magnitude being discussed and present it on a platter. Bottom drawers are full of such foolish and forgotten schemes. Such an approach not only feeds on vanity but it also reflects a laziness and dereliction of duty of those who should be involved. Involvement, of course, means cooperating with others. A cooperatively achieved solution would require collaboration among many with diverse knowledge and interest. Such a coming-together could be constructive or destructive, depending on the attitude.

What is appropriate today after twenty-five years is to restate the original goal of a knowledge-based performance code. The significance of a code as an instrument and a part of a system was not appreciated twenty-five years ago. The philosophy, however, was fundamental and is as relevant to the system which is the subject today as it was to the code goal of yesteryear. As previously stated, the goal involved the documentation of knowledge. The documentation needed was

clearly in three fields: building use, the external environment, and the fabric or material of building.

Let us now look to the future and assume that the documentation is complete. How would this information be used? In answering this, specific procedures will not be discussed since the development of procedures is the task of all concerned. With this reservation, answering the question means stating how the knowledge would be applied to achieve performance in building safety control.

We could take, as an example, a project that is being proposed. The owner and his agent would consult the first field of documentation, building use, to answer the question "Shelter for what?". Here they would find explicit statements of the various activities of man but, of course, nothing about building. That would come later. They would discover the number and kind of people (e.g., elderly, children, disabled) to be considered in any activity, the space, furniture, and equipment needed and the expected time frame of the activity. They would also find knowledge of problems and hazards which relevant experience had revealed. These might include susceptibility of equipment to breakdown and fire, carelessness, and attitudes, such as public tolerance for exposure to injury and death.

With this as a basis, the second field of documentation could be consulted to answer the question "Shelter from what?". Here would be found knowledge of the conditions of the environment that cannot be classified as "building use." From these, conditions that are antagonistic to the particular activity being addressed would be identified. Is rain, wind or cold temperature antagonistic? What other conditions must be guarded against to achieve the goal, e.g., the continuation of the activity for an agreed-upon length of time? It might be known that other activities would be adjacent or close to the activity in question. To judge their compatibility, the building use documentation would be consulted again and data recorded that would be necessary to judge the kind of barriers to be placed in between.

Finally, when all this knowledge had been assembled and put in order, the designers would be in a position to answer the final question, "Shelter with what?". For this, they would refer to the third field of documentation which would include knowledge of materials, equipment, and other factors that are necessary in turning design ideas into reality. When the design had been prepared with graphic and written presentations, or drawings and specifications, the designers would be able to go back to the knowledge they had assembled and check that their solution (their design) had in fact provided shelter for all the conditions they had identified that shelter was needed for and provided safely in accordance with the limits set in the documentation. They could also present this material, including their final check, to the authorities whose job of policing safety would thereby be greatly simplified.

One word of caution is needed, however. With a knowledge-based system, this shelter could provide only for the hazards and conditions that are known. Admittedly, not everything is known, but since it is impossible and therefore wasteful and expensive to provide for what is not known, this is not a serious limitation.

Let us consider some examples of what these activities might be. The following gives an idea of the range that the system could handle. It could be the growing of a thousand bushels of wheat, or the transportation within three hours of one hundred people from Calgary to Regina, or it could be the activities of three hundred households, the display of a flag so it could be seen for one-half mile, or the activities of a group of people organized for the purpose of assembling television sets, or the activities of people centring around an event such as the Calgary Stampede. No matter what the activity, this system could take care of it.

This system appears, therefore, to cover everything that man does or at least builds for. Like an encyclopedia, it would be a book containing knowledge, but in three special categories. It would not prevent a person from developing his own solution to his problems. It would help him and also remind him of hazards related to the activities he wished to shelter that were of concern to the community at large, and it would provide knowledge of the means of controlling these hazards. But would it be desirable to have one book of knowledge applicable to bridges, trains, mines, farms, and buildings? The answer is yes and no.

Yes, because there is no logical cut-off point. One would want to control an egg-producing or turkey-breeding plant located in an urban area, as well as a salesroom and storage shed for farm machinery. One would want to control schools in rural as well as in urban areas. The book of knowledge could solve these problems. For example, hay storage might be a hazard only to neighbouring activities. If it was isolated in a rural area, it could comply without hardship because there would be no neighbouring activities.

Against this, the answer is no, temporarily at least, since different agencies develop different expertise and, despite the book of knowledge, some division of responsibility in recognition of these differences would become a practical necessity. The broader the coverage of the knowledge code, the more fundamental it would have to be. It would undoubtedly be more practical to derive applied codes from the fundamental one for different purposes.

This is not the place, however, to examine these details. There are current problems of building safety control. The collection of knowledge is a first step toward solving them but only a first step. The next step is to consider what delivery system or systems could best be used in conjunction with it. The development of various kinds

of documents which are the delivery system vehicles involve practical considerations and it is necessary to take these into account.

But is knowledge enough? Would there not be some who would try to skimp? Yes, undoubtedly there would be. It would be necessary to have the back-up force of law in case it was needed. This means that the system would have to provide some way to force the owner to use the book of knowledge. Some directive or directives having the force of law and relating to its use would be necessary.

What has been described is a very generalized and perhaps idealized building safety control system. An ideal is approachable but seldom if ever attainable. Its value is to provide a criterion to aim at so that the continuing effort for improvement can be channeled in that direction. A knowledge-based system of building safety control can never be totally achieved but, by looking far enough ahead, it is possible to anticipate problems, be prepared, and make step by step advances toward the goal.

This paper is a contribution from the Division of Building Research, National Research Council of Canada, and is published with the approval of the Director of the Division.

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