

ACCEPTABLE SOLUTIONS

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ABSTRACT

Building regulatory systems around the world are going through dramatic change in response to changing stakeholder needs and political environments. These changes are introducing greater flexibility through the explicit statement of the objectives of the regulations and an increase in expression of code requirements in performance terms. A common characteristic of these new regulations, generally referred to as performance or objective-based, is that they include or are supported by at least one set of acceptable solutions which are deemed to deliver the required performance.

An alternative solution different from the corresponding acceptable solution may also be considered. This characteristic of these new building regulatory systems is an important feature for those wanting to encourage innovation and the advancement of new technologies.

There are many issues and questions surrounding acceptable solutions, which must be addressed by those implementing performance-based building regulatory systems. CIB TG37, which is titled Performance-based Building Regulatory Systems, is working to gather information and experiences related to these issues and questions. These issues include the form of the acceptable solutions, what constitutes the minimum level of performance, relationship of the acceptable solutions to performance-based requirements and issues surrounding documentation and publication of the acceptable solutions. There are similar questions with regard to the acceptance of alternative solutions but the timeframe within which a building authority must respond is much shorter. In some cases the alternative solutions will be assessed against the objectives and performance requirements of the performance-based codes while in others the alternative solutions will be compared with the acceptable solutions.

This paper will present the work to date of TG37 in studying these issues and questions.

KEYWORDS:

Acceptable solution; alternative solution; performance-based code; objective-based code

INTRODUCTION

The changes in building regulatory systems around the world are occurring for varied reasons. The common element resulting from the changes however is the introduction of greater flexibility for the building code users. This is achieved through the explicit statement of the objectives or goals of the regulations and an increased use of performance-based requirements.

There is also extensive use of the concept of acceptable solutions as an explicit part of the building regulatory system. These solutions often establish the baseline against which innovative designs or project specific designs can be compared to determine compliance with the regulations. In the past the prescriptive code provided the code users with a solution which was considered acceptable to the regulatory system. The knowledge was lacking as to how to express the desired outcome in performance terms so it was provided in a single specification based solution. Because the complete knowledge to express the requirements in performance terms that can be verified at the time of construction still does not currently exist in all areas, the role of the acceptable solutions in today's performance-based regulations has become very important.

An increase in the number of acceptable solutions will likely occur over time as new approaches and methods are employed in building construction. They will not necessarily all perform at the same level but they will all be considered to deliver at least the minimum level of performance expected by the building regulation in all areas covered by the code.

A point of departure between the performance-based building regulations introduced in different countries is the handling of alternative solutions. Alternative solutions are methods of complying with the code different from the acceptable solutions, usually but not necessarily project specific. Generally speaking there are two ways these alternative solutions can be assessed for compliance against the code: comparing against the stated acceptable solutions (benchmark approach) or assessed against the objectives and performance requirements (first principles approach). There are pros and cons to the two approaches and they can co-exist. The decision as to which approach or combination of approaches is employed in a specific country is governed by broader aspects of the legal system and desired regulatory framework being pursued.

WHAT ARE ACCEPTABLE SOLUTIONS?

The term "acceptable solution" means many things to many people and is used in different ways around the world. Traditionally the prescriptive approach was to write a code with a single method that had to be followed. Implicit in these prescriptions was the level of risk or performance, which was acceptable to society. These prescriptions would frequently be the first acceptable solutions.

The new approach to codes is to express requirements for performance by stating objectives and some expression of the systems performance. In this way, codes are focusing on required outcomes rather than just one solution.

From the perspective of the building regulatory structure, an acceptable solution is considered to be a set of provisions which when met will deliver the desired performance as intended by the objectives and performance requirements. In this paper, the term "acceptable solution" is used in a broad sense and shall include prescriptive solutions as well as those expressed in performance terms, including their verification methods. Acceptable solutions have become an important part of the new performance-based regulatory systems. What has happened in the transition to performance-based regulations is a majority of the designers and builders continue to want to follow the acceptable solutions they became most familiar with. Even though there is greater flexibility if a performance-based design is chosen, anything more than comparatively minor departures from the acceptable solutions is viewed as a higher risk or more costly approach and is only used in certain kinds of projects. Consequently, when looking at performance-based regulations today, most countries will have some form of a prescriptive option available for their stakeholders.

HOW ARE ACCEPTABLE SOLUTIONS ESTABLISHED?

As mentioned above, the first official acceptable solutions were usually the old prescriptive codes. So when performance-based regulations were first introduced the old code frequently became the acceptable solution. Over time the identification of these solutions became more explicit and tied to

the objectives and performance requirements they are satisfying. In most countries the body that develops the code usually establishes the acceptable solutions. It is anticipated that over time the number of acceptable solutions will likely increase so that code users will have more ready-made options to choose from. For those countries wishing to increase the number of acceptable solutions, the method of approving solutions needs to be established within the building regulatory system.

As more solutions are established, questions are raised as to the minimum performance needed to meet the code. This becomes important when considering the performance of new or innovative alternative solutions.

WHAT IS THE RELATIONSHIP BETWEEN ACCEPTABLE SOLUTIONS AND THE OBJECTIVES AND PERFORMANCE REQUIREMENTS?

In most cases the acceptable solution is deemed to meet the objectives and performance requirements without a precise analytical relationship being established. Such acceptable solutions are frequently deemed to meet the objectives and performance requirements because they are what people are used to and accept as being adequately safe, especially when they formed part of the previous prescriptive code. The countries that have adopted performance-based regulations have built at least one set of acceptable solutions into the structure of their regulations.

As mentioned above, there can be different structural relationships between these parts of the regulations. The "first principles" approach allows equivalencies to be assessed against the objectives and performance requirements. The "benchmark" approach is more conservative by recognizing that objectives and performance requirements are predominantly qualitative and that the societal performance expectations are reflected in the acceptable solutions. The latter approach tends to be used where a more evolutionary change is being introduced to the system and may perhaps be a reflection of the concern for liability. Most countries allow a combination of the two approaches.

WHAT ARE ALTERNATIVE SOLUTIONS?

Alternative solutions present ways of complying with the performance levels expected as expressed in the objectives and performance requirements or the acceptable solutions. They can be a unique solution for a specific building or be a solution which represents a type of construction that is repeated in different buildings or locations. The solution can just meet the requirements or be significantly better than the minimum. These solutions must be accepted by the local authorities or by some established organization acceptable to the building regulatory authority. This is where some confusion comes up because the solution would be "accepted" by a local authority as an alternative to the corresponding acceptable solutions in the building regulations. That acceptance by one local authority is not legally binding on anyone else. That contrasts with the corresponding acceptable solutions, which is part of the building regulations and is binding on all local authorities administering the building code.

HOW ARE ALTERNATIVE SOLUTIONS ASSESSED?

This is not a new problem for the building regulatory community or designers. Codes have traditionally had to accept new technologies and innovative designs for as long as they have been in existence. Under a prescriptive code, building authorities could have dealt with such designs by way of acceptance as alternatives to prescriptive design. In certain cases building authorities have the ability to set aside certain specific prescriptive requirements when overall equivalent performance is achieved. The same approach is sometimes taken to existing situations. As a result, in countries where there are codes in place there are already a variety of methods being used by the authorities to permit alternatives to the prescriptive requirements of the code.

Ultimately, for a design, product or method to be used the building regulatory authority must accept it. This is usually a local authority. It is their responsibility to ensure it meets the requirements of the codes. Depending on the complexity there are different steps that could be taken. These steps are made a bit easier now that the objectives and performance requirements are stated in the code. The different methods are:

- Plans examination may be adequate if a simple concept is being introduced.
- Checking of design calculations, or certification by a third party, or sometimes by the designer, is often used when there is a verification method such as a standard referenced in the code. In some cases it might be sufficient for the application to be “stamped” by the engineer or architect responsible for the design. Those methods could also be used for a new or different application of a product or design not considered by the acceptable solutions. However, if the design is incorporating many innovative aspects to the solution being proposed the use of a peer panel can be considered. This method would bring together a variety of disciplines to reach a consensus on the design’s ability to meet the objectives and performance requirements of the code.
- Products or systems that are not specifically covered by the acceptable solutions or justified by the verification methods will often require an evaluation by an independent evaluation body. In certain cases organizations that do certification can do such an evaluation. Many countries now have specific evaluation bodies to do this type of assessment. In some countries guidelines are published on how new and innovative products or systems can satisfy the performance required by the regulations.
- Some cases may require in situ verification of building work after construction to confirm acceptance.
- Any other method that reasonably and rationally establishes, to the satisfaction of the building regulatory authority, compliance with the objectives and performance requirements.

Ultimately, if the proposed design is so general in its application, such as a generic system that would be applied numerous times across the country by many practitioners, the building authority would expect this to be taken to the established body to be processed as a new acceptable solution of the building regulations.

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The ability and level of effort to achieve the above is impacted by whether you assess performance against first principles (objectives and performance requirements) or benchmarks (existing acceptable solutions).

In the first principles approach, considerably more responsibility is placed on the designer and building authority to determine acceptance. They will be faced with gaps in knowledge and methods to analyze against the qualitative objectives and performance requirements. This approach allows a building authority to accept an alternative solution that would provide a level of performance deemed to be “acceptable” but not necessarily equivalent to the level of performance offered by the existing acceptable solutions. The main difficulty with this approach is to determine what exactly is an “acceptable” or a “satisfactory” level of performance. It does however allow the greatest flexibility and does not inadvertently impede innovative approaches by the nature of the benchmarks or acceptable solutions.

Assessing against the benchmark recognizes there is a risk in trying to elicit all performance expectations that have become inherent in the solutions that have evolved in our present codes and that there are implied expectations not articulated that need to be understood before establishing a system based on first principles. The main difficulty with this approach is to determine which acceptable solution establishes the minimum expected level of performance. This would become the basic acceptable solution against which equivalency of a proposed alternative solution would be assessed.

WHAT DOCUMENTATION/RECORDS ARE NEEDED FOR ALTERNATIVE SOLUTIONS?

Codes have permitted alternatives to prescriptive requirements for years. What is different now is the extensive use of performance-based requirements in new codes and the capacity to use alternative solutions, which has amplified the need for proper documentation and records for future reference. In many cases the authority can no longer simply look at the code in force at the time of construction to get an indication of what was built.

Documentation of the design of an alternative solution is needed to ensure future modifications to the building do not negate or inadvertently change the key elements or features critical to the intended performance of the building and its systems. There are questions raised about how does one capture the design assumptions and parameters that were used and accepted as alternative solutions when the building was first built. It is of particular concern where private certification /inspection has been implemented.

Many regulatory systems require the plans and specifications for any building to accompany the application for a building permit and to be held thenceforth by an office of record. Where that is not a feature of the control system, then at least consideration should be given to requiring the documentation for alternative solutions to be held at an office of record. Suitable offices are:

- Municipal building permits office. This is where there is the expertise to understand the importance of the depository.
- Some have suggested that it is similar to other property characteristics that are attached to the title of the property such as a deed restriction, and therefore should be kept in the land registry office.

Since one of the benefits of performance-based codes is that they enable greater flexibility and creativity in achieving the desired level of performance, the need for good records is simply amplified. Under performance-based codes, which use extensively performance requirements, the question of capturing the critical aspects of the solution employed in a specific building becomes more important.

WILL PERFORMANCE-BASED CODES REQUIRE GREATER CONSIDERATION OF OPERATIONS AND MAINTENANCE ASPECTS OF ALTERNATIVE SOLUTIONS?

It is fair to expect that the acceptable solutions established as part of the code development system will be consistent with how operations and maintenance is considered already in the codes. When alternative solutions are developed with significantly greater reliance on active systems then it becomes a subject for greater assessment. This can arise in designs assessed against first principles or simply designs such as in the area of fire safety, which shift to a greater reliance on active systems involving intricate controls.

This would also tie into the proceeding section relating to documentation. If there are maintenance considerations important to the long term functioning of the innovative solution then they should be communicated through some permanent record that remains attached to the property through the life of the building. In at least one country the performance-based building code includes mandatory requirements for durability, given routine maintenance. In that country, the regulatory system is structured to ensure that specified maintenance procedures are followed. That gives code developers greater confidence to include such systems in acceptable solutions, and gives building authorities greater confidence in accepting them in alternative solutions.

CONCLUSION

Acceptable and alternative solutions are an integral part of a well functioning performance-based regulatory system. Acceptable solutions provide a dimension of stability for those who remain confident in the way things are being done while alternative solutions give the freedom to deal with innovative ideas or difficult rehabilitation.

As we expand the use of alternative solutions answers will be needed for the questions about

- Acceptable level of performance.
- Interpreting the objectives and performance requirements of the building code.
- Evaluation methods for assessing compliance.
- Documentation.
- Degree to which building regulators and designers need to be engaged in the issues surrounding maintenance.

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