

Challenges of Using Building Regulations in Architecture from the Perspective of Design Research

Asghar Mohammad-Moradi^a, Mohammad Ali Khan-Mohammadi^{b*}, Mojtaba
Pour-Ahmadi^c

^a Professor of Architecture, School of Architecture and Environmental Design, Iran University of Science & Technology

^b Assistant Professor of Architecture, School of Architecture and Environmental Design, Iran University of Science & Technology

^c PhD researcher of Architecture, School of Architecture and Environmental Design, Iran University of Science & Technology

Abstract

The use of building regulations in architectural design has been a controversial issue for a long time. From the view point of critics, building regulations inhibit innovation, promote conservative design and are incapable of insuring design quality. From the defenders point of view, some professional mentalities of architects regarding building regulations are problematical and must be changed. The present research aims to illuminate the reasons for the above-mentioned tension between architectural design and building regulations. This is done by examining the structural match between architectural design and building regulations. Seeing from a designer point of view, the paper compares formal characteristics of building regulations with architectural design. Three general characteristics of building regulations are found in contrast to characteristics of architectural design. Building regulations are analytical in nature, while architectural design is a synthesis-oriented act. Building regulations are mainly based on a reductionist approach towards defining design problems and solutions, while innovation and originality are considered as fundamental values by most architects. And thirdly, building regulations are usually framed in a way that matches an evaluative mode of thought, while architects often have to work in a generative and predictive mode. These explain why architects from time to time feel frustrated with regulations. The paper continues to make recommendations to both architectural designers and regulators. To the designers some facts and points are stated to help them better understand the nature and performance of building regulations and guide them safely and positively use regulations in their design process. Addressing the legislators, the paper offers some recommendations to facilitate the use of building regulations in architectural design. Moving towards performance-based regulations, a broader involvement of information technology in building regulations, and production of designer-oriented guidance documents are some of these recommendations.

© 2014 Published by TMU (Tarbiat Modares University).

Keywords: building regulations, architectural design, design research

1. Introduction

While the use of building regulations plays an essential role in building control systems in today's societies, there are serious debates about their function in design process. Obstructing innovative designs, promoting uniform and conservative designs, and being incompetent in guaranteeing architectural quality are some of the characteristics that are criticized by architects. On the other hand, from the view point of the supporters of building regulations, some mentalities in architecture profession are to blame and must be changed (see: section 2). Lawson describes this tension when he says: "The designer may, at times, see the legislator as mindlessly inflexible, while to the legislator the designer may appear wilful and irresponsible" [1:89].

The current research tries to shed light on the reasons for the tension between architectural design and building regulations and tracks its roots in some formal and structural incongruities between these two phenomena. In other words, Instead of putting the blame on architects or legislators, this research attempts to yield a realistic understanding of the nature of the tension between design and regulations through an examination of the formal characteristics of building regulations on the one hand and a consideration of the general properties of design process on the other hand.

Next, the research continues to present some recommendations for the proper use of regulations by architectural designers. This is based on the premise that if designers are not well-informed about the characteristics and limits of building regulations, their design process may suffer some damages. On the other hand, in order to improve the formal harmony of regulations and design, the research makes some recommendations to those responsible for making laws for architecture.

The current research is conducted through a critical review of the relevant literature and an evaluation of the views of important commentators using the logical argumentation strategy [see: 2: Ch. 11].

2. A critique of relevant viewpoints and statement of the adopted approach

In this research the current viewpoints on the use of building regulations in architectural design are divided into three categories. The first category comprises viewpoints that consider building regulations as problematic and put the blame on legislators. These views are predominantly stated by architecture designers who emphasize the weaknesses and flaws of building regulations.

From the viewpoint of many architects building regulations can prohibit innovative act and encourage conservative and passive attitudes towards design [3:520, 4:281, 5:138, 6:1, 7:159]. Inflexibility of regulations has been criticized as well [8:89, 4:282]. Carmona and his colleagues through reviewing the literature have provided a summary of the potential strengths and weaknesses of design codes [9:237]. Among the weaknesses are mentioned items like standardization of design, being restrictive and formulaic, the potential to stifle creativity, the danger of architectural fundamentalism.

The incompetence of building regulations to ensure environmental quality is another criticism that recurs in the literature [10:20]. There the regulations may be considered as an "additional burden" [4:280] with which the designers have to conform or as an "add-on" [5:140] external to the creative process of design.

In order to explain the reasons for this incompetence Carmona and his colleagues have mentioned some factors: "because coverage was often patchy, because they only covered a limited number of environmental factors, and because, when used, they were seen as the maximum rather than the minimum desirable qualities to be achieved" [3:520]. Partial and exclusive attention to the material human needs has been criticized as another reason for the weakness of building regulations to ensure environmental quality [11:709].

From the viewpoint of this research, generally the regulations are not by nature obstacle to good design, but for some of their typical characteristics, may render the work more difficult for designers or may make the design process prone to some damages.

In contrast to the previous viewpoint, there is a point of view that sees the origin of the problem not in regulations but in architecture and architects. Carmona [12:178] after dividing the key actors of design control into the development and design lobby (architects) and the amenity lobby (planners), states that from the viewpoint of the amenity lobby, architects' mentalities pose a serious challenge to design control (figure 1).



Figure 1. An architect from the viewpoint of a planner [30:52]

Imrie and Street are also among the commentators who refer to some specific mentalities of architecture society in order to interpret the tension between architecture and building regulations. They recognize the "Palladian conception of practice" [5:277] at the heart of these tensions according to which architecture is considered as a "form of artistic expression and endeavor" [5:8] and the architect as the "heroic form giver" [5:8] who deploys his creative talents to design and produce the built environment. In this conception building regulations belong to construction which is inherently inferior to architecture. Therefore, architects disdain to work with these regulations and feel dissatisfied with them.

From the viewpoint of this research, the conception of architect as a free artist though problematical, cannot be considered as the mere reason for the tension between architecture and building regulations. It may be likely that architects who do not believe the afore-mentioned conception feel discomfort working with regulations too. Therefore, it seems that this interpretation of the problem has not reached the depth of the real problem enough.

Finally, the third viewpoint which provides a basis to approach the problem is one that focuses on the structural and formal harmony between architectural design and building regulations. In this viewpoint both architectural design and building regulations are considered as two specific mechanisms which have their own structural characteristics. The more these two mechanisms are in structural and formal harmony, the better and smoother the performance of building regulations in architectural design process will be (Figure 2).

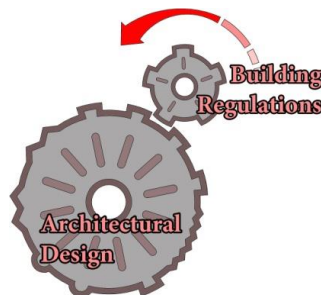


Figure 2. Structural disharmony between building regulations and architectural design causes some problems for architects.

It seems that this approach is best observable in Lawson's writings. Lawson sees the root of architects' dissatisfaction with building regulations in its structural relation to design process. He describes the problem in this way that "It is increasingly difficult for the designer to maintain a sensibly balanced design process in the face of necessarily imbalanced legislation" [8:73].

In other words, when an architect finds out that application of the regulations in some conditions prevents him to go through his desired balanced and sensible design process, feels disappointed with them. It is interesting that this point of view was somehow expressed by some of the architects who were interviewed by Imrie and Street. For example, an architect is cited who had said: "If an architect's allowed to go through a proper design process, in my view there's no need for a design code, quite frankly" [5:239]

Lawson pointing to the contrasting attitudes and directions of building regulation and architectural design calls them "upside down and back to front" towards each other [13].



Figure 3. Lawson sees regulations and design as "upside down and back to front" towards each other. (Lawson, 1975, 28)

In current research it is aimed that by assuming the structural properties of design process as constant and by looking from a designerly point of view, the mechanism of building regulations is adjusted to the process of architectural design. Also, where it is not possible or practical to change the format of regulations, the current condition is accepted but attempts are made to inform the designers of the potential limits and threats of building regulations for their design process.

3. A model for comparing common properties of building regulations and architectural design

In this section common characteristics of building regulations and architectural design are compared and contrasted under three main titles:

3.1. *analysis-oriented approach of regulations versus synthesis-oriented approach of design*

Design has to result in synthesis. In other words, design is a movement towards creation of a synthesis. The produced design solution is often a holistic and integrated response that simultaneously solves a number of problems [8]. Good design necessitates such integration [14:35]. While synthesis is the general approach of design, building regulations are generally analysis-oriented, i.e. they decompose architectural performance and examine it in a fragmented manner. Building regulations does not view a building as an integrated whole but as a collection of parts.

Each part of building regulations considers building performance from a narrow specific point of view and reflects concerns of particular organizations. For example, Iran's national building regulations consist of twenty two independent parts each of which deals with a specific dimension of building.

One of the main reasons why building regulations adopt a compartmentalized approach returns to the way they have come to existence. Each part of the regulations is the result of specific institutions and organizations' concerns about and demands of buildings.

For instance, in England the first comprehensive building Act came into the statute book as a reaction to the great fire of London (1666) [15:1], therefore it was exclusively concerned with fire safety matters. Or the first building regulations aimed at securing the interests of health dealing with issues like the sufficiency of air space about buildings, ventilation, drainage, water closets, etc. were issued by the then Ministry of Health (1875) [ibid]. In the USA the first building codes related to people with disabilities (ADA) was developed by the Department of Justice (DOJ) and the Department of Transportation (DOT) as a civil rights law [16:28].

Therefore the range of the subjects that are covered by building regulations is restricted to a limited number of issues that through the course of history have been taken into specific consideration by societies and in turn by their legislators. Thus, it is obvious that much many factors affecting the quality of a design are not spoken about within the frame of building regulations. This status of being partial towards building quality is in contrast to the holism necessary for design.

Another characteristic related to the analytical nature of building regulations is their tendency to separate quantitative aspects of architecture from qualitative ones. After decomposing architectural performance to detached items, building regulations only examine those which are more susceptible of quantification and remain silent to other items. For example, in design for the disabled the legislator among all the environmental factors capable of improving the quality of life of the disabled only considers some simple quantitative factors like the slope of ramps, dimensions of bathrooms, and clearances of corridors. Having taken this approach, it will be evident that the expectations from building regulations to enhance the life quality of the disabled should be very limited [see: 17]. Thus the quantification-based view of regulations puts them in contrast to holistic view needed in design that must consider both quantitative and qualitative aspects of buildings.

Partial view of building quality in building regulations may result in a scattered collection of rules. By quantitative development of building regulations and legislating organizations, fragmentation of these regulations is increasing steadily and may act to "inhibit the realization of quality in the built environment" [18:150].

Partial and quantity-oriented view of building regulations leads to their focus on micro-level characteristics of buildings. In practice, this may deflect the designer's attention towards the detailed and quantitative specifications of building regulations and lead to an imbalanced attention to those aspects [13:26]. In addition, requirements of building regulations unlike other requirements of the brief are mandatory and cannot be negotiated or at times compromised. These characteristics make it difficult for most inexperienced designers to maintain a natural and balanced design process. Specifically, in absence of other complementing mechanisms for design control, this may damage the proportionate prioritization and valuation of relevant factors in the design process.

Instructions of building regulations are presented as isolated subsets from the totality of architectural design instructions and orders. In order to produce a sensible design, the designer should refer to a great number of architectural design orders only a small number of which are presented within the frame of building regulations. Instructions of building regulations are given as detached from this natural context and this may lead to the misconception that they are independent from their contextual conditions.

One conclusion that follows setting the orders of building regulations in a broader context of architectural design orders is that in order to produce a sensible design all the instructions used, whether as building regulations or not, must be harmonious in terms of quality level. Since the quality level in building regulations is a minimum one a danger here for the design process is that the designer neglects this fact and for items mentioned within the regulations limits the design to their minimum standards, while in issues

outside the coverage of building regulations goes beyond the minimums. This will result in the heterogeneous design.

3.2. reduction-based approach of regulations versus diversity-oriented approach of design

Reductionism means that in order to understand a complicated system only some parts of the system are considered and a reduced image of the real system is presented. Framing building regulations in their prescriptive format requires some reductionism.

Pragmatic concerns of the legislators prove influential in reductionism of building regulations. This pragmatism favors control processes that are practical in the face of all the limitations in terms of required human resources and their qualifications, time, cost, predictability of the outcomes, and the like. In addition, these processes have to be practical throughout a broad geographical context often the whole country, while in architecture sensitivity to context [31] is essentially important. In line with these practical concerns is that for legislators maximum simplification of the definition of design problems and their acceptable solutions becomes a priority.

As a result, proposed solutions of the building regulations are in fact general and somehow compromised substitutes for the accurate case-inferred solutions for a specific design situation. For instance, fire safety regulations can be considered approximate solutions for the custom solutions produced using the fire engineering science in which for each building fire safety measures are designed according to exact calculation of fire risk factors and proposed rescue scenarios [19:138]. Thus, the danger here for the design process is that this pragmatic nature of the prescriptions of building regulations be neglected.

Another characteristic related to the reductionist approach of building regulations is an attempt to formulate the regulations in terms of abstract concepts. For instance, instead of using the names and titles of familiar elements of architecture terminology which can easily connect to the architectural precedents some abstract concepts are used in which the definition of that element is reduced to a specific dimension of its function. As an example, part four of the Iranian national building regulations that is dedicated to the general building requirements refrains from using current terms and familiar patterns of residential architecture such as parents bedroom, children's bedroom, living room and the more abstract term of "residence space" is used instead or the term "opening" is used for doors and windows [see: 20]

An examination of the structure of regulations can better explain why they are reductionist. In Nordic system building regulations are formulated in five levels: goals, functional requirements, operative requirements, verification, and finally examples of acceptable solutions [21:8]. The problematic work is where the goals and qualitative requirements (levels one and two of the system) are to be transitioned to quantitative and physical specifications (levels three and four). Here the unexpected reduction takes place. Thus building regulations which are based upon prescription of specific physical characteristics may be viewed by architecture designers as illegitimately restricting their creativity and freedom. This is while creativity and innovation are of critical importance for architecture as a discipline.

Hidden premises and contextual conditions of orders of building regulations are closely related to their reductionist approach. Behind the orders of building regulations are some assumed conditions that may not be stated explicitly in their formal text. These premises are usually conceived in a reductionist way as the simplest and most common possible conditions for a design problem. As a result orders of building regulations work better and more smoothly in some specific problem contexts and apply with more difficulty to other conditions.

For example, in part three of Iranian national building regulations when the method for determining the location of exits and their distance from each other is stated it is based on the premise that the floor plan of the building has a regular shape and enjoys a level of uniformity around the specified diameter and preferably has a rectangular shape. These characteristics are assumed to all buildings. Thus it will be expectable that this method will not work properly for buildings that do not conform to those preconditions

(figure 4).

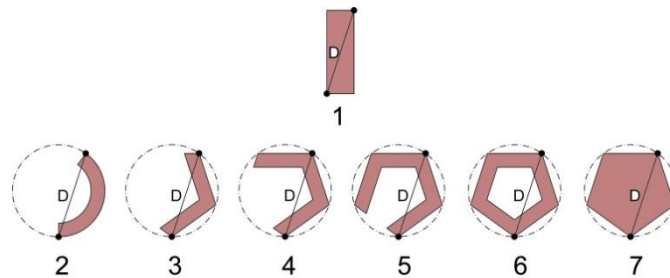


Figure 4. The error resulted from reductionist approach. For all the plans despite different shapes a constant $D/2$ is calculated as the distance between two exits.

Another example can be presented from part four of the Iranian national building regulations. There the minimum height for guard rails and hand rails is set at 110 cm [22:104]. It seems that some of the premises for this specification are that the railing is positioned exactly at the outermost edge of the floor, the floor continues as a flat surface to its edge, and the railing has the form of a thin flat vertical surface (figure 5, no. 1). These premises are based on a reductionist view of the design problem and solution and neglect the fact that a designer may conceive any one of these premises in a different way (figure 5, no. 2, 3, 4)

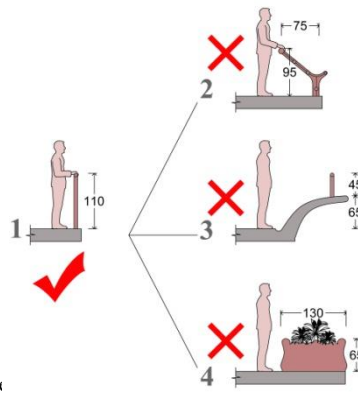


Figure 5. Reductionist view in setting the height of guard rails according to the building regulations.

Since these premises and preferred typologies are hardly mentioned in building regulations, it may render working with these regulations problematic for designers who want to approach the problem differently or even may lead to unreasonable outcomes. In fact, when quantity-oriented approach of the regulations is accompanied by reductionist view unreasonable outcomes are not far from expectation. It seems that this is closely related to what Lawson calls “number trap” for design [8:227]. Thus, building regulations not only try to develop uniformity of designs in aspects relevant to their subjects, but also can encourage uniformity in aspects not directly relevant to their specific subjects.

Having a reductionist view, building regulations try to define design problems in their simplest and most common forms and propose simple, common, and conservative solutions for them. This is while studies indicate that [see: 23:429] many expert designers deliberately try to approach the given problem in a challenging way to pave the way for developing more creative solutions. This challenging the hidden premises, not constraining oneself to preserve the current conditions, and offering original perspectives are critical in advancing architecture. In sum, while building regulations promote reductionism in design,

designers try to examine design problems using a diversity-interested view and create original and innovative solutions for them.

3.3. Evaluative framing of building regulations versus generative framing

The third characteristic of building regulations is that they are organized and framed in a way that for control officials it is most convenient to use them in design check while this evaluator-centeredness may make the job difficult for designers.

Building regulations merely state the required specifications for the final product of design process and are not concerned about how the designer should make proper decisions throughout the design process to satisfy these requirements and what information are required in each phase of design process to make these decisions. Therefore, it may happen that the requirements of building regulations are framed in such a way that does not provide the necessary information required by the designer within the natural design process. So the designer is frequently compelled to progress the design process by trial and error in order to satisfy the requirement of building regulations. In Lawson's terms, designer is forced to go through "unnecessary tedious synthesis and evaluation loops" [13:28]

This often happens for subjects of building regulation that influence the design of a building beyond its small details and necessitates proper design decisions in more general and strategic levels. For example, part three of Iranian national building regulations states that for hotels not equipped with automatic sprinklers "the number and location of exits should be determined so that in exit access passageways the distance between the door of every room or space and the closest exit does not exceed 30 meters" [22:44].

Here the formulation of this requirement is so that it will be clear and convenient for the design control official to check whether it is satisfied in a given design or not. But it offers no guidance for an architect who has just started the design of a hotel and in the preliminary stages of design has to determine the number and location of exits in a way that finally this requirement is met. The designers, specifically the more inexperienced ones, have to progress their work doubtfully and by trial and error. Although this does not prohibit finding an acceptable design solution, but it can make the process more laborious than needed. Table 1 presents a summary of the contents of this section:

Table 1. A comparison of general approaches of building regulations and architectural design and their potential outcomes

Approach of Building Regulations	Approach of Architectural Design	Probable Influence on Design
1. Analysis-oriented	Synthesis-oriented	1-1. imbalance in paying attention to design factors The designer becomes unduly concerned about subjects dealt with in building regulations and overlooks other subjects. 1-2. heterogeneity of quality levels in a design For subjects mentioned in building regulations the designer limits the design to their minimum standards, but for other subjects uses different levels of quality. Different parts of building regulations are not equalized in terms of quality level and are used accordingly in design.
2. Reduction-oriented	Variety-oriented	2-1. Reduction in originality and accuracy of design decisions The fact is ignored that prescriptions of building regulations are practical and approximate substitutes for case-inferred solutions. 2-2. simplistic view of the possibility and method of architectural design control Legislator ignores the fact that the control mechanism based on building regulations has its serious limitations.
3. Evaluative	Predictive/Generative	3-1. causing some inconvenience for designers

The designer is forced into an evaluative mode of thought and the progress of design is slowed.

4. Recommendations for a better performance of building regulations in design process

After identifying the possible damages that the design process is likely to suffer from the structural characteristics of building regulations, in this section some recommendations are presented to both designers and legislators. They are aimed to mitigate the negative effects of building regulations on design process.

4.1. Concerning the analysis-oriented approach of building regulations

In design research literature, building regulations (legislators) are one of the main generators of design problems [8:Ch. 6]. What the designer is provided by the regulations is some scattered parts of the design problem. However, the designer is responsible to produce the design solution which is a holistic and integrated response to the whole design problem [8]; “Good design is often integrative” [14:35]. Therefore the designer’s strategy in response to the analytical approach of the regulations is specified.

In order to alleviate the effects of analytical approach of building regulations measures should be taken to help the designers maintain a unified view to the design problem and its various dimensions. The first recommendation is an attempt to create a unified and simultaneous view towards the fragmented parts of building regulations. Computer software has considerable potential in this respect. For example, software that is able to provide the designer with all the relevant pieces of regulations in every design issue and does the relevant calculations quickly. As Lawson indicated “such programs can conceal the complexities of calculations and make a direct link between solution and performance, restoring to the architect his ‘feel’ for what he is doing” [24:82].

The second recommendation is using building regulations together with other technical architectural documents and seeing them as complementary resources. It has been discussed that the subjects dealt with in regulations comprise a little part of all the issues that should be considered in architectural design and that the subjects outside the regulations are not necessarily inferior to those inside them. Therefore, designers should be encouraged to view building regulations in a broad and integrated context of architectural knowledge resources.

The third recommendation is related to the balance in quality level of architectural designs. Since the analytical approach of building regulations may increase the threat of disharmony in terms of quality level, first it is necessary that the quality level of regulations is equalized in all its parts. The legislators are responsible for doing this task. Second, designers should be aware that building regulations only determine the minimum acceptable standards. So if they content themselves to this minimum quality level for the issues dealt with in regulations, then it will be better to stay at a similar quality level for the issues outside the regulations. Then the resulted design will not suffer from a heterogeneous quality level.

4.2. Concerning the reductionist approach of building regulations

In design research literature one explanation for describing the nature of design process is that the design process is a kind of conversation that takes place between the designer and the design situation [see: 8]. Therefore, a conclusion can be that a good building regulation is one which assimilates in this conversation more conveniently and fluently and plays a more positive and constructive role in it.

Furthermore, according to the literature the nature of designer’s relation to the legislator (or building regulations) is alike his relation to the client [see: 8:Ch. 6]. Thus conditions necessary for a constructive

relation between the designer and the client will be almost the same for the relation of designer and the legislator. Lawson referring to his conversations with a number of expert architects indicates that “designers want the client to begin the process without preconceptions about the nature of the solution” [1:26].

In other words, a good client instead of insisting on some predetermined physical characteristics and compelling the designer to use them in design expresses his requirements and demands mainly in terms of goals and objectives and gives the designer the reasonable freedom to produce the best possible solution. Similarly, good regulations communicate to the designer more in terms of goals and performance objectives rather than emphasizing on some physical characteristics of the design solution.

Therefore, the first recommendation is going towards performance-based regulations instead of now-traditional prescriptive ones. In performance-based regulations instead of determining physical characteristics of architectural elements, some performance criteria are set for them as Gibson puts it [25:92]: “The performance approach is, first and foremost, the practice of thinking and working in terms of ends rather than means. It is concerned with what a building is required to do, and not with prescribing how it is to be constructed.”

As an example, in performance-based regulations concerning design of handrails it is not emphasized that the height of railing has to be 110 cm at least, instead the designer is required to provide a specific amount of safety against unintentional falls of people (see figure 5).

In addition, both legislators and designers should know that the prescriptions of building regulations are often approximate and practical substitutes for accurate case-specific design orders inferred by the designer from the design situation. Thus, there may be cases in which the designer finds it reasonable to disobey the routine building regulations in order to respond to the specific conditions of design problem. For these special cases, arrangements should be in place to let the designer defend his different design and present his arguments to the control officials. For example, in designing a Zoor-khaneh the designer may find it reasonable to follow the tradition of lowering the height of the head of entrance door below the minimum set by the regulations. It is known that they lowered the head of the main door in order to provoke a sense of respect in entrants. The designer should be given the opportunity to negotiate his design with the control officials.

Another point is that legislators should try to make hidden conditions and premises behind prescriptions of building regulations transparent and provide the designers with the logic of these rules. This can be done by issuing guidance publications to support the building regulations.

Devising a comprehensive system of architectural control can help the position of regulation-based control be better distinguished and its boundaries more clarified. In this system a variety of evaluation and control mechanisms will be arranged as an integrated system to complete each other. Regulation-based control, control and evaluation based on other technical resources like design guidelines and multi-dimensional tools like DQI (Design Quality Indicator) and HQI (Housing Quality Indicator) [see: 27, 28: 208-218, 29: 352-373] and control by design review boards all can be integrated into a unified system.

4.3. Concerning evaluative framing of building regulations

In order to alleviate the negative effects of evaluative framing of building regulations and facilitating designers' interaction with regulations through design process it is recommended that parallel to each part of building regulations which is framed in an evaluative mode, a designer-oriented guidance publication be produced that provides the designers with necessary information they need through design process. In these guidance publications the prescriptions of regulations can be arranged according to different design phases form preliminary design to final abstract design. So the designer is not forced into “unnecessary tedious synthesis and evaluation loops” [13:28] in Lawson's terms.

In contrast to the evaluative framed version of building regulations, the designer-oriented guidance can be accompanied by diagrams and images of acceptable solutions and in Lawson's terms can use a “problem-

focused strategy” instead of a “solution-focused strategy” [26]. Also, in order to facilitate the designers’ interaction with building regulations and instantly doing the relevant calculations developing design assisting software offers good prospect.

5. conclusion

The present research attempted to illuminate the reasons for tensions between architectural design and building regulations. It considered building regulations and architectural design as two specific mechanisms that each one had its own intrinsic characteristics and the two mechanisms should work well together. The research was based on the premise that in order to enjoy a smooth and efficient performance, building regulations should be in structural and formal harmony with architectural design. Seeing from a designer point of view the paper finds three general characteristics of building regulations in contrast to relevant characteristics of architectural design. Building regulations are analytical in nature, while architectural design is a synthesis-oriented act. Building regulations are mainly based on a reductionist approach towards defining design problems and their acceptable solutions, while innovation and originality are considered as fundamental values by most architects. And thirdly, building regulations are usually framed in a way that is suitable for an evaluative mode of thought, while architects often have to be in a generative and predictive mode.

The paper continues to make recommendations to both architectural designers and legislators. To the designers some facts and points are emphasized: the subjects dealt with in regulations are not necessarily more important than subjects outside the realm of regulations; building regulations should be situated in a broader context of all the resources of architectural knowledge and should be used in company with other resources; regulations only determine the minimum acceptable solutions for design problems, not the best ones; orders and instructions of building regulations must be considered as simplistic approximate solutions for a design situation, not the most accurate and original ones. The suggestions to regulators contain: Developing computer software to facilitate the simultaneous attention to the fragmented issues of building regulations and helping designers preserve a unified look to all the design aspects; improving the consistency of different parts of building regulations in terms of quality level; promotion of performance-based regulations versus prescriptive regulations; clarifying the premises and the logic behind the orders and sentences of regulations through guidance publications and other supporting resources; devising a comprehensive system of architectural control that comprises a variety of complementary control mechanisms while clarifying the role of building regulations within the totality of the system; production of designer-oriented guidance documents parallel to the original issues of building regulations.

References

- [1] Lawson, B. *What Designers Know*, Architectural Press, 2004.
- [2] Groat, L, Wang, D, *Architectural Research Methods*, New York: John Wiley and Sons, 2002.
- [3] Carmona, M, Magalhães, C, Local environmental quality: establishing acceptable standards in England, *TPR*, 80 (4-5), 517-548, 2009.
- [4] Gann, D M, Wang, Y, Hawkins R, Do regulations encourage innovation? - the case of energy efficiency in housing, *Building Research & Information*, 26 (5), 280-296, 1998.
- [5] Imrie, R, Street, E, *Architectural Design and Regulation*, Wiley-Blackwell, 2011.
- [6] Punter, J, *Design Guidelines in American Cities: A Review of Design Policies and Guidance in Five West Coast Cities*, Liverpool: Liverpool University Press, 1999.
- [7] Saint, A. Lessons from London, in Echenique, M. and Saint, A. (eds.), *Cities for the New Millenium*, Spon Press, London, 2001.

- [8] Lawson, B, *How Designers Think: The design process demystified*. Architectural Press, 2005.
- [9] Carmona, M, Marshal, S, Stevens, Q, *Design Codes: Their Use and Potential*. *Progress in Planning*, 65, 209-289, 2006.
- [10] Street, E, *Project Paper 2: Architecture and the regulation of design: a review*. Department of Geography, King's College London, 2006.
- [11] Heywood, F, *Understanding Needs: A Starting Point for Quality*. *Housing Studies*, 19 (5), 709-726, 2004.
- [12] Carmona, M, *Design control — bridging the professional divide, part 1: A new framework*, *Journal of Urban Design*, 3:2, 175-200, 1998.
- [13] Lawson, B, *Upside down and back to front: architects and the building laws*. *RIBA Journal* 82(4), 25-28, 1975.
- [14] Lawson, B, *Design and the Evidence*. *Procedia- Social and Behavioral Sciences*, 105, 30-37, 2013.
- [15] LDSA (London District Surveyors Association), Stephenson, J, *Building Regulations Explained 2004 Revision*. London and New York: Spon Press, 2005.
- [16] Harmon, S, K, Kennon, K, E, *The Codes Guidebook for Interiors*, Hoboken: John Wiley & Sons, Inc, 2005.
- [17] Imrie, R, *The role of the building regulations in achieving housing quality*, *Environment and Planning B: Planning and Design*, 31, 419-437, 2004.
- [18] Nelissen, N. J. M, Vocht, C. L. F. M. D, *Design control in the Netherlands*. *Built Environment*, 20 (2), 142-156, 1994.
- [19] Loveridge, R, *Building regulation: from prescription to performance*. In: Rick Best and Gerard de Valence (Eds.) *Design and construction: Building in value*. Oxford: Butterworth-Heinemann, 2002.
- [20] Bureau of National Building Regulations, Part 4: General Building Requirements. Tehran: Nashre Tose'e ye Iran, 2013.
- [21] Sheridan, L, Visscher, H J, Meijer, F M, *Building regulations in Europe – Part II: A comparison of the technical requirements in eight European countries*. Delft: Delft University Press (DUP Science), 2003.
- [22] Bureau of National Building Regulations, Part 3: Building Fire Protection. Tehran: Nashre Tose'e ye Iran, 2013.
- [23] Cross, N, *Expertise in design: an overview*. *Design Studies*, 25(5), pp. 427-441, 2004.
- [24] Lawson, B R, *Science, legislation and architecture*. In: B. Evans, J. A. Powell, and R. J. Talbot (Eds.) *Changing Design*. New York, John Wiley, 1982.
- [25] Meacham, B, Bowen, R, Traw, J, Moore, A, *Performance-based building regulation: current situation and future needs*. *Building Research & Information*, 33:2, 91-106, 2005.
- [26] Lawson, B, *Cognitive Strategies in Architectural Design*. *ERGONOMICS*, 22: 1, 59-68, 1979.
- [27] Voordt, D J M, Wegen, H B R, *Architecture in Use: an introduction to the programming, design and evaluation of buildings*. Oxford: Architectural Press, 2005.
- [28] Giddings, B, Sharma, M, Jones, P, Jensen, P, *An evaluation tool for design quality: PFI sheltered housing*. *Building Research and Information*, 41:6, 690-705, 2013.
- [29] Carmona, M, Sieh, L, *Measuring Quality in Planning: Managing the Performance Process*. London and New York: Spon Press, 2004.
- [30] Carmona, M, *Controlling urban design—part 1: A possible renaissance?*, *Journal of Urban Design*, 1:1, 47-73, 1996.
- [31] Mahdavejad, M, Bemanian, M, Molaei, M, *Architecture in Context: Inspiration of Conceptualism in Design*, *Naqshejahan*, 1: 1, 21-34.