DEVELOPING PROCESS OF THE IRANIAN NATIONAL RURAL BUILDING CODE ORGANIZED TO MAINLY MITIGATE EARTHQUAKE LOSSES

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ABSTRACT :

In this paper, developing process of the Iranian national rural building code (The national code for low-rise residential buildings) is reviewed. While earthquakes are responsible for many losses in Iran, rural areas suffer more losses due to unsafety of houses. Unsafe houses are the consequence of improper design or lack of any engineering design and low level of building inspection throughout construction process. Hence, a national program containing both financial facilities and technical supports is developed and implemented by Iranian government body to rehabilitate the rural houses. The developing process of the national code for low-rise residential buildings is ongoing to address the design and construction problems in rural areas and unify the housing practice. The objectives of this code are categorized in three priority levels: (1) Safety and Health, (2) Wellbeing and Energy-Saving, (3) Sustainable development. These three priority levels of objectives are considered to put emphasis on limiting the earthquake losses. This code is considered to be performance-based, but prescriptive solutions are also presented as an acceptable solution. In addition efficiency qualifying methods are utilized to demonstrate the accordance of new systems with the objectives and performance requirements. Prescriptive solutions with simple terms, comprehensive commentary and also design charts for modular members are considered to facilitate the design and construction process and reduce the need for professional engineers.

KEYWORDS: Rural, low-rise, residential building code, performance-based, priority levels.

1. INTRODUCTION

Particular limited regulations pinpointed by the town hall were put forward in Iran subsequent to the compilation of the first municipality-based regulations in 1286. The architectural and urbanization codes were approved in 1352 which were reappraised in 1356. The “vigesimal discourses of the Iranian national building codes” has been published by the ministry of housing and urbanization, which is being compiled and rewritten incessantly by specialized groups and committees. The vigesimal Iranian national building codes are currently the documented legal authority in all deliberation points pertinent to constructions. Any sort of activities within national regulations has to be effectuated based upon these codes. Even minute rural buildings in rustic zones won’t be an exception to these regulations.

Given the fact that a behemoth portion of Iran’s population especially the inhabitants of the rustic zones are settled in one- or two-family buildings, provision of special regulations for rural buildings was particularly deemed to diminish seismic death-rolls through improvement of the construction system. Although such codes have been purveyed specifically aiming to improve the constructional situations in rustic zones, the corollaries can be taken advantage of in one or two-family low-rise buildings.

The structure of the Iranian national building code was remonstrated in this article. Some discourse points were dealt with on the sine qua non to purvey national regulations on the subject matter of purveying small buildings, characteristics and objectives of such codes as well as methods of fulfilling goals.

2. EXAMINATION OF THE IRANIAN NATIONAL BUILDING CODES

2.1. Traits

The Iranian national building codes comprise a set of yardsticks which have to be observed by devisers, implementers and utilizers as bottom-line criteria when constructional design, utilization and maintenance is concerned. Such norms apply to any cast of constructional operations such as demolishing, renewal, utilization alteration, expansion of edifices, decrease and increase of floors, displacements, essential reparations or suchlike cases. These are unified joint principles all over the country alluded to as national codes owing to this type of validity. The detailed subordinate points may vary in disparate zones due to locational and climatological conditions.

The detailed scope of such codes is terribly confined. There are no direct instructions for design and implementation. They merely mention laconically what ought to be observed. National constructional regulations are enforceable all over the country. That is why innuendoes are imperative without any educational or uplifting aspects. The Iranian national building codes possess 20 segregated discourses:

Table 1: Discourses of The Iranian national building codes

1	Definitions	11	Prefabricated Construction
2	Administration & Enforcement	12	Precautions During Building Operations
3	Fire Protection	13	Electrical Installations
4	General Building Requirements	14	Air-Conditioning and Heating Installations
5	Building Materials & Products	15	Lifts and Escalators
6	Loads	16	Sanitary Installations
7	Foundation	17	Gas Supply Plumbing
8	Masonry Buildings	18	Acoustics and sound Control
9	Concrete Structures	19	Energy Conservation
10	Steel Structures	20	Signs

2.2. The Quandaries Pertinent to Applicability Scope, Overseeing Rules and Implementation of The Iranian National Building Codes

Maybe most of the points caviled at in this theme pertain to pragmatic aspects and execution of a controlling set-up and quality control. Expressed in plain terms, one ought to admit that there are no ways of guaranteeing the implementation of the provisions on the national constructional regulations in design, accomplishment and utilization. Although downsized burghs do not require technical facilities to achieve suitable qualities as humongous cities do, the number of well-versed trained humans in minute towns and villages is less than intermediate and behemoth ones. This matter winds up in failure of objectives in such zones. The extant enforcement code of national buildings regulations does not distinguish humongous or minute constructions in oppidan behemoth or petite burghs and dorps. Such codes do not regard temporal and locational dimensions.

2.3. Quandaries Relevant to Categorization of Buildings in The Iranian National Building Codes

The segregation of discourses of the Iranian national building codes are effectuated in terms of the specialized views of diverse courses of studies. As a result of this classification a great portion of the extant regulations have not become pragmatic in most of the constructions as in minute buildings or they may be rarely utilized.

The examination of the national constructional regulations in diverse countries evinces that buildings are

categorized based on the aspects of complexity, functionality and occupancy. Although life-sustaining aspects is quite crucial in such classifications (the buildings of a particular batch may catch fire on an equal probability), however when a specific group of low residential buildings are taken into account, it will be feasible to put forth specific obligations of these constructions.

2.4. A Critical Exploration of The Iranian National Building Codes

The objective of the Iranian national building codes was approved by the council when article 33 of the engineering code and building control methods were propounded in the solar year 1374 officially: “Safety, Health, Appropriate performance, Comfort, and Cost effectiveness”. Such objectives are numerous and vague on one hand and intervening on the other hand. Lack of categorizations and prioritizations of objectives leads to failure and inefficaciousness of national codes.

“Appropriate performance” may pertain to the construction’s efficiency to actualize the end for which it has been devised and implemented, nevertheless in this case its connotation may approach other objectives of the national regulations for “Comfort” and “Safety”. Similarly, as it was mentioned before, the aforesaid “Comfort” concur the concept of “Appropriate productivity” in scads of cases. On another perspective it may denote solace due to implementation of the regulations. Some notions of “Comfort” are comprehensible in architectural aspects, however this matter pertains to the private life of people, hence it should not be encroached by national codes.

There are some vague points on the objective of “Cost effectiveness” objective in addition to the above-mentioned points. Achievement of a higher level of “Safety”, “Health” and even “Comfort” necessitates further investments which is intrinsically counteracting frugal savings. Thus the adoption of an optimum point has a bearing upon the analysis of cost and benefit. If a percentage of risks is reckoned for accomplishment of each one of the objectives, the expenses can be realistically and pragmatically figured out.

When this subject matter concerns low residential buildings notably in minute dorps and boroughs, it is not feasible to apply oneself to all the objectives in a parallel manner due to the technical and frugal debilities of Iran because such quandaries have their own predicaments too. On this account it is indispensable to reappraise the objectives particularly in the field of low residential buildings.

3. A PROPOSAL FOR ENACTMENT OF THE NATIONAL CODE FOR LOW-RISE RESIDENTIAL BUILDINGS

As it was cited before, the extent of low residential and minute constructions effectuated in villages and boroughs is a matter which sheds light upon the necessity of heeding such structural collections. Considering the aforesaid facts and an objective to generalize the contents of the Iranian national building codes while taking note of the applicability extent and the variegated manners of jerrybuilding in Iran, the recommended point is relevant to compilation of a novel discourse within the national codes in a simplified manner for low-rise residential buildings (one- or two-family dwellings). If regulations pave the way for builders of low-rise residential buildings by preservation of global tenets, it will be deemed as a furthering point accelerating the prevalence of technical discourses.

Analogous worldwide experiences can be addressed in this context. Separate code have been marshaled in the United States of America entitled “International Residential Code”, which deals with one-family and two-family dwellings to proffer prescriptive solutions. Part-9 of National Building Code of Canada (NBCC) pertains to housing and small buildings. Volume Two of the Building Code of Australia contains the Criteria of buildings categorized in class 1 and 10 (Housing Provisions). Residential constructional tasks in this country comprise two third of the constructions. Thus the second volume of the constructional code has been assigned

to this task. All the constructional stages have been sequentially put forth from land-preparation stage up to the end in a detailed manner. Sometimes they have been propounded without any designing requirements.

4. CHARACTERISTICS OF THE NATIONAL CODE FOR LOW-RISE RESIDENTIAL BUILDINGS (ONE- OR TWO-FAMILY DWELLINGS)

4.1. Objectives of The National Code for Low-rise Residential Buildings

Objectives of national codes are noteworthy from the ruling aspect. The enactment of such regulations is conceived as a permit meddle with the private adnominal personal life of people, hence, its justification pertains to instances in which general advantages are concerned. In addition to this matter, introduction and prioritization of the national regulations code for low-rise residential buildings (one- or two-family dwellings) has to be probed from the pragmatic aspect. Consideration of the climatologically variegated circumstances of Iran and jeopardizes of national calamities is efficient in identification and prioritization of objectives. Thus while taking note of the pinpointed objectives “Safty” and “Life-Safety” are severally prioritized to “Efficaciousness” and “Financial-Safety”. Therefore general goals of these codes are as follows:

- *Level-1 objectives:*
  “Safety”. It is relevant to integrity, stability, and stamina of the structure to safeguard the life of habitants as affected by gravitational loads, natural factors, and life-sustaining methods effectuated due to fire occurrence and security points observed in construction and utilization of buildings.
  “Health”. It pertains to hygienics and salubrious environmental conditions to safeguard habitants’ life owing to environmental factors during the constructional and utilization stages

- *Level-2 objectives:*
  “Energy Saving”. This is a part of the sustainable development actualization. Therefore energy saving and retrenchment is accentuated as a developmental pivot.
  “Well-being”. It purports the provision of suitable living conditions and eschewing paucity, environmental and performance convenience

- *Third-degree objectives:*
  “Sustainable Development”. It betokens provision of conditions resulting in resource economization to uphold national sources to minimize constructional pollutions and environmental shielding.

The enforceable nature of objectives is the most crucial reason for their categorization. Vulnerability of buildings against earthquake motions has wound up in heavy death-rolls in Iran during the past years. One of the government’s duties or objectives pertains to rehabilitation of buildings against earthquakes to safeguard populace’s lives. Its rapid fulfillment appears obvious. In fact, actualization of some of the objectives is sort of tantamount to the adoption of the optimum point in allocation of extant resources of the nation.

Consideration of level-2 and level-3 objectives which are categorized in the remnant levels of significance does not purport preclusion or deletion of them at all. It merely states the ensuing priority. Level-2 and level-3 objectives are the ones which people themselves can purvey based upon their penchants. The government can pave the way for vast implementation of them lest pertinent facilities are furnished and the effectuation necessity is discerned. It goes without saying that such objectives are valid within a period. They ought to be delved into subsequent to the elapse of an epoch so that it will be feasible to transform level-2 and level-3 goals to level-one ends with due consideration of locational and temporal circumstances.

4.2. The Applicability Scope of The National Code for Low-rise Residential Buildings

Such code pertain to low-rise residential buildings (one- or two-family dwellings) up to the elevation of 8 meters above the ground. No limitations may be deemed for it in diverse districts. In any case, sporadically populated boroughs or villages may be prioritized on account of the deficiency of well-versed human forces and low applicability of the constructional control and implementation.

The quantity of accessible facilities and the feasibility of retrieving the required experts in all stages of construction will differentiated constructional activities in minute boroughs and villages from other sorts of constructions. Therefore regulations compilations style is effectuate in a straightforward manner as operational recommendations so that semi-skilled agents can conduct them too. Given the facts mentioned above, the applicability scope of such national code is deemed for 3 years in the extant stage in villages and boroughs populated less than 150000 persons. It can be conducted in larger towns lest the legal authorities ratify it.

4.3. Determining the Regulations Compilation Procedure and The Pertinent Classifications

The compilation approach of laws and the sequence of retrieving materials can play a crucial role in efficaciousness, ease of usage, accurate commentaries, propagation of materials and suitable efficiency in implementation of objectives. Utilization of national codes of other countries as a ready prescription won't meet the requirements of the country at all nevertheless perusing the constituents of such codes and their rearrangement and amendment may entail adoption of reasonable and suitable decisions.

Foremost components of the national code for low-rise residential buildings are set forth as follows based upon the structures consistent with Iranian national building codes:

4.3.1. Objectives

Some typical objectives as well as the predominant framework of laws are articulated in this section. As it was mentioned in part 4.1 objectives categorizations and considerations of temporal and locus-based dimensions have been deemed in enunciation of objectives. These objectives can be categorized into level 1, 2 and 3 and they can be ramified from an integral entity into the constituents. Then they are prioritized in terms of sequences. Public interest is deemed in compilation of objectives but they can't be justified when private tasks of citizens are concerned. Such objectives are all-inclusive, coherent, transparent and practicable and they can be actualized within the national flair and technical competence of the country.

4.3.2. Performance Requirements

Such pragmatic requirements assert benchmarks whose consideration entails achievement of objectives. Performance requirements comprise those mandatory requirements which are contrasted in an objective-based manner to actualize the objectives. Performance requirements actually differ from solutions. Solutions encompass requirements such as utilization of particular materials for constructions, wielding recommended technical techniques or other procedures matching a predetermined plan to discharge a specific aim whereas performance requirements pertains to enunciation of objectives in details and recognition of crucial determinants which bring about a swifter actualization of objectives. Furthermore, performance requirements do not deal with enunciation of specific prescribed instances, rather it articulate minor objectives and functions in a specific sequence to achieve the global target.

4.3.3. The procedure of fulfilling the objectives and performance requirements

When objectives and performance requirements are articulated, regulations are set in conditions in which no particular solutions are proffered. Thus all the solutions which manage to fulfill objectives and performance requirements will be accepted, however as it has been cited in the perusals of other countries prescriptive strategies presented together with performance requirements are customary and required.

Hence while considering the aforesaid instances, two foremost methodologies may be conceived to fulfill objectives in the national code:

4.3.3.1. Application of deemed-to-satisfy solutions

What is named as “deemed-to-satisfy solutions” pertains to the wielding of a collection of prescriptive requirements. Their observation winds up in accomplishment of code objectives. In prescriptive strategies users do not directly deal with achievement of performance requirements or actualization of particular objectives, rather it delves into a set of detailed criteria which articulate dos and don’ts, the fabrication and implementation methodologies, the approaches of determining dimensions and volumes and suchlike. The boundary between acceptance and refusal is quite obvious in these criteria.

Users (encompassing designers and implementers) of codes in some cases (such as small buildings) are those people whose technical knowledge and specialty is less than professionals. They prefer to avail themselves of certain step by step instructions to design and erect buildings. Thus the ensuing instances can be considered for “deemed-to-satisfy solutions”:

- Clarified definitions of approaches, patterns, permitted constructional systems in specific applicability fields and pinpointed limitations.
- Constructional specifications involving materials, configuration, members and connections, manners of determining dimensions of members, and utilization of ancillary design tables.
- The implementation methodology and installation procedure are clearly explained in which all the disparate task-based sections ranging from design to installation and productivity as well as required supervisions are expressed together with details.
- A design example together with pragmatic aspects and implementation of instances inserted in the code.

In the part of structural systems of the national code for low-rise residential buildings the following “deemed-to-satisfied solutions” are presented as a minimum solutions and some design tables have been devised for them: masonry constructions, steel buildings, concrete buildings, and steel cold-formed buildings.
Similar attitudes are applied in the part of architectural aspects of the national code for low-rise residential buildings. The “deemed-to-satisfied solutions” are proffered proportionately, for instance when dimensions and specifications of windows are opted for the relevant traits are submitted in a manner that all the performance requirements and objectives are effectuated in the fields of illumination, ventilation, energy saving, acoustical infiltration, and ease of usage.

It goes without saying that the propounded systems and specimens are not deemed as the only solutions. If solutions based upon the aforesaid methods cited in the section entitled “efficiency qualifying methods” can fulfill objectives and performance requirements, the novel system will be adopted as a pre-qualified one. Some of the boons of “deemed-to-satisfied solutions” and pre-qualified constructional systems can be succinctly stated as follows:

- Reliability of users on stability, reliability and durability of the constructed building as well as manners of matching structures with the inhabitants requirements.
- Making coordination in the design system, construction procedure, and methods of manipulating building establishment in the country.
- Accelerating the construction velocity and deletion of exorbitant time-consuming stages.

- Paving the way for industrial production of standard parts and instigation of vying activities among manufacturers entailing expenditures reduction and quality enhancement.
- Acquainting builders and even users with accurate methods of construction for errorless construction of buildings and their appurtenant constituents.

- Training technical craftsmen aiming to devise and install such systems as well as minimization of human-based and installation errors.

- Obliteration of the fleeting construction and lodging quandaries in natural calamities such as earthquakes due to the availability of ready standard parts.

4.3.3.2. Application of efficiency qualifying methodologies

As it was quoted in the former section, “deemed-to-satisfied solutions” can be taken advantage of in the applicability scope for limitations of each system. Moreover they do not fulfill all the extant requirements. Therefore, we need some methods for authentication of efficaciousness of novel constructional systems as well as typical constructional systems not included in “deemed-to-satisfied solutions”.

The quandaries of efficaciousness corroboration can be partially removed by adoption of upstream codes such as the Iranian national building codes devised for the national code for low-rise residential buildings. In fact, it should be accepted that if someone does not wish to use propounded methods, he / she can allude to the Iranian national building codes. Anyway the compilation-undergoing code does not act more fastidiously than the extant one.

The ensuing strategies are reckoned within the confines of the novel systems and those set-ups seeking to be deemed as a qualified one: 1) the formation of an competence-validating board composed of individuals well-versed in the appurtenant fields to check the layouts to find out their conformity with objectives and performance requirements 2) Developing the benchmarks of competence verification by the competency-verifying authority encompassing the slightest required calculations, the necessity of go through tests, acceptance benchmarks, manner of proffering of documents, and the appurtenant stages for its verification 3) introducing some of the standards of the global authority which take the offering of plans for granted.

5. CONCLUSION

This article alludes to the fact that the Iranian national building codes are the legally documented source for all the moot points appurtenant to constructions in Iran. the Iranian national building codes were ferreted out afterwards. The corollary evinces that some of the objectives are vague and ambiguous. No classifications or prioritizations have been effectuated for their implementation. Some of the objectives do not possess temporal or locus-based dimensions. A standalone approach adopted for minute buildings in the national building codes is deemed as one of the instances which render such laws inefficacious especially in the scope of low-rise buildings in urban and bucolic zones. The compilation of the national code for low-rise residential buildings was proposed as a solution to ameliorate the qualitative level and facile manner of actualizing quantitative objectives. Objectives were categorized in 3 levels from 1 to 3 to enhance the pragmatic aspects of the code. Iran is a country in which stability of buildings against pivotal factors such as earthquakes has been feeble during the past years entailing heavy death-tolls in the past. One of the crucial duties and objectives of government concerns enhancement of buildings against earthquakes to safeguard the lives of inhabitants. Swift actualization of these ends seems immanent deemed in the first priority. Although the 2nd and 3rd objectives are less momentous, they have never been precluded or omitted. They merely state the ensuing priority. The performance-based method has been utilized in such regulations to fulfill objectives. The performance

requirements of each objective are cited. Actualization of performance requirements is effectuated by utilization of “deemed-to-satisfied solutions”. They put forth specific constructional systems prescriptively. In cases where novel systems or those out of the “deemed-to-satisfied solutions” are put forth, efficiency qualifying methods are utilized to demonstrate the accordance of such systems with the objectives and performance requirements.

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