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A REVIEW OF THE IMPLEMENTATION OF IRANIAN NATIONAL BUILDING CODE; CURRENT CHALLENGES AND FUTURE DIRECTIONS

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Abstract

The development and upgrade of the standard provisions presenting minimum engineering requirements for design and construction of buildings, also known as building codes, has been recognized as an effective tool toward the improvement of building and seismic resilience in developing countries, although, painful experiences of catastrophic earthquakes causing extensive damage and loss have illustrated that much attention is needed to be paid to the successful code implementation phase. This paper reviews the attempts and achievements in development, enforcement and implementation of the Iranian national building code over last four decades.

The most important practical experiences and learned lessons during this period have been addressed that can be useful for similar developing countries which are at the beginning of the road. A critical analysis is presented to recognize the basic challenges and obstacles slowing down the progress rate of the country toward the desired predicted levels by seismic risk reduction programs. After the assessment of current status of the code implementation, suggestions are proposed as the potential remedies for determined problems. The results show acceptable growth in the provision of the basic engineering services and expertise human resources in all around the country as a response to the code enforcement procedures. However, the distribution and the penetration rate of these provided requirements are not uniform.

Based on the results, the more efficient involvement of the concept of seismic risk in the development of comprehensive master plans, the promotion of the idea of “certified safe and standard building”, and change in the role of the government from “free insurer” providing financial supports for reconstruction and recovery to the “supporter” of the effective risk transfer mechanisms such as earthquake insurance are the main future directions should be followed to improve the current situation. Finally, the idea of the development of an integrated evaluation and rating system is introduced as an effective solution for promoting economically defensible policies for improving seismic safety of buildings.

Keywords: National Building Code, seismic code, building quality, risk reduction, code compliance, Iran.

1. Introduction

Iran, as developing country, located in one of the most important seismic prone regions of the world, has experienced severe earthquakes causing extensive damage to the buildings and infrastructures and huge human losses with critical socio-economic consequences. The national programs to improve the resiliency against seismic events have started since about four decades ago. In addition to the major problems, such as poor quality of construction and lack of engineering services, as well as the provision of standard building material at the beginning of the organized government-based actions, the decision makers and planers were faced to the extra barriers, such as the rapid population growth, 8-year imposed war with Iraq, and financial limitations for investment in housing projects, during this period. The progress and achievements of Iran in the field of earthquake science and engineering in conjunction with code development and implementation provides a unique experience to be shared with other countries which are at the beginning of the same path.

This paper summarizes the 40-year efforts toward the reducing the seismic vulnerability in the country through the implementation of national building code and its enforcement. After a brief review on the historical background and gradual development of the code, the concept of regulatory organizations and enforcement process are explained focusing on the major role players and their interaction in the housing projects in Iran. Finally, a short discussion about the level of code compliancy in new constructions is presented. Also, some basic requirements for future directions are explained. Finally, the idea of the provision of "Standard for Evaluation and Ranking of Quality and Safety of Buildings" is described as the potential comprehensive solution for identified barriers in the path toward the sustainable seismic safety.

2. Key Players in the Iranian Building Construction

There are different entities established by government or private sectors which are playing major roles in the housing industry in Iran, the most important ones are; Ministry of Road and Urban Design (MRUD) , Municipalities, Islamic City Councils, Iranian Construction Engineering Organization (ICEO), Road, Housing and Urban Development Research Centre (BHRC) , Housing Foundation of Islamic Revolution (HFIR) and other local authorities. Also, Planning and Management Organization (PMO) financially supports the approved policies by government in housing and urban planning. MRUD is the authorized representative of the government taking on all macro and micro scale duties and responsibilities against housing and construction projects. Municipalities are the interface between the users of the built environment and construction industry which must provide building requirements in accordance with public demands and technical regulations. Fig.1 presents the position and role of each mentioned organization, as well as the interaction among different players in the construction industry in Iran.

3. Housing Policies and Urban Planning

Land use planning as a key parameter in the preparation of the comprehensive city plans is done by the Deputy of Architecture and Urban Planning in the MRUD. Urban plans in Iran are based on approximately 50 years of experience as a response to the rapid population growth in 1960s. First important action to prepare the master development guidelines and plans for big and medium cities is the enactment of the law for the formation of "High Council of Architecture and Urban Development" in 1973. After Islamic revolution in 1979 and the 8-year imposed war between Iran and Iraq (1980-1988), significant changes in the social, cultural, and economic characteristics of Iranian society occurred. During the reconstruction process, more extensive efforts have focused on the rural development to control the rate of rural-urban migration. In the last years of 1990s, the conventional centralized planning approaches, gradually, changed in to the mutual participation between citizens and decision makers by the formation of city councils [1]. Since 1999, more than 300 comprehensive plans have been developed for cities in Iran. Urban comprehensive plans, which must be prepared in the case of cities with a population of more than 25000 people, include master guidelines on subjects influencing the development process of a city, such as land use planning, public service enhancement, regulations for private and public building construction, and the protection of environment and historical sites.

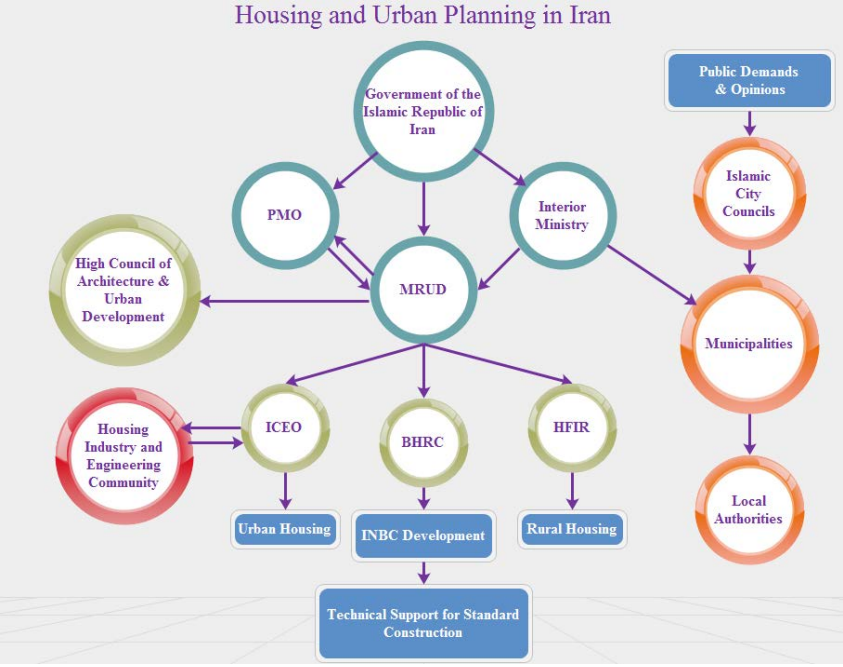

Fig. 1 – The hierarchy chart of key players in the construction projects in Iran

A joint cooperation among municipality, city council, and provincial offices of MRUD is needed to prepare a comprehensive plan after the recognition of the priorities based on the current condition of the city and future expectations. Reviewing the four decade experiences of comprehensive planning approaches in Iran; important deficiencies in the implementation stage can be indicated. The comprehensive plans, which was intended to control and direct the unplanned population growth and urban development, has caused socio-economic challenges, especially, in the big cities. An evaluation of the theoretical framework of comprehensive plans in Iran highlights some mentioned problems as follows [2]:

- Poor understanding of the updating prospective of a city and related future problems;
- Focus on the physical aspects of planning and, consequently, neglecting the overall big picture based on the social and economic objectives;
- Lack of active interaction with concerns and needs of stakeholders, practical beneficiaries and users;
- Absence of clear definition for short-, intermediate-, and long-term goals and policies for the implementation and periodic revision of the plan;
- Paying excessive attention to the irrelevant details and second-order issues.

4. Construction Process

General steps required for obtaining construction license and permit in Iran are schematically shown in the Fig.2. Although the current process involves several inspection phases in different stages of construction, there are major obstacles and deficiencies in the implementation which can threaten the safe and reliable housing construction. Table 1 summarizes the most important barriers for efficient building construction based on the experiences in the practical cases. So, there is an inevitable need to the certified engineering services at different stages of construction process. The reference which can verify the qualification of such professional engineering services and certify the legal or individual practitioners in the construction projects is the Iranian Construction Engineering Organization (ICEO). All technical parts of a housing project, such as architectural and structural works, as well as electrical and mechanical installations must be designed by qualified individual engineers or legal engineering companies. The MRUD and ICEO are the official references for the qualification process and issuance of the work permits for applicant engineers. Municipalities must accept only the building plans which are signed and stamped by certified designers. The provincial disciplinary-committee investigates the violation

claims against ICEO members which can lead to temporary or constant suspension and termination of their work permits.

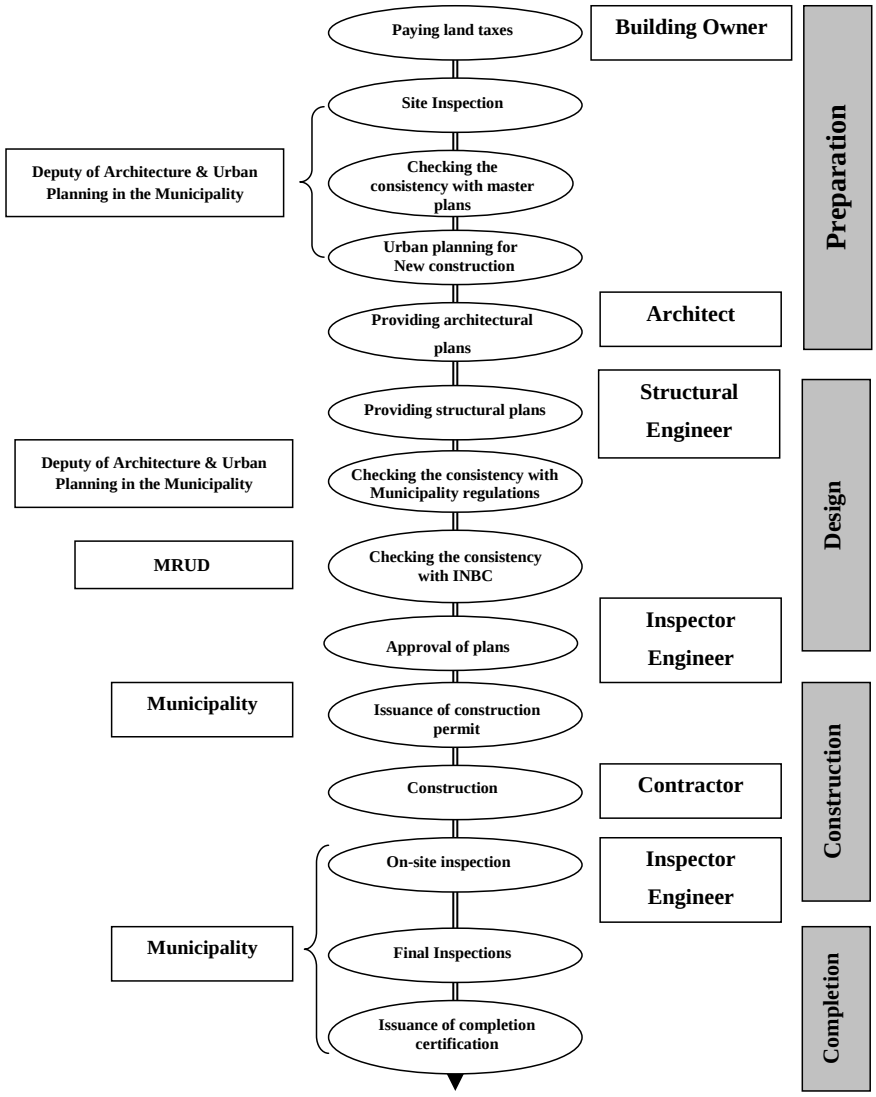

Fig. 2– The flowchart of the construction process

5. Iranian National Building Code (INBC)

National building code is a set of rules that specify the minimum standards for constructed objects, such as buildings and non-building structures. The main purpose of code is to protect public health, safety, and general welfare as they relate to the construction and occupancy of buildings and structures. 22 parts of INBC are compulsory regulations for any new construction, demolition, and rehabilitation project in all around the country.

Table 1 – Code implementation and housing challenges

Procedure	Problems	Consequences
Request for building construction	Building owner directly hire the structural engineer, architect and contractor	Designer and contractor try to keep building owner satisfied, which cannot, always, result in the building code compliance
Issuance of the construction permits	Just the architectural plans are examined by municipality	The inspection on the structural strength is reduced
Inspection during construction	All inspection duties of municipality are limited to the technical reports prepared by inspector engineer	Poor construction quality due to the reduction of precise inspections
Construction process	There is no restrict inspection on the quality of materials or qualification of workers and technicians	Weak structures may be constructed
Final inspections at the completion of project	Usually, the final inspections focus on the appearance of building and non-structural components	No serious structural evaluation is made to prevent unsafe construction

INBC is intended to be applied by architects, engineers, constructors, and manufacturers of building products and materials. Municipalities review plans submitted to them before construction, issue permits, and conduct the comprehensive inspections to verify compliance to these standards at the site during construction.

5.1 Building Code Development

Following the preparation of the primitive regulations related to the approved act to organize the housing and architecture activities in 1973; first comprehensive studies started to provide basic requirements for national building code development. The development of the first proposed text for national building code started from 1987 by using the results of extensive investigations on the gathered technical documents and international references in the previous phases. Although, the development process was started independently, the selection of the overall formation of INBC and predicted technical committees was based on the US building code framework.

The members of executive committees were invited from different research centers, universities and other entities related to the code preparation and enforcement. Iranian code of practice for seismic resistant design of buildings “standard No. 2800” approved and endorsed by Islamic Republic of Iran's government as an independent code in 1988. The general framework and mentioned requirements in the code are, completely, comparable to the corresponding provisions from ICC [3], however, due to the fact that the distribution of the qualified engineering services and, subsequently, available construction quality is not uniformly distributed in different parts of country, the current approved version of INBC can be considered, approximately, equal to the antepenul edition of ICC. Table A.1 in the appendix presents gradual updating process of different parts of INBC. Usually essential revision has been made after a major seismic event such as Manjil earthquake of 1989 and Bam earthquake of 2003.

5.2 Other guidelines

5.2.1 Iranian seismic code of practice (Standard No. 2800)

First step to the prevention of earthquake induced structural damages by the application of standard design and construction of buildings in Iran was the compilation of Iranian code of practice for seismic resistant design of

buildings as a chapter in “Iranian design loads standard No. 519” in 1970. Iranian code of practice for seismic resistant design of buildings “standard No. 2800” has been approved and endorsed by Islamic Republic of Iran's government as a independent code in 1988. The standard No. 2800 has been revised several times to be consistent with last available technical achievements in the field of earthquake engineering. The 4th revision is approved and published in 2014.

5.2.2 Planning and Management Organization Technical Guidelines

The public funded construction projects in Iran must comply with technical instructions developed by Planning and Management Organization (PMO). There are about 800 technical guidelines which are developed and published by PMO to provide minimum engineering requirements for a variety of construction details and procedures. One of the most frequently used codes prepared by PMO is the Iranian instruction for seismic rehabilitation of existing buildings (code No. 360). The code No. 360 specifies provisions for the seismic rehabilitation of existing buildings which is intended to improve seismic performance of structural or non-structural components and provide an integrated seismic evaluation process. Also, focusing on the importance of seismic hazard analysis for different sites in Iran that are not provided with specific hazard maps; code No. 626 is developed as the reference guideline for seismic hazard analysis by PMO.

6. Evaluation of INBC in current format

The extensive variation in the life styles, climate conditions and accessibility to the engineering materials and services in Iran highlights the necessity of the preparation of the localized indigenous building requirements and construction practices. Although the INBC provisions have been adapted to the different possible local conditions, no specific local requirement is directly addressed in INBC. Such localized construction practices are covered implicitly in the part 8 of INBC and in the case of unreinforced masonry or adobe buildings which are representing the dominant rural fabric in Iran.

The seismic provisions described in standard no. 2800 uses the last version of the seismic hazard map developed and updated for country that classifies the main urban areas in to the four groups based on the predicted seismic hazard. The seismic microzonation of urban areas has not been implemented in the code; however, such detailed seismic data have been developed for several megacities and other important areas and can be accessed for mass housing projects or the construction of special infrastructures. It should be noted that current seismic approach in the code does not refer to a seismic risk map, directly.

The current 22 parts of INBC does not deal with evaluation or rehabilitation of existing buildings. There are specific guidelines such as Iranian instruction for seismic rehabilitation of existing buildings (code No. 360) which are published by PMO to provide standard procedures for rehabilitation of structures, but, the implementation of them is mandatory just for public founded buildings. Consequently, there is no specific regulation to alleviate the problem of existing non-conforming buildings.

7. Code Implementation and Enforcement

Any violation of building code which is reported by inspecting engineers to the municipalities must be investigated by an independent legal entity which is called the “commission of article 100”. The investigations are performed after the official request from municipalities based on the violation reports. This legal committee has the required authority from judiciary to decide about the level of penalty for reported violation from a high fine to even the closure and demolition of the structure. The committee is qualified to investigate complaints including; construction without permission, violation of the approved urban density (for example; allowable number of stories) in the region, insufficient parking capacity in the building, violation of INBC or other compulsory regulations on housing, architecture, and urban design, change in the designed occupancy or usage type of the building, as well as structural inadequacy. The committee may order demolition of the constructed building or determine penalty fees for the building owner based on the level of violations. Although the mentioned process provides a fairly efficient mechanism to restrict the construction of new non-conforming buildings, there is no legal limitation for existing buildings which may be non-conforming to the last version of INBC. Currently, the government encourages and facilitates the rehabilitation of vulnerable urban fabrics in

seismic prone zones. Also, the performance of the "commission of article 100" has been faced to the serious criticism from engineering society due to the large number of issued orders of financial penalties in comparison with orders of construction closure or demolition of constructed buildings. In fact, considering the socio-economic consequences, especially, in the poor urban or rural areas; the commission procrastinates about structural inadequacy of the constructed buildings to avoid the demolition of buildings as much as possible. As it is explained in the following section, the basic solution of the non-conforming construction cannot be achieved just by the enactment of severe legal restrictions, but, the key factor to improve the code compliance in housing projects is to increase public awareness about the risk of living in the vulnerable buildings and its possible catastrophic consequences.

One of the most important approaches which have been followed by ICEO in recent years to promote the idea of "safe and standard building" is the issuance of "ownership-technical certificate" for new buildings. This document is a formal statement issued intended to provide owners and occupiers with most important technical information describing the quality of a building and its components. Any residential property developer must transfer a household unit with this certificate, as well as as-built plans. This document is organized in three sections:

- General information about building and owner, plan dimensions and floor areas, characteristics of each floor and its usage type, and as-built details of different spaces;
- Information about designer, inspector, and contractor of housing project, as well as all other certified legal or real persons who are involved in the housing project;
- Detailed information about the quality of architectural, structural components of building, as well as electrical/mechanical installations. Also, the result of an overall evaluation is mentioned in the document to verify the adequacy of construction materials and procedures in accordance with standard levels defined by INBC.

8. Example of Code Compliance

After three decades from the provision of INBC, it can be claimed that almost in most part of the country the access to the certified engineering services and qualified building developers is provided. The penetration rate of building code implementation is highly dependent to the socio-economic factors of the urban or rural regions. In medium and big cities which the level of public awareness of the importance of the safety and the necessity of risk reduction is fairly suitable, the economic issues play the main role in the standard housing. In the popular urban regions which the price of new constructed building units is satisfying for building developers, the code violation is usually limited, because, it is not too expensive for them to use standard materials and qualified engineering services. Instead, in the poor urban regions and margins of cities, where the housing project is not a profitable investment, the use of non-standard material and procedures may lead to the economic thrift for building owners. In such cases, as well as rural housing, the government can interfere both directly, for example, through the HFIR and indirectly by providing financial supports to conduct industrial mass housing projects. Fig.3 illustrates different mentioned situations in case of the Lorestan province which is a middle-income region located in the south-west of Iran. The region is considered as one of the important seismic prone areas that has experienced sever historical earthquakes. Two cities from Lorestan province are selected: 1) Boroujerd, a medium-size city with a population of 250,000 which has developed more rapidly in socio-economic aspects among the similar adjacent cities due to its historical background; and 2) Doroud, a medium-size city with a population of 150,000 which is known for its unique beautiful natural zone. The city has preserved its rural fabric and the level of social developments is not comparable to Boroujerd.

The low price of new buildings in most parts of the Doroud and limited dimensions of existing lands result in poor-quality built environments. The minimum requirements of lateral load resistant systems may not be provided, because, due to the small dimensions of plan the priority is given to the provision of architectural openings. The code requirements for steel special moment frames needs qualified welding procedures which increases the cost of housing project and, subsequently, the potential of code violation (Fig. 3-a). The mass industrial housing projects which are supported by MRUD, in the margins of Doroud can alleviate the problem of code violation caused by non-profitable construction by building owners (Fig. 3-c). In Boroujerd, although we

can observe the same problem of land dimensions, the public awareness of seismic risk in conjunction with more effective presence of ICEO services have prevented the omission of the code-based lateral load resistant systems to provide architectural openings (Fig. 3-b)

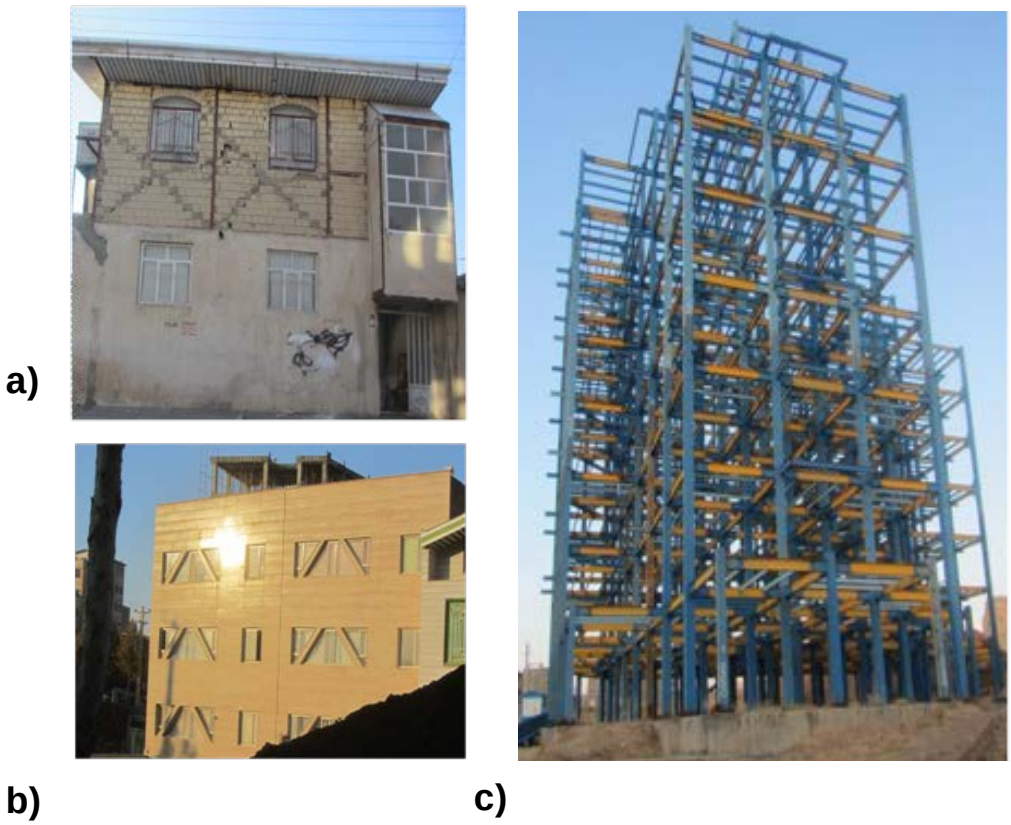

Fig. 3–. a) Poor lateral load resistant system in steel frame in Doroud, b) Industrial mass housing in Doroud and c) code-conforming lateral load resistant system in Boroujerd [3].

9. Future Directions

As it is shown by a brief review on the background of building code implementation and development in Iran, the required technical infrastructures can be provided gradually, while their growth rate is a function of time, cost and effort paid to promote them. Unfortunately, despite the mentioned fact there is no guarantee for these technical improvements to result in the safe construction until the violation of building codes be minimized. There are two major strategies to reduce the potential of poor housing construction; the promotion of the idea of the "safe residential building as a "civil right" and the application of "the economic concepts" to justify the improvement of the seismic safety. Knowing the fact that the need for rehabilitation and retrofit of the existing buildings has led to development of a variety of evaluation standards including: FEMA-178: NEHRP Handbook for the Seismic Evaluation of Existing Buildings (1992), ATC-40: Seismic Evaluation and Retrofit of Concrete Buildings (1996), FEMA-310: Handbook for the Seismic Evaluation of Buildings (1998), FEMA-154: Rapid Visual Screening of Buildings for Potential Seismic Hazards (2002), ASCE-31-03: Seismic Evaluation of Existing Buildings (2003), ASCE-41-13: Seismic Evaluation and Retrofit of Existing Buildings (2013); there is a tangible need to a more comprehensive evaluation scheme that focuses on the safety of structural and non-structural components of the building and simultaneously considers other factors that account for the resilience of the buildings. Any plan for future of the building code development and implementation must be compatible with important requirements such as green buildings and building sustainability that are experiencing rapid growth in the absorption of public popularity and funding supports. For example, Leadership in Energy and

Environmental Design (LEED) [5] is a green building certification program that recognizes best-in-class building strategies and practices by US Green Building Council. BREEAM [6], or Building Research Establishment Environmental Assessment Methodology, first published by the Building Research Establishment (BRE) in 1990 is the world's longest established method of assessing, rating, and certifying the sustainability of buildings. CEEQUAL [7] is the international evidence-based sustainability assessment, rating and awards scheme for civil engineering, infrastructure, landscaping and works in public spaces. It is promoted by the Institution of Civil Engineers (ICE) and a group of civil engineering organizations including CIRIA, CECA and ACE. Although many of these systems have succeeded at assessing and promoting the sustainability of buildings, they do not pay enough attention to the safety, quality and broadly speaking, the buildings' structure. In addition to all abovementioned standards and guidelines, there are a variety of other evaluation systems and standards regarding different aspects of buildings, such as well-being, comfort and energy efficiency. One of the most comprehensive assessment tools is: "Safe Hospital Index" developed by World Health Organization (WHO) [8], which has got promoted in the past years as a tool for evaluating and grading the safety of hospitals. The Safe Hospital Index applicability and reliability are being tested and evaluated in Iran and many countries. Nevertheless, none of these examples are comprehensive enough to be used for assessing residential buildings in terms of seismic safety.

In conclusion, before or at least parallel to the development of risk mitigation national plans including policy making for more effective code implementation, it is necessary to induce people to consider safety and quality, along with the design and appearance, while purchasing or constructing buildings. In order to do so, there should be a tool, which gives us the ability to both rate and certify buildings in terms of safety, quality, energy efficiency and sustainability; to make sure the importance of these fundamental factors are no longer being neglected or ignored. Hence, it is best to develop a better tool for evaluating quality and safety of residential buildings. One of the potential proposals is the creation and promotion of an economy-targeted index. It is worth noting that any proposed ranking system despite the fact that is intended to ensure a perfect perspective in the long term must provide users with tangible advantages in mid-term period by keeping the whole practical procedure as simple as possible. A good example showing the importance of latter fact is the successful experience of the Excellence in Design for Greater Efficiencies (EDGE) [9]. This system helps users to assess cost effective solutions to assure green building objectives in building design just by online process of the simple general input data that can be provided without essential need to the complicated implementation frameworks.

10. Conclusions: Ongoing Efforts in Iran

In this paper a brief review is presented focusing on the 40-years of experience of Iran in the development and enforcement of the national building codes. After a summarized description of the current structure of the enforcement of the building regulations designed to provide seismic safety; the most important challenges and obstacles in the path toward the ideal safety level are introduced. Considering other efforts to ensure the high quality construction in terms of green building concepts or sustainability related issues; it is proposed to define a comprehensive evaluation and ranking system covering the mentioned items as well as seismic safety of a residential building. The suggested approaches as the ongoing efforts that can lead the developing countries such as Iran to the acceptable prospective can be listed as: integration of safety with economy; promoting safe residential building as a civil right; constant upgrade of building codes and enforcement procedures; etc.

10.1 Safety and economy

Voluntary earthquake insurance has been offered by insurance companies in Iran since 1992. Based on the experiences from past post-earthquake recovery plans, it is concluded that providing reconstruction funds to those who have lost their properties by government has acted as "free insurer" to the private and public owners. To use insurance as an effective risk transfer mechanism, it is necessary to develop an effective system for financial recovery and compensation through insurance, financial incentives, and supporting funds; as well as promoting and regulating financial incentives for the general public and integrating earthquake risk insurance into the construction process. From the insurance Authority's point of view, the first mandatory step to financially justify earthquake insurance policy is to estimate the building loss index as a base for earthquake

insurance premium calculation. For this purpose the mean annual loss zonation for different building typology in Iran has been evaluated following main phases: 1) development of Earthquake hazard model of Iran; 2) updating building inventory and its classifications; 3) development of the fragility functions according to the available information; and 4) evaluation of the mean annual loss of each building type for each zone. The mean annual loss of each building type has been evaluated for each city provinces as shown in Fig.4 for the steel buildings by the first author.

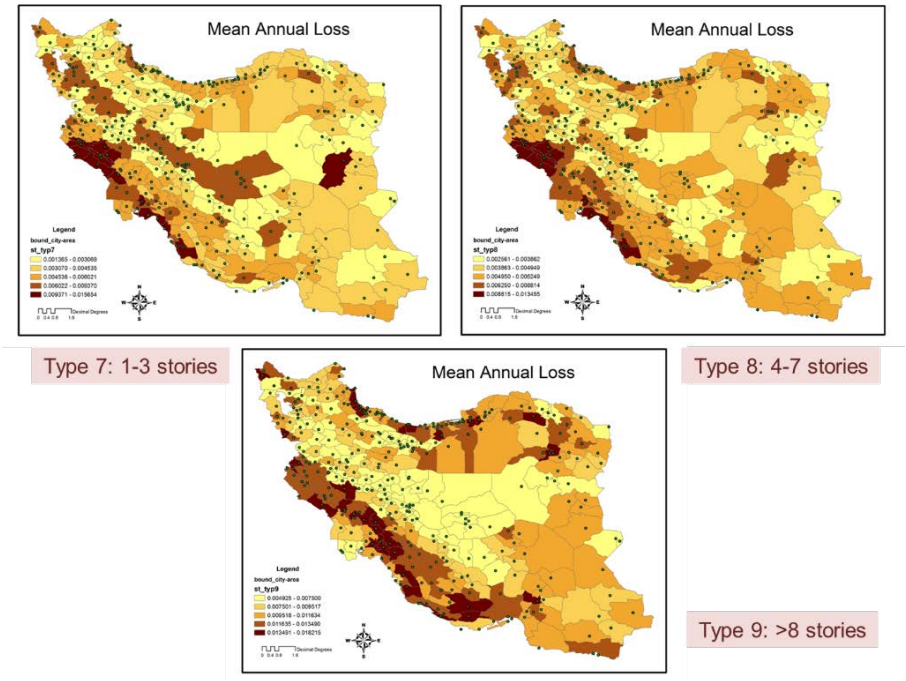

Fig. 4– Expected mean annual loss zonation of the various type of steel frame buildings for 475-year seismic hazard level, built after 2003

10.2 Safe residential building as a civil right; moving toward a safe society

It has been revealed by reviewing four decades of efforts toward improved seismic safety in Iran that any effort in this field is convicted to the failure until it supports by both building industry stakeholders and consumers. For example, when the inspection and enforcement procedures become more restrict it is not desirable for consumers if it results in the increase in the building prices. On the other hand, more precise enforcement cannot be achieved by imposing more tasks to the practitioners in housing industry without increasing their payments. So, a doable and affordable win–win strategy is needed to be designed for example by creating financial and economic incentive such as added value for the builders and buyers through a comprehensive ranking system helping the buyers to differentiate between good and bad quality of buildings, good and bad builders; etc.

10.3 Constant upgrade of building codes and enforcement procedures

There are two important factors influencing the effective code implementation in developing countries such as Iran; the inappropriate transfer of codes from high-income countries that are not necessarily indigenous to the localized construction styles and the possible gaps in the regulations that provide wrongdoers with escape routes to violate the existing codes. As it is summarized in Table A.1, constant efforts is dedicated to the upgrading the INBC as well as great academic efforts to provide essential earthquake engineering requirements such as risk maps. The second issue regarding the provision of resiliency in the enforcement system against the potential of corruption is under development by essential changes in the second part of INBC to revise the administration

process. This is designed to be reached by increasing transparency in the activities of the ICEO and allocating works to the qualified legal persons based on their technical competency and reputation.

11. References

[1] Rasoolimanesh S, Mastura Jaafar, M, and Badarulzaman N (2013): Urban Planning and Management System in Iran: A Review and Assessment. *Middle-East Journal of Scientific Research* **18**(2), 220-229.

[2] Mohammadi H (2010): Citizen participation in urban planning and management: The case of Iran, Shiraz City, Saadi community. kassel university press GmbH.

[3] http://www.iccsafe.org/

[4] Astraki A, Arian-Moghaddam S, Soghrat M, and Motovali Emami M (2014): Seismic Vulnerability Asseeement of Doroud and Boroujerd, Lorestan province, Iran", *Provincial office of MRUD*, Khorramabaad.

[5] http://www.leed.net/

[6] http://www.breeam.com/

[7] http://www.ceequal.com/

[8] http://www.who.int/

[9] http://www.ifc.org/

12. Appendix

The gradual revision and completion process of INBC is summarized in the following table.

Table A1 – The gradual development and revision of the INBC

Title	Part	1st Edition	2nd Edition	3rd Edition	4th Edition
Definitions	1	2013			
Administration	2	2005			
Building Fire Protection	3	2001	2013		
General Building Requirements	4	2008	2013		
Building Materials Products	5	1990	2003	2010	2013
Design Loads for Buildings	6	2001	2006	2013	
Foundation	7	1990	1990	2009	2013
Masonry Buildings	8	2005			
Design and Construction of Concrete Structures	9	1989	2006	2009	2013
Design and Construction of Steel Structures	10	1989	2005	2008	2013
Industrialized Construction	11	2004	2013		
Safety and Precautions in Construction	12	1993	2001	2006	2013
Electrical Installations	13	1993	2003		
Mechanical Systems	14	2001	2012		
Elevators and Escalators	15	2001	2008	2013	

Plumbing systems	16	1993	2003	2012	
Natural Gas Piping	17	2002	2008	2010	
Acoustics and sound Control	18	2001	2011		
Energy Conservation	19	1991	2002	2010	
Signs and Symbols	20	2005			
Passive Defense	21	2012			
Care and Maintenance	22	2013			
Standard No. 2800	-	1988	2000	2005	2015