Reconstruction Projects by Using Core Housing Method in Iran- Case study: Gilan Province Experience

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Abstract

Core housing is defined as one of the methods of providing shelter after disasters. These shelters are incomplete at the time of initial occupation. The aim of this housing method is supplying a minimum safe residential space against future disasters. These shelters are built after disasters with limited resources and with the consideration of lack of time for the survivors. Accordingly using the beneficiaries' participation on building a core unit and using vernacular housing methods, the inhabitants will be able to extend their core house. In this research it will be shown that most of village houses which have been reconstructed after 1990 Manjil earthquake in Iran has been done by core housing method. Moreover, the way core units were extended by beneficiaries after 19 years since the disaster will be evaluated. Furthermore, other factors such as residential space needs of the residents, the role of the used structure in building the core units and the role of climatic conditions in the expansion of residential units will be investigated. In conclusion this research will demonstrate that despite great variation on core unit extension done by habitants, these extension are based on a special logic which is itself based on the inhabitants' needs of residential spaces and habitance patterns. These results can be useful in planning and designing shelters for survivors for future disasters.

Keywords: core housing, reconstruction, disaster, core units, extension

1. Introduction

In many of the reconstructions done by the Iranian government in the natural disasters before Manjil earthquake, the government designed houses with modern technology and building materials. Moreover, the government did not ask for the survivors' active participation in reconstructing the houses. This led to the survivors' dissatisfaction of the houses or not using them at all. (Fallahi, 1994; Razani, 1984) In the reconstruction of the destroyed housing units of Manjil earthquake (1990), the government changed its policy, seeking the survivors' participation and using local technology and building materials. Hence, this time the reconstructed houses were used by the survivors. (Fallahi, 1994)

In the reconstruction of Gilan province's rural housing units after Manjil earthquake (1990), the primary core unit of the building was set up in the temporary sheltering stage and was then expanded to the permanent sheltering stage using the survivors' participation. (Bahreyni, 2000) In fact, the reconstruction program has been a core housing method. Hence, considering the use of local technology and building materials and the survivors' participation in all the stages, we witness a contradiction of the dwelling pattern and climatic solutions in reconstructed houses in comparison with the traditional houses. This has led to the disruption of traditional housing pattern and the traditional architecture of the region.

This is a multi-disciplinary research using a case study method which examines core housing in a specific area of reconstructed villages after 1990 earthquake of Gilan province. The selection of villages was based on the policy applied in reconstructing dwelling units by The Housing Foundation's assistance headquarters[1]. (Shadi-Taleb, 1993) The next priorities were destruction degree, height from sea level and the variety of economy (agriculture in low height and animal breeding in high foothills), variety in climatic conditions and nearness to the main road. Having considered the above factors in selecting reconstructed village houses using core housing method, we studied 86 dwelling units-equaling 5% of total reconstructed houses- in 20 villages of Tootkabon area to Barehsar in the east of Gilan near the center of the earthquake. In this survey, some information regarding the place of the core units in the temporary sheltering stage, their expansion in the permanent sheltering stage and after these was collected. Moreover, with the use of behavior study research method, some recognition of traditional and modern life styles of the dwellers in the residential units before and after the earthquake was obtained. To extract the influential items on the expansion of the residential units, an open questionnaire in terms of quality research method was provided for the residents to answer. The obtained information was summarised using quantity research method and some suggestions were offered.

In this research, bearing the traditional architectural pattern of the region in mind, an evaluation of the way core units are expanded according to the survivors' needs to habitable spaces and of the

[1]-Governmental relief offices from 11 unaffected provinces and from different parts of the country prepared to help the quake-ravaged regions. They were called assistance headquarters and were responsible for providing temporary shelters in the region

improvement of environmental conditions with regard to climatic conditions has been done. Moreover, some suggestions for the improvement of core housing method for future reconstruction programs are offered.

2. The reconstruction strategy after Manjil earthquake (1990)

At local time, 30 minutes of morning, on the 21st of June, 1990, a very strong earthquake shook Gilan and zanjan provinces in the north of Iran. The epicenter of this earthquake was announced to be between Roodbar and Manjil in the south of Caspian Sea. This event, announced to be the greatest earthquake of Iran history, ended up to the killing of 14000 individuals and 500.000 homeless persons. (Bahreyni, 2000) The villages under the study in this research were destroyed severely as they were located in the east of Roodbar, on the south mountain chain of Caspian Sea between two small cities of Totkabon and Barehsar and nearness to earthquake epicenter.

Reconstructing earthquake-suffered regions by Iran government was delivered to Housing Foundation due to their experiences in reconstruction activities of past events in Iran. Having passed the relief and rescue stage, survivors help and their emergency dwelling in the tents, there were established some shelters to transfer from harsh climate of autumn and winter by Housing Foundation's assistance headquarters. Considering the desirable performance of indigenous wooden structures (Zigali structure) against earthquakes and the survivors' familiarity with its construction methods and expansion and the government's handing over the responsibility of constructing temporary shelters to the survivors themselves, temporary shelters were constructed in the under-study region using the following methods.

- In some villages 285$ (20 Iranian thousand Rials) in cash and some building materials (mostly wood, nail and galvanized sheets to cover the roof) were distributed among the people so that they begin to construct temporary shelters themselves using the Zigali method. (Bahreyni, 2000; Shadi-Taleb, 1993)

- In some villages, there were applied wooden skeleton with gable roof by government and mud coating of walls was finished by dwellers. In fact, the method of setting up temporary shelter was based on constructing dwelling core by zigali method. (Bahreyni, 2000)

The stage of providing permanent shelter was done in terms of policy of exploiting the people's maximum participation in construction, local resources, technology and indigenous materials. In this stage, there weren't strategies proposed to realize these policies in destroyed regions, based on the great scale of earthquake spread, yet there were some macro policies complied in reconstructing permanent shelters. Therefore, managers' performance of assistance headquarters in different regions led to offer various solutions. What was implemented in the region of study was supply non-refundable loans of government and encourages the people to build strong houses apart from temporary shelter by using zigali system of construction. In addition, some architectural plans and limited training were provided in constructing permanent shelter.

In this research, the observations of the ways permanent houses were built indicate an extension of the rooms of temporary shelters (using the government's loans) which turn the reconstruction program into core housing method.

3. Traditio nal architectural pattern

The existence of rain-bearing winds of north and western north, Alborz mountain ranges in the south and the Caspian Sea in the North has amounted to a particular climate in the North of Iran with heavy rains, high humidity and hot summers. In addition, since the under study region in this research is located in the Northern parts of Alborz mountain ranges, it has cold winters. Therefore, traditional architecture of this region has reached some solutions to these climatic conditions to provide peace and comfort for dwellers along with living, social and cultural factors.

Because of continuity and severity of rain, the roofs of traditional houses were built with 2 or 4 slopes. The space between sloped roof and upper floor roof caused the air to flow and the humidity to decrease in warm seasons. In addition, since this space is usually filled with hay in cold seasons, it functions as insulation against cold. In this region, houses have been built in two storeys to avoid the penetration of land moisture into the house. The basement was built with stones and was allocated to livestock spaces such as stable, yarn, foodstuff storage places and bathroom. The mud-covered, wooden structure of the upper floor, which was free from the moisture of the floor or ceiling, was a suitable place for the habitation of the dwellers. With the linear expansion of the building in East-West direction, the inhabitants enjoyed enough sunlight and local air flow. The veranda was built in one or several faces of the building in order to prevent rain from hitting the building body. The livelihood and dwelling style of rural families has adapted to the climatic strategies after many years leading to a harmony in the architecture of rural houses. (Bromberger, 1991; Khakpor, 2005)

In this architecture, the upper floor consists of some rooms allocated to dwellers living space. Rooms, except the great one (Talar) commonly seen in the rich people's house and allocated to guests, did not have any special function and were used differently based on season and family's requirement. veranda was located in one or more sun-facing sides of building which was the place of daily activities such as cooking, eating, doing house chores, living and even sleeping during some suitable months of the year while in the cold seasons of the year, these activities were transferred in to the house. Water closet and bathroom were located in a corner of the building far from it due to humidity and reduction of useful life of wooden structure. (Khakpor, 2005) (Figure1)

The formation of this traditional pattern is based on an almost square-shaped module which is the basis of this architecture. With the linear expansion of this module vertical on air flow, in East-West direction, spaces are formed leading to bigger houses. In front of the rooms of the upper floor, there is a veranda which is itself part of the base module and is expanded together with the linear expansion of the rooms. (Diba, 1993) In some cases, the rooms of the upper floor cover the western face of the veranda in order to prevent the infiltration of cold western wind. In the traditional pattern, rural houses based on the need of dwelling spaces and economy conditions are created by putting one to four modules together. The following characteristics of the traditional architecture of the region based

on the number of the used modules and the patterns of the arrangement of the dwelling units' spaces can be seen in Table 1 in simplified terms. (Table 1)

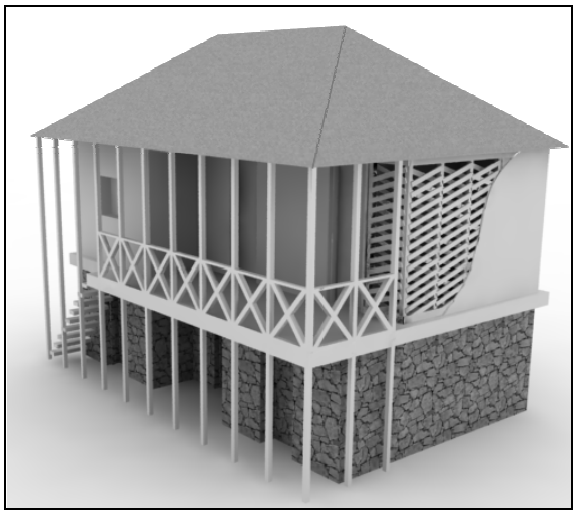


Figure1: A model of the traditional houses of the region using the zigali structure

1- The two-floor structure of the residential units

2- The basement built with stone and the first floor with Zigali structure

3- The use of almost square module as the basis of the traditional architecture of the region

4- The expansion of units in east-west direction to use ventilation and sunlight

5- The veranda as the main space of residence in the upper floor and in the sun-facing front of the building (mainly south face)

6- The basement dedicated to livestock and service space purposes and the first floor for residential space

7- Lack of specifying applications for rooms except for ‘Telar’ as a guest room

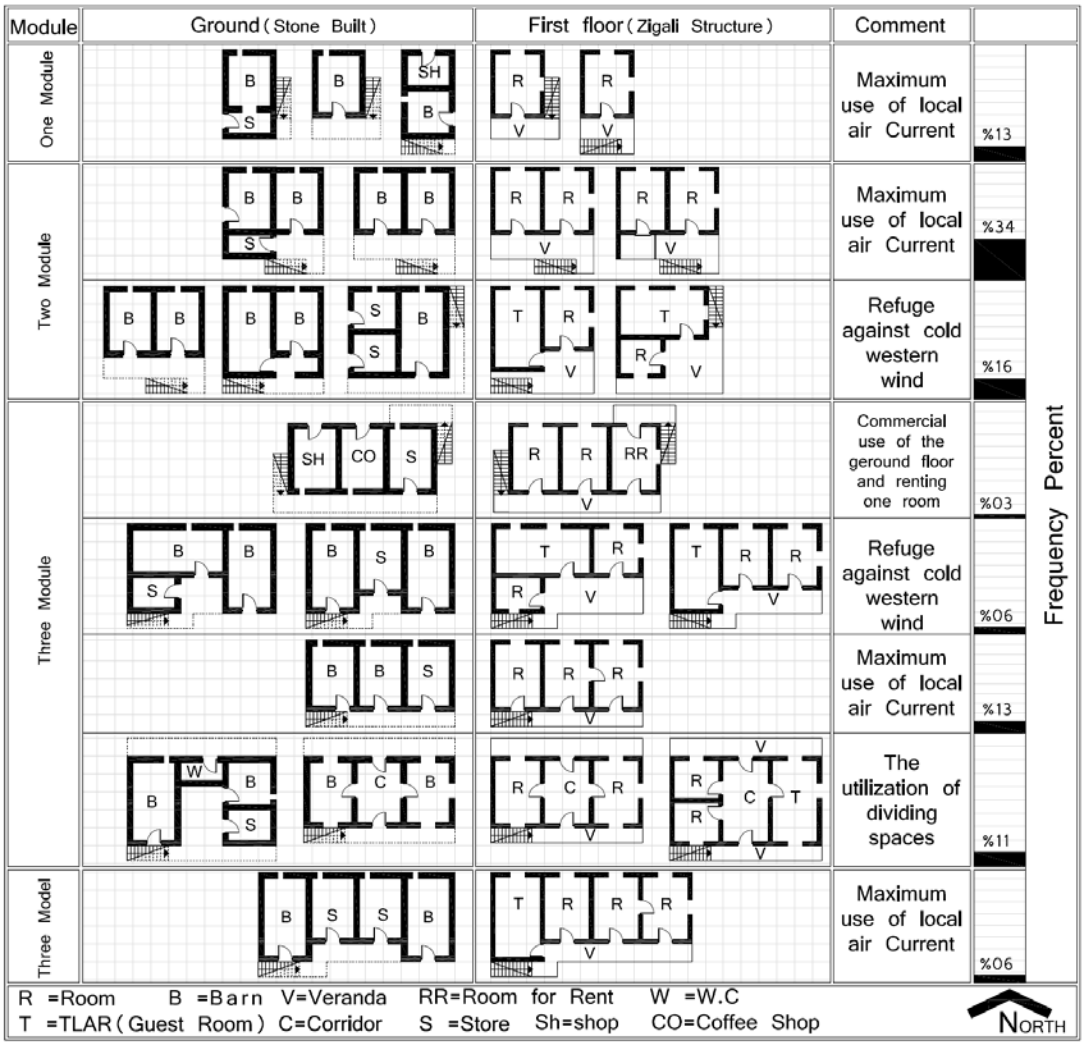
4. Primary core unit or temporary sheltering

Setting up of primary core units in the temporary sheltering stage using Zigali structure (12 to 14 square meters) was a clever decision made by the observation of the appropriate performance of Zigali structures in the traditional buildings of the region. (Bahreyni, 2000) The zigali rooms having remained safe against earthquake built in one floor and allocated to various functions (yarn, stable, store-house etc.) encouraged the people and authorities to set up temporary shelters by Zigali structure in a small distance (30 to 50 CM) from the ground. The familiarity of survivors and local carpenters with zigali structure, using local materials and basic module of region traditional architecture in

setting up temporary shelters encouraged the authorities to use zigali structure to exploit people's participation in construction and fund reduction to build temporary shelter to organize the environment.

Therefore, by using indigenous Zigali structure (Figure 2), some temporary sheltering rooms were set up in the destroyed areas of villages to help the villagers pass the harsh climatic conditions of autumn and winter. The temporary dwelling units were ready to use at the end of summer and the survivors lived there for 6 months. The permanent dwelling units were built from the beginning of the spring

Table 1: The variety of traditional houses before the disaster based on the expansion of the base module[2]



[2]- The information in this table has been obtained from interviews with the inhabitants and fro drawing the plans (by asking the inhabitants) of their previous houses

5. Expansion of primary core units towards permanent shelters

Increasing the spaces required for primary core of temporary shelter happened in most reconstructed rural houses by occupants and by using non refundable governmental funds. Maintaining the built rooms in temporary sheltering stage for reconstructed permanent shelter was the most reasonable method for villagers to provide suitable accommodation based on least cost and most familiar method along with indigenous materials and available tradition of expanding dwelling units. Dependency of this kind of providing accommodation on family's economical conditions resulted in prioritizing necessity to dwelling spaces added to the house spaces in different stages.

Expanding spaces continued gradually after constructing primary core of accommodation and it will go toward the development of houses to meet the changing requirements of the family. What is mentioned as three different stages of expanding primary core is resulted from a simple classification based on observations in this research to organize the various versions of expansions in primary cores in different stages.

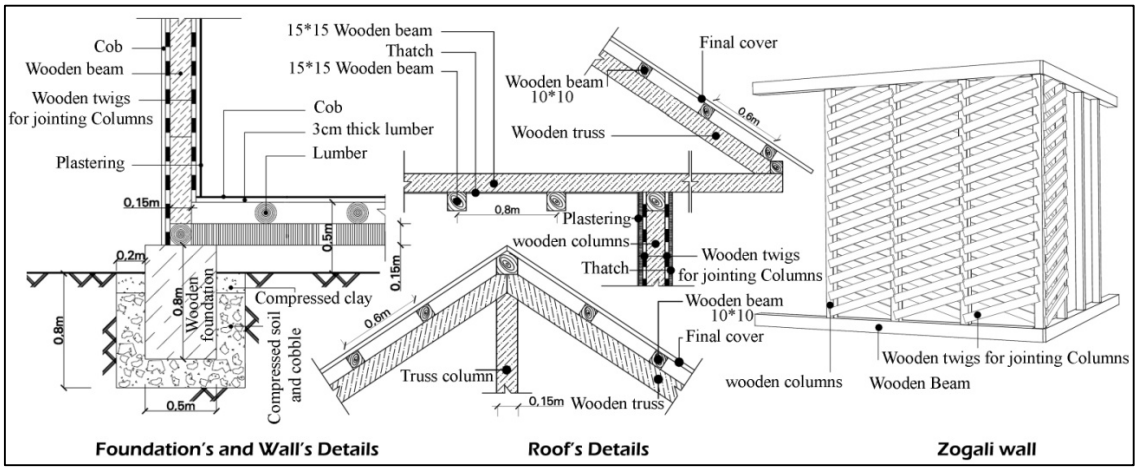


Figure 2: The implementation of the primary cores using the Zigali structure in detail (Khakpor, 2005)

What can be referred to as the main characteristics of the architecture of the reconstructed rural dwelling units by the expansion of temporary dwellings' primary cores, are in striking contrast with the characteristics of the traditional architecture. These characteristics, expounded in 10 different designs of the expansion of the primary cores based on the three stages of the expansion, are shown in Table 2 and include the following:

1. The expansion of dwelling units in one floor

2. The non-linear expansion of dwelling units without taking appropriate light and ventilation concerns into consideration.

3. Using the Zigali structure in all parts of the building

4. The omission of the veranda and its merging with the interior spaces of the structure

5. Dedicating the rooms to particular functions

The comparison of the architecture of the reconstructed rural dwelling units using the core housing method with that of the traditional rural houses of the region indicates many differences in their characteristics which can be accounted for by several factors such as the local carpenters' lack of enough knowledge to construct the building in two floors by using the Zigali structure since in this structure one floor was constructed on the stone-built ground floor in the traditional pattern of the region. Moreover, the survivors were afraid of constructing the structure in two floors. On the whole, the influence of two factors on the expansion of primary cores and on the formation of the reconstructed dwelling units in different stages of the expansion is significant

- The expansion of the primary cores in the light of the inhabitants' needs to dwelling spaces and change in the traditional dwelling pattern

- The expansion of the primary cores for solving the problems caused by negligence to climatic conditions in the temporary sheltering stage

5.1 The inhabitants' needs to dwelling spaces and change in their traditional dwelling pattern

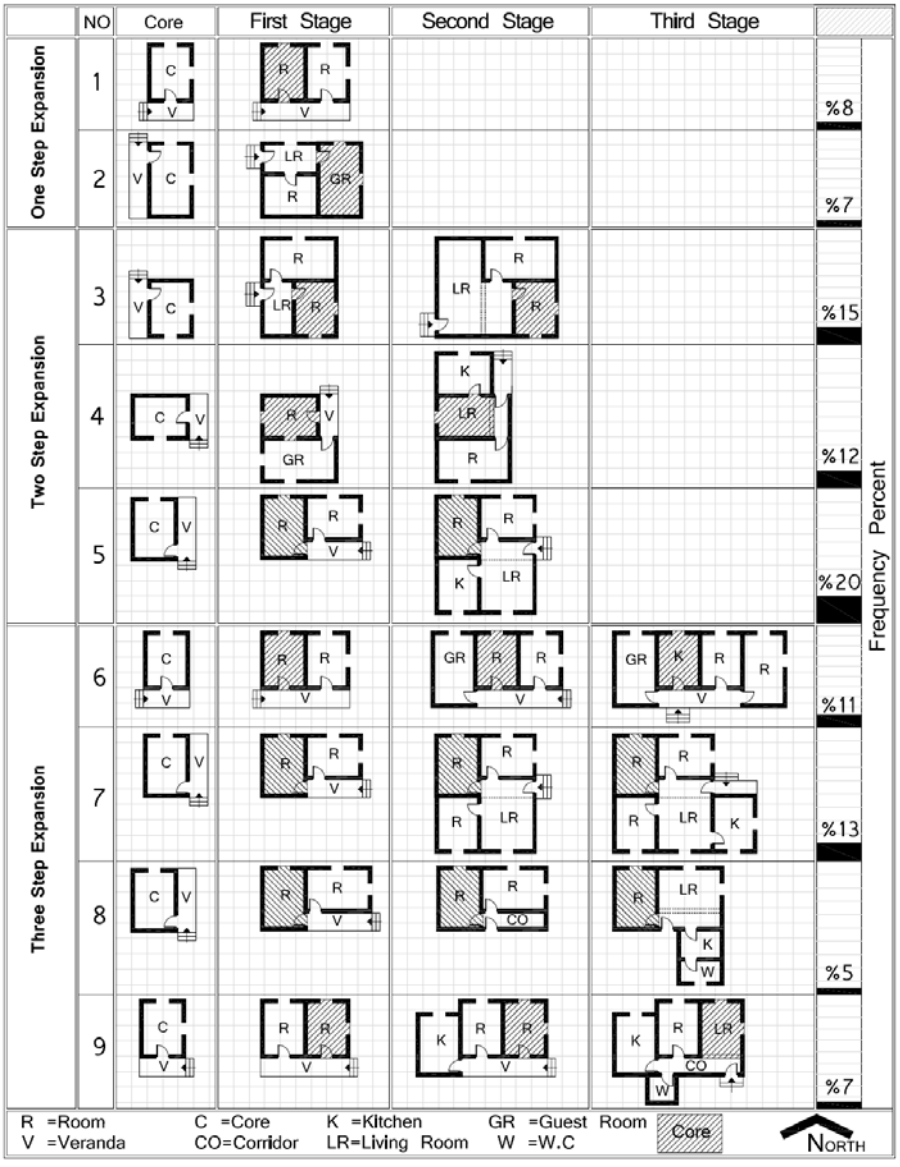
The expansion of the primary core in the first stage -nine months after the earthquake- which began after receiving governmental non-refundable aids to provide permanent housing for the people, sought to add another room to the dwelling spaces of the primary core. The aim of adding another room to the primary core was to provide a flexible space which could supply the needs of the inhabitants based on the traditional dwelling pattern. In fact, adding a space could supply the basic dwelling needs of the household based on the number of the members. More interestingly, building a water closet separated from primary core and on the corner of the house emerged simultaneous with the first stage of expanding primary core.

The second stage expansion was applied after the relative recovery of live hood conditions and returning to natural conditions of life in the following years. In this stage, respond second order priorities are proposed to be met. In this stage the living room which is referred to as 'Telar' in traditional houses is added. Living room as an example of guest's room in the traditional houses was added. This space was extracted from urban culture to modernize the space of residence in the village which, in turn, changed the harmonic composition of traditional architectural pattern of the region.

Kitchen, previously limited to a room corner or veranda without any specific space, was added as a separate room in the second or third stage of expansion. This event was influenced by modern dwelling and creation of specific design and space for an application, leading to a change in the traditional pattern and the transformation of its characteristics.

The third stage of expansion can be found in the houses in which the need to dwelling space in the second stage of expansion wasn't met due to the number of residents or the economic situation of the family, or the change in the family size and economic recovery brought the need to add dwelling spaces. The presence of water closet adjacent to the building, showing a trend toward the urban architecture, was the sign of breakdown in continuity tradition of traditional architecture.

Table 2: The expansion of primary cores in various stages3



[3] - There will be no reference to the addition of subsistence spaces such as the stable or hay storehouse since they are built separate from the main body of the house or omitted from the house altogether because of the change in the livelihood of the household.

What is observed in the examination of expanding primary cores of residential units in terms of responding the necessity to residential spaces, is adding to the house space in the first expansion based on traditional pattern of dwelling and meeting elementary requirements of residents. In the later expansions, the original composition of the building underwent a great change in organic relationships of internal spaces and the traditional solutions were neglected (diagram 1).

5.2 Solving the problems caused by negligence of climatic conditions in the temporary sheltering stage

The negligence of the climatic solutions of traditional houses in setting up primary cores including suitable orientation to use ventilation and distance from ground level resulted in thermal discomfort and brought some problems. The location of veranda in western front brought rain penetration a long with west cold wind which was prevented by the setting spaces to the house in this direction in the expansion of primary cores. (Table 2 Rows 2, 3 and 5). In addition, lack of suitable distance from ground level, constructing one floor building, penetration of ground humidity and rain ruined the veranda quality as a semi open space so that residents protected it from rain or wind, and added it to internal parts of the house. This blacked the air current flow, and humidity at home which increased discomfort at home while destroying the application of balcony as a semi open space. (Table 2 Rows 5, 7, 8 and 9)

The construction of primary cores in the temporary sheltering stage without taking climatic solutions of the traditional architecture into consideration, led to thermal and moisture problems. The later expansions have sought to solve these problems which not only caused thermal discomfort for the inhabitants but also changed the traditional dwelling style and disrupted the traditional architecture style of the region.

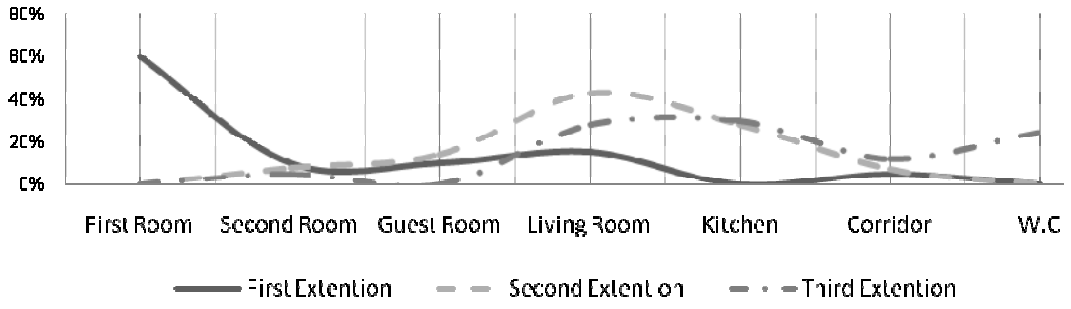


Diagram1: The addition of various spaces in the stages of the expansion of the primary cores

5. The inhabitants' satisfaction

According to what was mentioned about the process of accommodation reconstruction and the problems in extended units such as interruption of dwelling patterns or facing with climatic conditions of regions, the residents have stated their opinions about their relative satisfaction from their accommodation and its strength against the future disasters. (Diagram2) This shows the coalition of positive and negative aspects of reconstruction process in different stages of temporary sheltering and

the expansions in primary cores. On the whole, the positive and negative aspects of the reconstruction program, which have been referred to in the interviews with the inhabitants, can be summarized as follows:

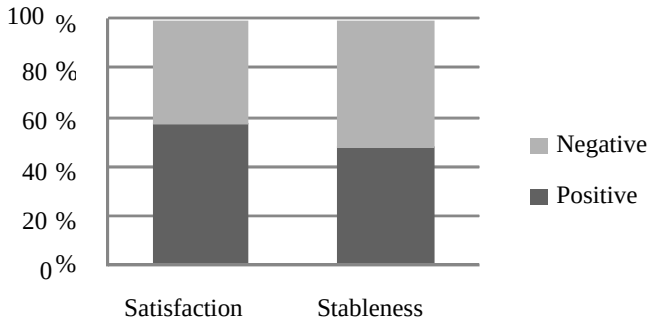


Diagram 2: The inhabitants' trust in and satisfaction of the stability of the reconstructed dwelling unit

5.3 Advantages

1. The use of Zigali structure, which as the traditional structure of the region has had an acceptable performance against the earthquake, for reconstructing dwelling units

2. Using the indigenous building materials

3. Using the relative knowledge of the local society in constructing the Zigali structure for reconstruction of the houses.

4. The participation of the survivors' in constructing temporary shelters and their expansion to permanent shelters.

5.4 Disadvantages

1. The unrealization of the assigned functions (to satisfy the dwelling needs of the household members) for the added spaces.

2. The lack of thermal comfort as a result of negligence to climatic conditions, in constructing temporary shelters and their later expansions

6. Conclusion

The Iranian government changed its previous policy in the reconstruction of damaged regions in Manjil earthquake (1990) to decrease the dissatisfaction of the survivors of the reconstructed dwelling units. To gain the participation and satisfaction of the survivors, the government used the traditional Zigali structure and available building materials in erecting temporary and permanent shelters.

Therefore, the process of reconstruction turned into core housing method. The survivors, with the help of Assistance Headquarters and the government's financial support, constructed primary cores in the temporary sheltering stage and expanded and added other spaces to it. (Bahreyni, 2000; Fallahi, 1994)

Though the primary cores built in the temporary sheltering stage turned into permanent houses by the addition of other dwelling spaces and services in different stages, they were not compatible with the inhabitants' dwelling pattern and were deficient in satisfying the inhabitants' thermal comfort by being negligent of climatic solutions.

The lack of an appropriate reconstruction program for using core housing method in the temporary sheltering stage, the authorities and the survivors' negligence of the requirements of the traditional architecture, and the inappropriate orientation of the structure in relation to wind and sunlight, have led to problems in the reconstruction of permanent houses. Moreover, the authorities' negligence in educating correct method of constructing is another problem this program faces with.

What can be concluded by the studies of the reconstructed houses by using the core housing method is that many problems of previous reconstructions were solved leading to the survivors' satisfaction. However, the incompatibility of permanent shelters with the survivors' dwelling pattern, and the survivors' lack of thermal comfort are problems which can be solved by studying and analyzing the traditional architecture pattern and by presenting suitable expansion methods.

7. Recommendations

A successful core housing method of reconstruction needs pre-arranged programs so that few problems can happen during the various stages of reconstruction.

Villagers' dwelling pattern is changing with time due to livelihood change of penetration of urban culture through mass media. What is more important is considering the principle of region architecture based on climatic conditions and the relation ship of dwelling spaces resulting from communication of family members and society. Therefore, attention of authorities and experts to basic principles of traditional architecture in setting up temporary shelter and the later expansions is necessary.

Employing core housing method for the reconstruction by the use of indigenous technology and building materials encourages the native people to participate in the reconstruction of their own houses. Paying attention to and attempting to solve the weak points of the indigenous technology and building materials and the shortcomings of the traditional knowledge, and providing instruction for the survivors can increase the sustainability of reconstructed houses and can lead to appropriate expansions.

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