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Problems and Countermeasures for the Seismic Safety Project of Chinese Rural Buildings

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Abstract

Due to implementing the city-countryside dualization management for a long time in China, rural construction is in a state of unsupervised, low seismic ability and high-risk once suffered from strong motion earthquake. To this end, the Chinese State Council decided to launch the rural dwellings' earthquake safety project from 2006, and Xinjiang, Gansu, Shandong and other provinces are the first to implement the project in the form of demonstration pilot. After nearly a decade of development, some provinces have taken various effective policies and measures to actively implement the project. These have created a lot of the typical successful cases and experience, which provided an important experience for comprehensively promoting the project. Earthquake safety demonstration rural dwellings constructed by some provinces perform well when suffered from destructive earthquake even from severe and great earthquake. These safety dwellings can protect the people's life and property safety, and good disaster mitigation and social benefits were achieved. However, some problems and difficulties are exposed during a larger progress is obtained in the rural dwellings project. This paper, at first analyzes the present situation of Chinese rural dwellings' earthquake safety project, and then discoursed experience from the implementation of the project for various regions. Secondly, the problems and difficulties in implementation process are summarized. Finally some suggestions on the current situation of rural dwellings' earthquake safety in China are put forward.

Keywords: rural residence; earthquake safety project; earthquake prevention and disaster reduction; construction of new socialist countryside; urban and rural construction

1. Introduction

China is a large agricultural country, with agriculture as its foundation of the national economy, there are about 8 million people living in rural areas. Meanwhile, China is one of the countries which suffer the most serious earthquake disasters in the world, there are more than 80% of the earthquake above magnitude 5 occurred in the rural area, earthquake disaster is a serious threat to the life and property safety of the peasants masses. According to the latest Seismic parameter zoning map of China [1], about 58% of the land area is in the high risk area of earthquakes above 7 magnitude (0.10g). The living security of peasant masses has become the outstanding problems needed to be resolved urgently in China.

However, owing to the long-term implementation of economic and social development pattern of dualization in China's urban and rural areas, the level of economic and social development in rural areas is relative low, the consciousness of earthquake prevention and disaster reduction is weak. In addition, the government and relevant departments didn't pay enough attention to the rural residential construction, rural residence construction has long in a random and disordered state, and it is almost blank in the management system, technical standards and other aspects. Most of buildings in rural areas are being in the "three noes state": "barely defending, barely design, and barely anti-seismic". In the events of several earthquake damage, the results show that the collapse rate of the rural residence constructions is much higher than normal urban architectures when under the equivalent strength of earthquake, earthquake at about 5 magnitude will cause casualties and economic losses, "mild earthquake can lead to disaster, little earthquake can bring out large disaster, and large earthquake incurs major calamities" has become the significant characteristics of earthquake disasters in rural areas of China. It is a common phenomenon in rural areas that people fall into poverty or back into poverty after the earthquake occurred. Jianmin CHEN, the director of China's Earthquake Administration, has pointed out on the "Chinese forum on Sciences and humanities" that: the rural residential seismic fortification of our country is related to people's safety of life and property, social stability and economic stability. Therefore, it is the urgent need to comprehensively carry out the work of rural residential seismic safety engineering, and gradually improve the ability to defend the earthquake and carry out relief work in rural areas.

2. Development and present situation of the seismic safety rural building project

Since the reform and opening up of China, with the continuous development of economy and society, the ideas and principles of earthquake prevention and disaster reduction has gradually been improved and grown mature, and the understanding and attention on earthquake safety in rural areas has increased gradually. After the 6.8 magnitude earthquake in 2003 occurred in Bachu Xinjiang, the CPC Central Committee, and the State Council has attached great importance to the seismic safety work in rural. The State Council has respectively held three national work meeting of earthquake disaster mitigation in 2000, 2004 and 2010. And after the meeting, guidance documents were issued by State Council to further strengthen the work of earthquake prevention and disaster reduction, and guidelines were also set up for rural seismic fortification. In view of the present situation that the rural buildings have weak ability to take precautions against earthquakes, 18 academicians of the Academy proposed to start a "earthquake safe housing project" in 2004, the State Council is fully affirmed with their suggestion, and at mean while asked the earthquake and the earthquake related Department to study the suggestion. In 2006, the State Council held an Earthquake security work conference of national rural buildings in Xinjiang, after the meeting the views on the implementation of the rural residential earthquake safety project was print and distribute. In the same year, Planning on National Earthquake Disaster Mitigation (2006-2020) was issued and released, which clear the important role the seismic safety rural buildings project has played in the cause of earthquake prevention and disaster reduction. Seismic safety in rural areas has been incorporated into the legal category, management rules and regulations of Earthquake Disaster Mitigation Act of the People's Republic of China and urban and rural planning law of the People's Republic of China. According to the incomplete statistics, there are 23 provinces in total (municipality directly under the central government, autonomous region) which has introduced more than 30 local provincial regulations, political and government rules that are related to seismic safety in rural areas [2].

Since the opening of seismic safety rural buildings project, the construction of the project began to implement as pilots and demonstrations in Xinjiang, Shandong, Gansu, Hubei, Hainan, Sichuan and other provinces. By the end of 2014, except Shanghai, there are 30 provinces, autonomous regions and municipalities in the mainland carrying out the rural buildings engineering demonstration pilot, with a total of 104 million households built, benefiting more than 4million people [3]. Various regions have formulated and took effective policies and measures to actively implement the demonstration project of seismic safety rural buildings, creating many typical experience and success cases; they have provided important practical experiences for comprehensively promoting rural residential earthquake safety project and improving the ability of earthquake prevention and disaster reduction.

After nearly 10 years efforts, part of the places has accomplished the seismic safety demonstration of rural buildings, which have make great performance in the face of devastating earthquake and heavy earthquake, protected the safety of people's lives and property effectively, and achieved good benefits of disaster reduction and social benefits.

According to statistics, since the implementation of seismic safety rural buildings project leaded in Xinjiang in 2004, 63 times earthquakes that are more than 5 magnitude occurred in the whole region (including earthquakes at magnitude 6.0-6.9 for 7 times, magnitude 7 or above magnitude 7 once), the casualty rate is far lower than that of other regions in China. The earthquake disaster assessment result of Xinjiang Yutian 7.3 earthquake in 2008 showed that about 9.5million yuan direct economic losses is reduced owing to the harmless of the seismic safety of rural buildings. In 2012, there happened another earthquake of 6.2 magnitude again in this region, the 1431 households that are not yet transformed have suffered more serious damage, due to the high coverage rate of the earthquake resistant buildings, 858 people transferred to the earthquake resistant buildings to live with their relatives, and only 573 households needed to relocated, the project effectively reduce the resettlement cost of the victims and reducing the pressure of government’s emergency rescue and disaster relief. In February 2014, a 7.3 grade earthquake occurred in Yutian County Hotan Area, which can be called the highest level earthquake occurred in Xinjiang in recent years, the earthquake safe buildings and post-earthquake reconstruction buildings are all without collapse, the damaged housings are almost old houses. In July 3rd 2015, there happened an earthquake of more than 6.5 magnitude in Pishan county in Hotan area, the earthquake disaster is relative severe, but with less casualties (3 dead only), the earthquake safe buildings in local has withstood the challenge, with 27000 sets of completed transformation houses in Pishan county standing safe and sound in the village. They have hold up a safety umbrella for the dwellers in local and decreased the loss to the minimum. This is the social effect of Xinjiang’ attaching great importance to the construction of people's livelihood project since the convene of central work conference held in Xinjiang, for five consecutive years, Xinjiang listed "to settle the livelihood and enrich people" as the primary of "livelihood projects", and at mean time vigorously promote it. However, in the 8 years before 2004 in Xinjiang, there occurred a total of 24 earthquakes that above magnitude 5, resulting in 318 deaths, and 5199 people injured, shaping a sharp contrast with present time [4-5].

The seismic safety rural buildings project has also achieved remarkable effect in the face of Wenchuan earthquake of 8 magnitude in Sichuan Province in 2008; it effectively protected the safety of people's lives and property. For example, located in the division of seismic intensity VIII district, 80% of the ordinary rural buildings there are severely damaged, however, the earthquake safety buildings in New Hondar village of this town is 100% intact after earthquake; even after suffering a earthquake intensity of X in the Yanjing Village Mianzhu city of Sichuan province, though 57 of the rural buildings constructed by the seismic safety project is seriously damaged, but none of them collapse, they effectively protect the safety of residents. The Lushan earthquake in April 20th 2013 has caused large casualties and huge property losses to Ya'an, there are 143 towns in the city affected by the disaster, with the affected area of 12 thousand and 500 square kilometers, the affected population of 1 million 520 thousand people. Particular in the epicenter, more than 90% rural houses were severely damaged, and even completely collapsed. However, most of the buildings constructed by the seismic safety rural buildings demonstration project can reach or exceed the standard of the local seismic fortification; they withstood the test of a strong earthquake [6]. From the site investigation of about 10 destructive earthquakes happened in Gansu since 2004, there shows that the seismic safety rural buildings are largely intact or only slightly damaged, obtaining great mitigation effect. Especially in Wenchuan’s 8 magnitude earthquake of

Sichuan, New Dongfeng Village of Gansu Province, Longnan city, Wenxian Linjiang Town, Wudu District Naxiangliting Cun and Daoqi Cun and other 1290 seismic safety demonstration buildings that located in the District of earthquake intensity at VIII are all intact, even the walls had no cracks. However, the adjacent district of Wudu new village and Hekou village Wenxian, above 80% of the buildings are collapsed or severely damaged [7].

3. Difficulties and problems existed in the work of the seismic safety rural buildings engineering

At the mean time of the full implementation of the rural buildings project of China, there exist some problems and difficulties in the implementation process. There is a large gap between the seismic fortification goals suggested in Planning on National earthquake prevention and disaster reduction (2006-2020) and the reality. Among which are shown as follow:

(1) Supporting policies and regulations for seismic management of rural building are relatively backward and lack of mandatory. Seismic safety rural buildings engineering is carried out mainly depending on propaganda, guide and encourage instead of compulsory measures, which is not conducive to promote the engineering.

(2) The management system of rural buildings' construction cannot keep up with the development needs, and rural buildings have not been included in the unified regulatory category. Due to the rights and obligations defined in the rural buildings' construction is not clear, and the corresponding management department, the management system and technical standard in the process of the project absent, responsibility and supervision subject of key links such as design, construction, supervision and acceptance are difficult to guarantee.

(3) The construction of the seismic safety rural buildings project covers large and wide areas and the shortage of funds is still the bottleneck of the promotion of the seismic safety rural buildings project. Construction fund of seismic safety rural buildings is mainly from self-funding, and country or local government haven't formulated the corresponding invest mechanism and the subsidy polices. This leads to the project lagged. For example, there are 1.8 million dangerous buildings in Gansu province need to transform and more than 100 households have no ability to conduct.

(4) The relevant technical standards of the whole process and the whole chain of guiding the design, implementation, acceptance of rural buildings' seismic work are not complete. Because of different areas in China have a unique rural architectural style, and the seismic design, construction technology and acceptance standard of corresponding structure is different as well as corresponding specification standard as technical guidance in most of the rural construction absent, it is hard to ensure the ability of anti-seismic.

(5) The farmers' awareness of earthquake prevention and disaster mitigation is weak, independent buildings of the farmers are lack of scientific location, overall planning and reasonable design, and the construction quality is difficult to guarantee. Most of buildings in rural are built in condition of ignoring scientifically site selection and rationality design, especially to areas which have not suffered any earthquake disaster.

(6) Rural buildings are built with conditions such as unreasonable design, deficient of construction quality regulation, and difficult to guarantee for aseismic capacity. Some backward aseismic buildings which are built with traditional habits and customs are still prevalent in many areas, such as stone house in Fujian, rammed-earth house civil houses in Xinjiang and Gansu, soil and lintel civil houses in Yunnan, piece of rock house in Tibet and Qinghai, etc.,

(7) The earthquake resistant construction of rural buildings has not been widely carried out in the country; the scale of demonstration model project is still small, and lack of coverage. At present, places such as Xinjiang, Gansu, Sichuan, Shandong, Hainan and other provinces in China have been promoting the seismic safety rural buildings demonstration project. But quite a part of the provinces and regions hold a large gap to the requirement s of the national earthquake disaster mitigation planning (2006-2020). It is so urgent to sum up the typical experience and promote it.

(8)The publicity and education of seismic knowledge about rural buildings is not universal, the propaganda and mobilization of parts of areas is not deep enough. Although Xinjiang, Gansu, Shandong and other places have been propagandize the science knowledge of disaster prevention and mitigation to the countryside, universal earthquake-resistant knowledge propaganda and education still need the provinces, villages and towns government to invest a lot of money.

4. Countermeasures and suggestions

To sum up, in order to promote the implementation and management of seismic safety rural buildings in China in a better situation, the following recommendations should be put forwarded:

(1) Attach importance to the construction of laws and regulations, strengthen the power of supervision. Improve the emphasis attached by local governments and their relevant departments on the seismic safety rural buildings engineering and construction, and enhance the mandatory of the regulations.

(2) Establish a management system, improve a sound management system. Set up a special seismic safety rural buildings management organization, clear the work tasks implement the main responsibility, strengthen the emphasis degree attached by government and the relevant departments.

(3) Balance urban and rural development; improve the status of rural buildings. Combined with the building of balanced urban and rural construction and the construction of a new socialist countryside, the new rural buildings should have strict requirements, and have similar standard of city building seismic fortification, so as to achieve real implementation of the management of "urban and rural integration".

(4) Increase capital investment, and formulate subsidize policies. Governments at all levels need to establish investment mechanism of rural building construction capital, formulate corresponding subsidy policy, combines the related funds and preferential policies related to the farmers, use multi-channel to raise the grant funds of rural residential seismic fortification.

(5) To prepare the integrated planning and implement the regulatory system built in a unified way. Adhere to the overall planning, coordinated development, and implement the method of overall relocation and migration, strengthen the comprehensive improvement of the rural public infrastructure and rural environment, and comprehensively improve the rural comprehensive ability of earthquake prevention and disaster reduction.

(6) Attach importance to technology research and development, strengthen the popularization and application. To act according to the characteristics of rural areas and the local conditions, study a new materials, new technologies, new methods, new standards which is simple and practical, convenient constructed, and inexpensive.

(7) Increase supervision, ensure the quality of the project. To strictly control the engineering design, building materials quality, and the acceptance check, prevent and solve the defects and problems of rural housing construction quality, so as to ensure the quality and safety of rural housing projects.

(8) Pay attention to the artisan training, to strengthen publicity and education. Focus on the training of personnel of engineering and technical management, rural artisans and farmers building, to carry out training work layer upon layer, enhance the skills of rural artisans. Vigorously promote the policies and measures of rural residential earthquake safety project, and actively promote the typical experience, improve the rural masses' initiative and consciousness to earthquake disaster prevention.

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