

THE SEISMIC DAMAGE OF THE RURAL DWELLING BEARING WALL AND ITS IMPROVEMENT MEASUREMENTS

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ABSTRACT :

There are diversiform structure kinds of rural dwellings in China. The much ill constructional custom has been formed because of the economic un-development and the lack of anti-earthquake knowledge in the long past time. The incorrect constructional measure of the bearing wall is much ubiquitous. The earthquake damage phenomena of the bearing walls of two structure kinds are enumerated in this paper, which are brick structure and brick-wood structure. The main earthquake damage reasons of the wall are the low quality of the material intensity, the masonry conglutination and the wall masonry. According to these reasons, the improvement method and structure measurement are summarized in this paper. All of the illustrated structure photo pictures from earthquake area show that these improvement method and structure measurements are available to improve structure anti-earthquake capability.

KEYWORDS: Rural Dwellings Wall Earthquake Damage Improvement

1. BACKGROUND

China is an agricultural country with a huge rural land. The rural area is 90% of the national area and the rural population is nearly 0.9 billion which is more than 70% of national population. Most earthquakes in China took place in rural area. Therefore the earthquakes are easy to befall the rural dwellings. Because the constructors in rural area are lack of anti-earthquake knowledge, many rural dwellings are poor anti-earthquake capability and are easy to be destroyed.

There are diversiform of rural dwellings in China, such as brick structure, brick-wood structure, stone structure and earth structure etc. These rural dwellings are widely distributed in China. One of the main reasons of the earthquake damage is that the bearing wall lacks necessary measurement.

2. THE PHENOMENA OF THE EARTHQUAKE DAMAGE OF THE BEARING WALLS

2.1 Brick structure

The more and more brick buildings occurred along with the economic development in the rural area in China. The brick structure is generally stronger than the above two structures in the anti-earthquake aspect. However brick buildings haven't still exerted real effect during earthquakes. We can see many problems of bearing wall from the following pictures.



Figure 1 Brick structure, Ms 8.0 Wenchuan Earthquake



Figure 2 Brick structure, Ms 8.0 Wenchuan Earthquake



Figure 3 Brick structure, Ms 8.0 Wenchuan Earthquake



Figure 4 Brick structure, Ms 8.0 Wenchuan Earthquake



Figure 5 Brick structure, Ms 8.0 Wenchuan Earthquake



Figure 6 Brick structure, Ms 8.0 Wenchuan Earthquake

2.2 Brick-wood structure

Brick-wood structure is a mixed structure that the both of brick wall and wood stud bear the whole building weight. Hereinafter some designed and constructional problems would be found. Fortunately, brick-wood structure decrease gradually because of forest protection



Figure 7 Brick-wood structure, Ms 8.0 Wenchuan Earthquake



Figure 8 Brick-wood structure, Ms 8.0 Wenchuan Earthquake



Figure 9 Brick-wood structure, Ms 8.0 Wenchuan Earthquake



Figure 10 Brick-wood structure, Ms 8.0 Wenchuan Earthquake



Figure 11 Brick-wood structure, Ningbo, China



Figure 12 Brick-wood structure, Ningbo, China

3. improvement method and structure measurements

3.1 Brick structure

One of the important things for the brick wall is bricklaying method. Incorrect bricklaying methods are showed in Figure 4 to 6. Here two bricklaying methods are introduced in Figure 10 and Figure 11.

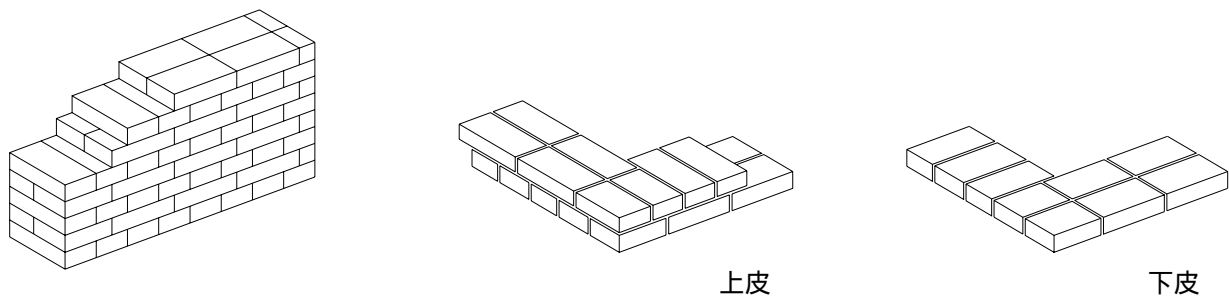


Figure 13 Bricklaying method 1

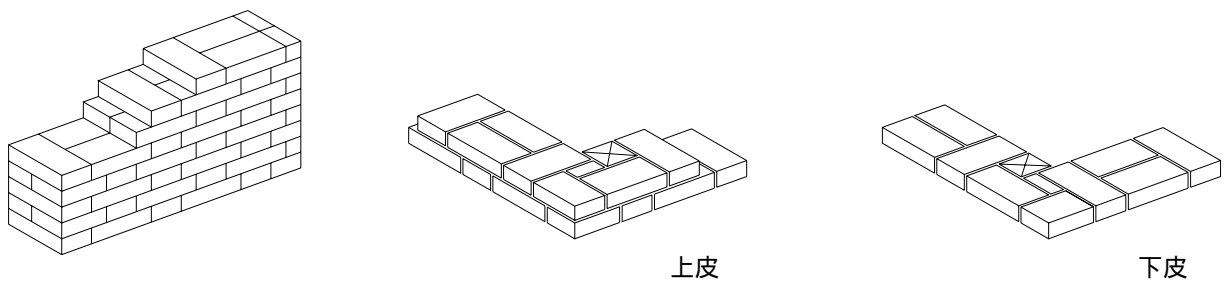
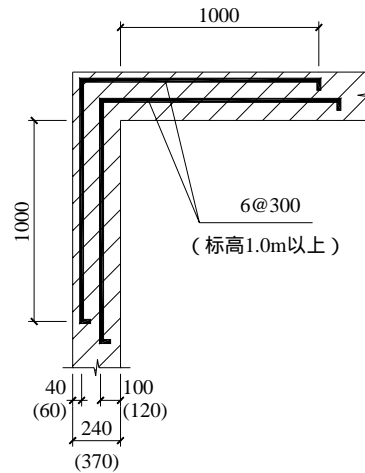
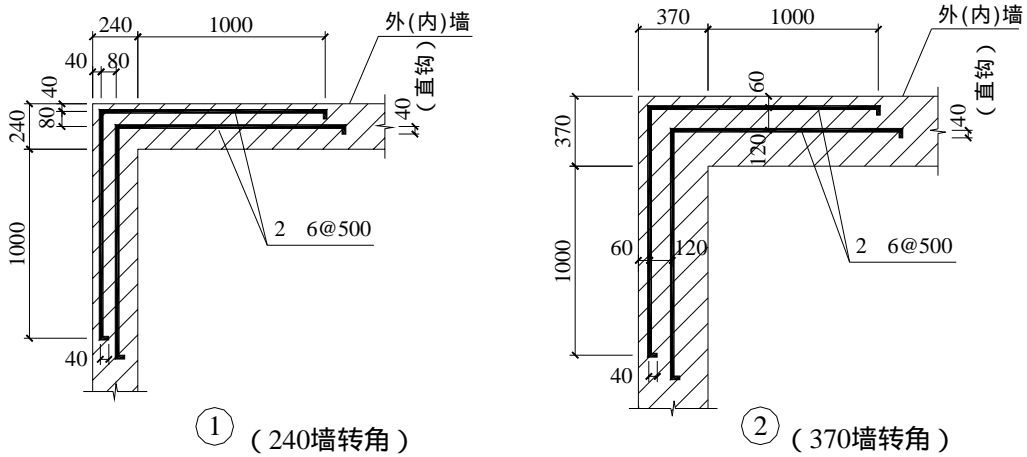


Figure 14 Bricklaying method 2

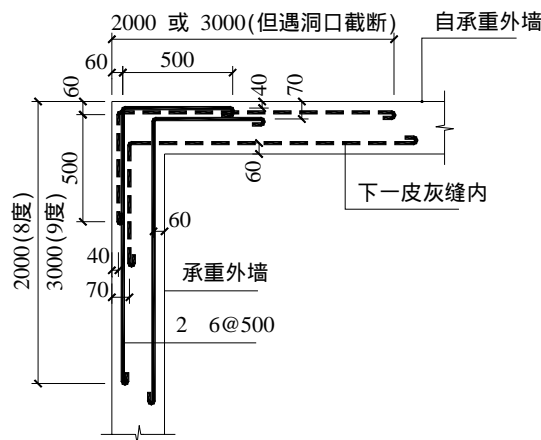
One of the strengthen methods at “L “ type joint of masonry walls with two reinforcing steel bars is demonstrated in Figure 12. Figure 12 (a), (b) and (c) show deferent length and diameter of steel bars under intensity 6, 7, 8 and 9, respectively.



(a) Reinforcing steel bars in outside wall joint under intensity 6

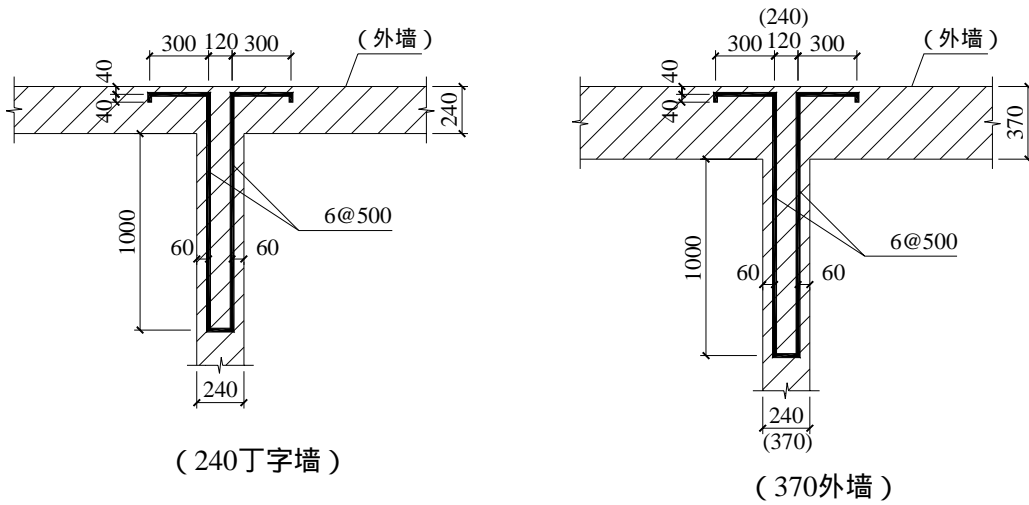


(b) Reinforcing steel bars in outside (interior) wall joint under intensity 7 to 9

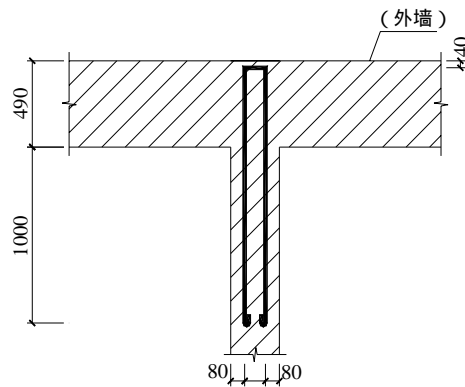


(c) Reinforcing steel bars in outside wall joint under intensity 8 to 9

Figure 15 One of the strengthen methods at masonry wall joint with “L” type



(a) and (b) Reinforcing steel bars in interior and outside walls with thickness 240 and 370 mm respectively



(c) Reinforcing steel bars in outside wall with thickness 490 mm

Figure 16 One of the strengthen methods at masonry wall joint with T type

3.2 Brick-wood structure

Because the both of brick wall and wood stud bear the whole building weight for brick-wood structure, it is necessary to connect brick wall and wood stud by suitable ways. 4 ways connected with brick wall and wood stud are displayed in Figure 15.

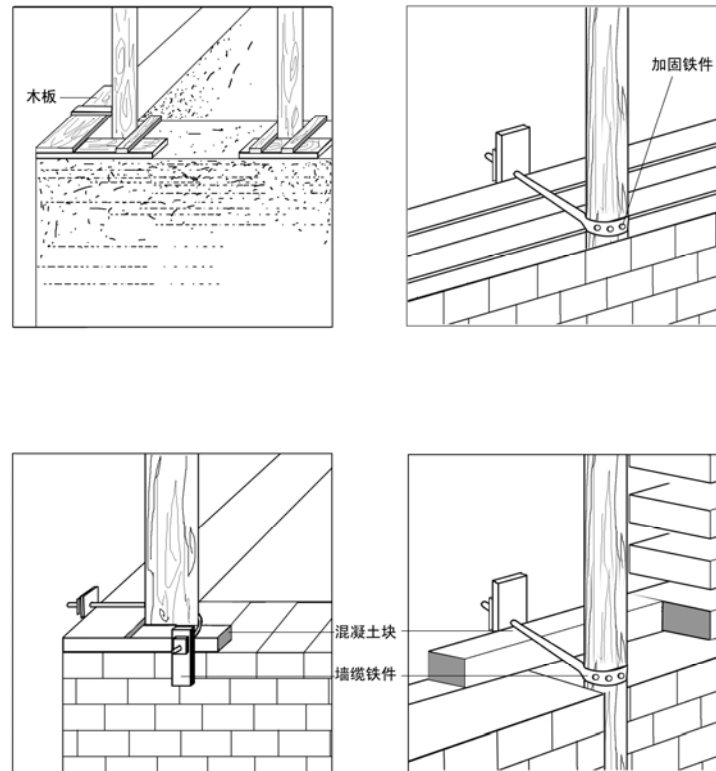


Figure 15 4 ways connected with brick wall and wood stud

4. Summary

For the brick wall, the bricklaying method and reinforcing steel bars used in the wall can be promoted the earthquake resistance capability and the holistic performance of the brick structure and the brick-wood structure.

Because the both of brick wall and wood stud bear the whole building weight of the brick-wood structure, it is necessary to connect brick wall and wood stud by suitable ways.

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