

## Application of Seismic Safety Evaluation Report in Seismic Design of Hospital Buildings

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**Keywords:** Seismic Safety Evaluation, Seismic Fortification Dynamic Parameters

**Abstract:** This paper takes the relevant provisions of the state laws and regulations and the code for seismic design of buildings of the hospital building as the key protection class of civil building seismic safety evaluation work, according to building seismic fortification. Combined with the project as an example, the earthquake safety evaluation report in seismic design to application are discussed for construction engineering design personnel in the hospital and other key fortification architecture design reference.

### 1. Introduction

The earthquake induced damage and collapse of buildings and engineering facilities are the main factors of the earthquake disaster, only casualties and property loss of the buildings and engineering facilities with adequate seismic capacity can effectively reduce the loss caused by the earthquake. To determine the reasonable fortification goal is a prerequisite for the seismic design of hospital buildings, as a matter of important buildings in the earthquake disaster, beneficial to the people's livelihood occurs and need to take treatment function, the seismic fortification goal should be higher than ordinary civil buildings. "Fortified buildings classification standards" provisions: the earthquake fortification medical building shall comply with: "take on special important medical tasks of three hospitals in the outpatient department, medical technology, hospital buildings, seismic fortification category should be divided into special protection class two or three grade hospitals, outpatient, medical, hospital room, with surgery Township hospital operation room or emergency department of the medical room??, the earthquake fortification fortification category should be classified as the focus, which means that most of and above the county level hospital medical room the seismic fortification categories should belong to the key protection class (class B) building, seismic capacity of this type of construction should be higher than residential, the general office building Taller buildings belong to lifeline projects where functions cannot be interrupted or need to be restored as soon as possible.

Seismic safety evaluation of engineering site is "a legal system establishment of People's Republic of China earthquake disaster mitigation act", "People's Republic of China earthquake disaster mitigation act" thirty-fifth "major construction projects and the construction projects which may induce serious secondary disasters, should be in accordance with the relevant provisions of the State Council for seismic safety evaluation The price, and the seismic fortification in accordance with the approved seismic safety evaluation reports of the identified requirements." "Seismic work under the State Council departments and provincial, autonomous regions and municipalities directly under the people's government is responsible for the administrative departments or institutions for seismic work, responsible for seismic safety evaluation of construction project approval report, determine the requirements for seismic resistance." And the scope of major construction projects and the construction projects which may induce serious secondary disasters are given in the supplementary provisions, the State Council promulgated the "seismic safety evaluation management regulations" and the provinces of seismic safety evaluation management practices are needed for seismic safety evaluation of Engineering defined the scope, in Shandong province " The seismic safety evaluation management measures "as an example, in the appendix has been clear

about the need for seismic safety evaluation of construction projects," more than 300 beds in the hospital outpatient service building, ward building, medical technology building, medical equipment room and blood center; "this means that for the vast majority of the province at the county level and above the main hospital For medical buildings and important equipment rooms, seismic safety evaluation is necessary. "Shandong earthquake disaster mitigation Ordinance" clearly stipulates: "the requirements of seismic fortification of major construction projects and the construction projects which may induce serious secondary disasters, the earthquake work departments of the people's governments at or above the provincial level according to the seismic safety assessment report approved approved." "Construction engineering schools, kindergartens, hospitals and other crowded places, should be designated in the earthquake area, the national seismic zoning map or seismic safety evaluation results to improve a determined the requirements for seismic resistance." The country and various provinces and cities have laws and regulations from the perspective of seismic fortification requirements and hospital buildings should be used after the approval of the safety assessment results for the seismic design made clear.

## 2. Application of safety assessment

"Code for seismic design of buildings GB50011 pointed out that the seismic fortification intensity shall be issued by the examination and approval according to the provisions of the state authority file (map) to determine the seismic fortification intensity of general engineering should be based on the" gb18306 China peak ground acceleration A1 "and" China zoning map of earthquake response spectrum characteristic period (TG) map B1 " The basic earthquake intensity of determining the fortification; under certain conditions, can be used for the seismic fortification design approved by the relevant competent departments of the state authority issued by the ground motion parameters (such as the peak acceleration of ground motion, response spectrum, seismic effect coefficient curve and seismic acceleration time history curve of) Fortification.

Due to historical reasons, "code for seismic design of buildings with double track system for seismic fortification expression, namely expression according to the design basic earthquake acceleration and seismic intensity. Seismic design generally includes two aspects of earthquake action calculation and construction measures for the content, hospitals and other key fortification buildings, construction engineering "gb50223" standard for classification of seismic protection is not required to improve earthquake action, only need to improve the seismic measures to calculate earthquake effect is related to the design of earthquake acceleration, and resistance Seismic measures are determined according to the intensity of fortification. "Code for seismic design of buildings clearly pointed out: according to the provisions of the state authority approved as a seismic intensity area of seismic fortification criterion for the local seismic fortification intensity, under normal circumstances, the seismic intensity of 50 years beyond the probability of 10%. 50 years

Cheng Example 1: Outpatient Medical and Technical Complex Building and Ward Building of a Hospital in Jiaozhou City, Qingdao, with emphasis on fortification. According to Appendix gb50011-2010 of Code for Seismic Design of Buildings, the basic seismic acceleration of the design in this area is 0.05g. The design earthquake is grouped into a third group with a special period of 0.45s. According to the results of seismic safety evaluation, the construction is carried out. The ground motion parameters of the project are as follows:

Design ground motion parameters exceed probability level in 50 years 63% 50 years 10% 50 years 2% Amax (c M / s<sup>2</sup>) 32 98 164 beta m 2.7 2.7 t0 (s) 0.100.10 TG (s) 0.45 0.55 0.60 C 0.90 0.90

The peak value of horizontal design ground motion acceleration with 5% damping ratio exceeding 10% probability in 50 years is 98gal. According to the principle of zoning ground motion acceleration in gb17741-2005 "Seismic Safety Assessment of Engineering Sites", this result belongs to 0.10g area. Equivalent to the basic earthquake intensity value of 7 degrees, according to the Shandong Provincial Regulations on Earthquake Prevention and Disaster Mitigation, after approval by the competent seismic authorities, the seismic fortification requirements of the hospital building

are determined according to the peak acceleration of 0.15g. The structural design is based on the basic seismic acceleration of 7 degree and 0.15g to calculate the earthquake action, and the seismic measures are taken at 8 degree.

Engineering Example 2: A Comprehensive Ward Building of a hospital in Jinan City, with emphasis on fortification. According to Appendix gb50011-2010 of Code for Seismic Design of Buildings, the basic seismic acceleration of the design in this area is 0.05g. The design earthquake is grouped into the third group, the site type is class II site, and the site characteristic period is 0.45s. The design parameters of the project are as follows:

Design ground motion parameters exceed probability water 50 years 63% 50 years 10% 50 years 20% 50 years 2%  $A_{max}$  (c M / s<sup>2</sup>) 31 78 134  $\beta$  m 2.62.6 t0 (s) 0.100.100.10 TG (s) 0.350.40 C 0.90 0.90 according to GB 17741-2005 "seismic safety assessment of Engineering sites" on the principle of earthquake acceleration zoning, 50 years exceed probability of engineering sites 10.78 134  $\beta$  m 2.62.6 t0 (s) 0.100.10 TG (s) 0.350.40 C 0.90.90. According to Shandong Provincial Regulations on Earthquake Prevention and Disaster Mitigation and the approval of the competent earthquake authorities, the seismic fortification requirements of the hospital building are determined by 0.10g of the peak acceleration of ground motion. The structural design is based on the basic seismic acceleration of 7 degree and 0.10g to calculate the earthquake action, and the seismic measures are taken at 7 degree. It should be pointed out that the characteristic period is determined according to site type and design earthquake grouping. The maximum value of horizontal seismic influence coefficient in current seismic code is related to the transcendental probability (small, medium and large earthquakes), while the characteristic period is not related to the transcendental probability, while the characteristic period of safety assessment report is generally related to the transcendental probability. The characteristic period of the response spectrum of large earthquakes is usually larger than that of small earthquakes. When checking the bearing capacity of the acceleration gear under small earthquakes according to the results of the safety assessment report, the seismic parameters (the influence coefficient and characteristic period of the base acceleration gear for small earthquakes) of the safety assessment should be selected for calculation, and the larger values of the two should be taken for design according to the dynamic parameters of the code.

In fact, as far as the seismic fortification requirements of construction projects are concerned, the seismic fortification requirements of lifeline related projects which can not be interrupted or need to be restored as soon as possible during earthquakes should be predicted.

Equipment and facilities in the structure under severe earthquake returned to normal as soon as possible, the provisions of seismic fortification of this kind of construction period should not be 50 years beyond the probability 10%, building codes are given load and earthquake action are based on the 50 reference period are 3 different water limit aseismic design of buildings design Accurate values can be transformed into the corresponding probability of 50 years, this is not discussed in this paper as the specific reference to relevant literature.

### 3. Conclusion

For this type of hospital need to focus on the most needed fortification building, seismic safety evaluation, safety evaluation, the conclusion is often the same code for seismic design of ground motion parameters is not consistent, "the regulations on fortification earthquake disaster mitigation act" and other laws and regulations of earthquake prevention and disaster reduction is not the same, but throughout the construction administrative department The door and the construction plan review there are also differences on the interpretation of the relevant design standard, the designers are often confused, from the relevant provisions of laws and regulations and the relevant provisions of the standard, discusses the hospital building and other key construction projects in the seismic fortification class such as what application security assessment results fortification. Combined with the engineering example, the concrete measures and suggestions for seismic fortification are given for reference by colleagues.

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