

## Geological Hazard Risk Assessment of a Construction Project

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### Original Research Article

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**Abstract:** Risk evaluation of geological hazard is the one of necessary works in engineering construction project, which plays an important role in legitimately avoiding the threaten from geological hazard. In this paper, we take a building construction project in weishan, yunnan province as research object. Primary items and methods have been introduced. By means of survey and analysis about the geologic environment, engineering geology, hydrological geology condition and mankind's activity, the present and future risk of geological hazard has been evaluated. In the end, corresponding suggestive measures are put forward.

**Keywords:** Geological hazard; risk evaluation; measures; suggestion.

### INTRODUCTION

Geological disasters are one of the main threats to human construction activities, which directly restrict our country's social development and economic construction. According to the ministry of land and resources, there were 3,893 geological disasters in the first half of 2012 alone, leaving 124 dead, 51 missing and 92 injured, while the direct economic loss was 7.2 billion[1].The frequent occurrence of geological disasters poses a great threat to the lives and security of the masses and seriously affects the local economic and social order, Therefore, it is of great significance to evaluate the risk assessment of geological hazards in the construction project. At present, with the state council in 2003 promulgated the regulations on the prevention and control of geological disasters [2] in 2004 by the ministry of land and resources and the geological disaster risk assessment technical requirements[3], greatly promote the development of the construction land geological disaster risk assessment.

Combining with the relevant requirements, a construction project in WeiShan County of Yunnan province geological disaster risk assessment of the status quo and forecasting and provides corresponding prevention measures and Suggestion.

### PROJECT PROFILE, DETERMINE THE SCOPE AND LEVEL OF EVALUATION

Weishan County is located in the west of Yunnan province and southern part of Dali .The proposed project was seated in the north of Nanzhao Town, Weishan County, 1.20km from the ancient city. Geographical coordinate of the proposed project: Longitude 100 degrees 17, 44 ', -100 degrees 17, 54', and latitude 25, 14 '13' -25 degrees 14 '18', attached to the town of Weishan, Nanzhao County. Construction area of 32.38 mus, with a total construction area of 21800.00m<sup>2</sup>, construction area of 4512.00m<sup>2</sup>.

According to the assessment of geological environment conditions, combined with the scale of construction projects and project layout, the extent of adverse geological geological disasters, the construction

area of the affected area and the engineering activities may cause geological disasters as the scope of the assessment. The construction site of the project area of 32.28 acres, according to the geological conditions, first of all to the first line for the assessment of slope area, no obvious boundary slope based on the scope of land requisition on the outward expansion of 200-300m, the assessment area of about 0.575km<sup>2</sup>.

The proposed construction project is an office building, 5-6 floors, a small scale project, According to yun the endowment ring [2004] no. 2004 "the notice on strengthening the geological disaster risk assessment work attachment 3 table 3" the classification of industrial and civil construction project importance "4", for the general construction project of the proposed construction project.

### Geological environment condition

#### *Meteorological and hydrological conditions*

Weishan is a subtropical plateau monsoon climate type, with summer heat free, winter cold, three-dimensional climate and regional microclimate obvious characteristics. The average annual precipitation is

843mm, from May to October, when the precipitation was concentrated, precipitation accounted for 84 percent of the annual rainfall. The annual steaming capacity of 1721mm -2085mm, the average evaporation capacity of 1924mm for many years; The average annual relative humidity is 73%, WeiShan dam for many years the average temperature of 15.9 °C (1992); The average annual sunshine is 2,320 hours.

There is no larger water distribution in the assessment area, and there is a river and fish pond only at the north end of the site. The river map is about 1.2 km long and is about 1.00 m wide. Surface water is seasonal water flow, the flow is affected by the season, the water quantity varies with season, and the dry season is dry. The runoff pattern mainly flows underground to the groundwater, which evaporates in the atmosphere. The proposed site is adjacent to the north side of the river, and the construction elevation of the site is basically parallel to the river surface elevation during the rainy season, and the north side stream has a certain influence on the proposed project during the rainstorm season.

#### **Topographic features**

The assessment area is located in the Weishan County basin, the basin is flat, elevation 1695-1834m, surrounded by mountains, the relative elevation between the basin and the surrounding mountains is greater than 200m. The basin is a fault depression accumulation basin. From Pleistocene to now, there are lots of Pleistocene lacustrine deposits, Holocene alluvial lacustrine deposits and flood deposits.

Evaluation area in WeiShan accumulation basin landform, the overall high terrain north east, south west low, elevation between 1695-1725 – m, terrain slope is less than 5°. The highest point on the north east side is 1722.50 m, the lowest point on the south west edge, which is 1698.50 m, the highest relative height is 34m. Proposed site is located in the middle of evaluation area, 1705.0 1710.0 m, height of slope is less than 5°. The evaluation area is simpler and the terrain type is single.

#### **Geological structure**

The geological structure in the area in the Tanggula – Changdu – Simao fold system of Lanping – Simao – Jiangcheng Yunlong depression fold beam north eastern edge. And Yangtze paraplatform unnan platform-margin fold belt points framed – ailaoshan fold break beam framed block adjacent, geological structure, the tectonic line in the North West and north to the east, a north-south and nearly east-west. The development of the whole fold bundle experienced multiphase tectonic movement, the prototype of the north-south and east-west structure may exist in unnan421e421n period or ago, North West construction

began in the late variscan development. After the period of printing, Yanshan period and the peak of the mountain period, it was finalized, the mutiperiodic activity, tectonic system has the long-term sustainable development of the history, recent times its activity is obvious, their composite parts, is often the quake zone and geothermal anomaly area. The undeveloped fracture and fold in the evaluation area only developed four faults and two fold in the area outside the evaluation area.

#### **New construction and its motion**

The structural fissures in the area were developed, and the overall stability of the site was affected by the major faults, and the fissures were developed in the fracture zone. Rock mass is broken, poor rock mass engineering geological conditions, the field strength of foundation soil engineering geological affected, structure near fault activity is strong, earthquake activity is frequent, The construction activity is affected by the earthquake activity, the area is located in the area of 8 degree earthquake intensity, the construction site is the earthquake earthquake seismic activity general location.

The new tectonic activity in the area is mainly in the form of intermittent strong rise, local relative stability, the area of the evaluation area is in the construction unit, and the new tectonic movement in the area is strong. Fast modern high crustal stress, tectonic deformation and regional area belongs to the strong rise, lifting movement difference obviously at the same time, the mountains rise strongly and basin fell sharply.

The area is located in the area of the red river-erhai fault, the fault of the red river erhai, which is close to the fault zone, the new tectonic movement has been strong since the last new world, and the seismic activity is more frequent. Seismic activity has the characteristics of “long interval length and frequent small earthquakes”. Grade 5 and above earthquake since the Ming dynasty, a total of 10 times, July 10, 1625 and December 16, 1978 earthquake magnitude 6.75 and 7.8 respectively, the epicentral area intensity of 9 and 10 degrees respectively.

Assessment of current situation of geological disasters, weak development landform is relatively simple, fault structure is complex, engineering geological properties of rock and soil mass is poorer, moderately complicated engineering geological conditions, a moderately complex hydrogeological conditions, human engineering activity is relatively strong. The geological and environmental conditions in the evaluation area are of medium complexity. The evaluation of the risk assessment of geological hazard of the project was assessed.

## ENGINEERING GEOLOGICAL CONDITIONS

Status quo of geological disaster risk assessment is the decision effect to the stability or risk factors or elements of the thorough analysis, the nature of the geological disasters, changing, and the object of harm and damage. The method of assessment is mainly through the field investigation, the visit, the historical record and the relevant investigation report, the data obtained [5]. Through field fieldwork, visit and collect existing data to carry out comprehensive analysis, assess the geological disaster phenomenon in the area, for example: Geological disasters such as collapse, landslide, ground collapse, ground fracture, ground subsidence and unstable slope are not developed, the bad geological phenomena are local soil and water loss. The evaluation area is located in the former basin of the mountain basin, the present situation geological disaster is weak development, the danger and the harm degree to the construction project building is small.

The main construction site of the proposed site is flat, the surface is covered by a fourth line, it has a certain covering thickness, the excavation of the foundation pit is excavated, and the excavation depth is greater than 5.00 m. The structure of the foundation pit walls of cohesive soil, gravel soil is loose, and if not effectively supporting foundation pit wall, under the condition of rainfall and vibration of foundation pit slope collapse may occur, causing instability of foundation pit wall, causing collapse and other geological disasters. Quaternary unconsolidated accumulation ( $Q_h$ ) in the field are all in distribution and accumulation in the local distribution of expansive soil, soft soil, soft soil engineering geological conditions is poorer, expansive soil great damage to the low-rise buildings. Project construction and operation process, under certain conditions, the soil deformation, and weak expansion and undermine its engineering geological characteristics, triggering proposed building foundation uneven settlement or deformation and other geological disasters. Proposed field engineering construction process, could cause well-up water after excavation, foundation pit wall by water after soaking, the possibility of collapse, soften medium, harm and danger of medium; In the area, the dust soil and silty sand layer of the dust layer are deposited in the ground, and the soil liquefaction can occur under certain conditions.

Soft thick laminated mudstones in the clip are in the hard thick bedded sandstone rock group: on the rock types include the Jurassic series dam road group ( $J_3b$ ) sandstone lithologic amaranth mudstone. The fourth and fresh rock interfaces are weak structures. The rock is hard, the weathering ability is poor, the mechanical strength is higher, the engineering stability is better.

## COMPREHENSIVE ASSESSMENT OF GEOLOGICAL HAZARDS AND MEASURES FOR PREVENTION AND CONTROL

### Comprehensive assessment of geological hazard risk

Weak area geological disaster development, bad geological phenomenon as the local soil and water loss, less likely, geological hazard prediction project construction aggravates hazards and risk small, induced by the geological disasters and the possibility of small to medium, harm and dangerous medium, general geological disaster hazards and medium risk.

### Measures for the prevention and control of geological disasters

In order to avoid geological disasters, geological and geotechnical engineering problems and to the harm of the proposed construction project, according to the geological environmental conditions of evaluation area, put forward the following construction control measures:

- (1) Existing in the construction of engineering excavation, excavation of slope stability is poorer, temporary to support, the disposal of the sun rain, and on the basis of the construction work in time, do a good job security.
- (2) Proposed site in expansive soil, soft soil and sandy soil distribution, important facility location, if encounter, have this kind of soil, soil must be clear, and concrete filling or hardening treatment, preventing water leakage, and do a good job in monitoring and inspection found that the problem timely processing in a timely manner.
- (3) For the proposed building the foundations of corresponding treatment measures are taken, and adopt reasonable form the basis of the prevention and control of expansive soil, soft soil and sandy soil damage to buildings.
- (4) Excavation engineering and soil formation should choose a good area for reasonable pile, soil formation of the high and steep slope, suggest adding retaining wall project, and to consolidate, slope protection, keep the slope stability, and make the slope and at the top of the waterproof and drainage facilities. The backfill of the foundation pit is used as a way of filling or piling up the dirt, and taking the corresponding measures.
- (5) To harden and prevent the whole construction site, improve the resistance of the site.
- (6) To river dredging river on the northern side of proposed site at any time, building silt dam embankment strengthening, protective measures such as governance, effectively prevent the flood broke out on the effects of the proposed construction project, the project by the river on one side of the building is higher than the flood water level for sand wall, to prevent the flood erosion of engineering.

## CONCLUSIONS

(1) The construction project of the Weishan County in unnan province covers 332.38 acres, the scale of the project is small, the floor height is 6 stories high, and it is the general construction project.

(2) In the evaluation area, the present situation of geological disasters is weak, dangerous and dangerous, and the bad geological phenomena are local soil and water loss.

(3) The prediction of project construction causes the possibility of geological hazards to be low to medium, dangerous and dangerous.

(4) Small increase the possibility of geological disasters, harm and risk small, suffered from the existing possibility of geological disasters, harm and risk small, engineering construction may suffer from foundation uneven settlement, the possibility of a foundation pit collapse medium, harm and danger of medium, may suffer from the north river caused by the possibility of soil and water loss is small, harm and danger of medium.

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