

CHAPTER 2

THEORITICAL BASIS

2.1 ANALYSIS LITERATURE

In the preparation and planning of the thesis, adopts from several literature sources that have been researched on objects related to the title of the thesis in the last 5 years. Consist of :

2.1.1 Reinforced Concrete Structure Design

Indonesia has experienced many earthquakes due to its geographic location. Therefore, the Indonesian National Standard (SNI) for seismic design has recently been released for immediate application. The National Standardization Institution of Indonesia issued a seismic design guideline for building structures called as SNI 1726:2019. In this study, nonlinear static analysis procedure is adopted to evaluate the seismic performance of reinforced concrete frame structures seismically designed using SNI.

The main purpose of this study is to assess the safety level of the building under an earthquake. Three typical building with different height have been evaluated. The analysis is conducted using the commercial finite element ETABS. The performance level is determined according to ASCE41-17 acceptance criteria. The results revealed that the SNI designed building generally comply with to the acceptance criteria.⁽¹⁾

⁽¹⁾ Suwondo Riza, Lusy Mellyati, and Sohaib Alama. Pushover Analysis of Reinforced Concrete Building Seismically Designed Based on SNI 1726-2019. *IOP Conference Series: Earth and Environmental Science* (2022) 998(1). Available in : <https://iopscience.iop.org/article/10.1088/1755-1315/998/1/012005>

2.1.2 Medium-rise Building

Structural Identification (St-Id) is the process of constructing and calibrating a physics-based model based on the measured static and/or dynamic response of the structure. Over the last two decades, although the St-Id methods have become increasingly popular amongst civil–structural engineering communities, most complete and successful applications are often found with flexible structures such as long-span bridges and towers.

Very few comprehensive studies were reported on building structures, especially those with medium-rise characteristics which are often associated with complicated analytical modelling and different degrees of parameter uncertainties. To address this need, this paper presents an in-depth study on St-Id of a benchmark medium-rise building firstly demonstrating the importance of developing appropriate initial analytical models that can be used for the automated model calibration techniques. Then, a novel parametric study-based sensitivity analysis approach is introduced to identify tuning parameters as well as their appropriate ranges to maximise the correlation of the calibrated model whilst preserving the physical relevance of the calibrated model. Modal data of the first few modes measured under ambient vibration conditions are used in this study. Further application of the St-Id process developed herein for structural health monitoring (SHM) of buildings is also discussed.⁽²⁾

⁽²⁾ Nguyen A. (dkk). Toward effective structural identification of medium-rise building structures. *Journal of Civil Structural Health Monitoring* (2018) 8(1) 63-75. Available in : <https://doi.org/10.1007/s13349-017-0259-y>. Accessed on date Juni 11, 2022. At 01.04 PM.

2.1.3 Implementation Manajemen International School

This study aims to determine the implementation of student management at international standard schools, know the problems faced in student management, know the actions taken by schools in overcoming these problems, determine the inhibiting factors and supporting factors in the implementation of student management at international standard schools. This study uses a descriptive method with a qualitative approach. Data collection was carried out by conducting observations, interviews and documentation. The data analysis used was descriptive qualitative analysis.

The results in this study indicate that the implementation of student management at international standard schools has been carried out well, this can be seen from the management of four aspects of student management, namely from student acceptance, student administration, providing guidance and counseling and recording learning achievement. The main problem faced in the implementation of student management is the existence of government policies that impose limits on the use of funds, the central government does not socialize the International Standard School program. Actions taken to overcome the problem are that schools follow established regulations and then communicate directly with the government.⁽³⁾

⁽³⁾ Yelis Nurwahidah (dkk). Implementasi manajemen kesiswaan pada sekolah bertaraf internasional, *Jurnal Pendidikan Islam Vol. 2, No. 2, Desember 2020, p. 118-126*. Available in : <http://journal.stitmadani.ac.id/index.php/JPI/index>. Accessed on date April 22, 2022. At 06.07 AM

2.1.4 Comparasion journal with the thesis

Based on the three journals above, the following equation is obtained :

1. Analysis structure using ETABS Software
2. Seismic design guideline for building structures used SNI 1726:2019.
3. Typical building is medium-rise building
4. Explain about international school

2.2 CIVIL ENGINEERING STRUCTURE

Civil engineering is a widely structured discipline to study the concept of design, construct and maintain infrastructure systems and projects. The scope of Civil Engineering lies in developing, designing, planning, calculating, monitoring construction as well as executing and managing the construction of buildings, roads and physical structures like bridges, dams, etc. and their maintenance. Structural engineers are responsible for designing (and making) their load bearing structures with economy, safety and elegance.

Construction building in the study of civil engineering consist of :

1. Construction of a building such as residential, schools, colleges, hospitals, government offices, industrial towers, etc. is of prime importance because of the increasing population and growth of any country.
2. Advanced contruction such as bridges, tunnels, dams, ports, power stations etc, to ensure their stability and durability.

In the preparation of the thesis, the research focuses on public building development. The planned building is school building using reinforced concrete structure with 6 story and height of 27 m, these specification are included in the specifications of the medium-rise building. The building is planned according to the latest SNI in Indonesia.

2.3 DEFINITION OF BUILDING

The building is a kind of structure which is built with materials and including with foundation, plinth, walls, floors, roofs, chimneys, plumbing, and building services, fixed platforms, veranda, balcony, cornice or projection, part of a building or anything affixed thereto or any wall enclosing or intended to enclose any land or space and signs and outdoor display structures. For example, houses, school, factories, shopping malls, hospitals, etc.

A building aims to give shelter along with security. Other purposes such as buildings serve several needs of society primarily as shelter from the weather, security, living space, privacy, to store belongings, supplied electricity, and to comfortably live and work.

Type of Building :

1. Low-rise Building

Given that there's no set definition, a low rise building can be as tall as 3 story or as much as 9 meters in height, with height story 3 meters. Usually, low rise buildings are those without elevators, making them "walk up" buildings. However, this can extend up to as many as four to five floors, again, depending on where the building is located. Although, most people would consider a low rise building to be one that's anywhere from three to four stories.

Characteristic :

- a. Using concrete reinforcement structure
- b. Using permanent wall.
- c. Core system is ignore.
- d. Foundation as building stability.
- e. Low-rise building can be of various shapes because it is not affected by large lateral loads.
- f. Using rigid frame.
- g. the number of elevators is not so much and is not distinguished between zoning and height.

2. Medium-rise Building

Medium rise buildings don't only have 3 stories in height, but also, as much as five to six stories or more stories. Unlike low rise buildings, which are generally unequipped with elevators and instead rely on stairs, mid rise buildings usually have elevators. (Although, not all buildings that are considered mid rise do have elevators.) However, this is quite unusual, given that there are standards, such as those which pertain to the Americans with Disabilities Act or ADA generally require buildings with three or more stories, to be equipped with elevators.

Characteristic :

- a. Using blend structure (concrete and steel)
- b. Using permanent and partition wall
- c. Core system recommended
- d. Basement and deep foundation as building stability
- e. Using rigid frame shearwall
- f. The number of elevator is distinguished between zoning

3. High-rise Building

High rise buildings, these are generally above six stories in height. Also, most high rise buildings are 100 meters in height. (These should not be confused with "skyscrapers," which are generally much taller, as little or as much, as 200 meters in height. For comparison, there are also "supertall" buildings, which can rise as much or little as 300 meters — approximately 1,000 feet — in height. As you can plainly see, there are many factors which help to classify a building as a low rise, a mid rise, or a high rise.

Characteristic :

- a. Using composite structure (concrete and steel).
- b. Using partition wall.
- c. Must have core system as vertical circulation.
- d. Recommended deep foundation, basement and podium as building stability.
- e. The shape of the high rise building is usually like a needle, the higher the tapered because it is influenced by a lateral load that is greater if the higher.
- f. Fassad plays an important role in dealing with lateral loads such as wind and also sunlight.
- g. Using frame tube with column coated lightweight concrete.
- h. System and number of elevator is distinguished between height zoning and function.⁽⁴⁾

2.4 DEFINITION OF STRUCTURE

Building Structure means the foundations, floor/ceiling slabs, roofs, exterior walls, exterior glass and mullions, columns, beams, shafts (including elevator shafts), stairs, stairwells, elevators, Building mechanical, electrical and telephone closets, Common Areas, public areas, and any other structural components in the Building. The Building Structure excludes the Leasehold Improvements (and similar improvements to other premises) and the Mechanical Systems.⁽⁵⁾

⁽⁴⁾ Diesel, Tim. (2020). Low, Mid, and High Rise Buildings Classified. Available in : <https://dieselcommercialgroup.com/how-are-low-mid-and-high-rise-buildings-classified/> . accessed on date May 30, 2022. At 06.00 A.M.

⁽⁵⁾ Law Insider. Building Structure . Link : <https://www.lawinsider.com/dictionary/> . accessed on date May 30, 2022. At 06.20 P.M

According to Scodek (1998) the definition of structure in the context of its relation to buildings is as a means of distributing load and due to its use or the existence of buildings into the ground.

Component of structure divided into 2 parts, namely :

2.4.1 Upper Structure

In a building is all parts of the structure that are above ground level (SNI:2002). The upper structure consists of roofs, columns, slab, beams, shear walls and stairs which each have a very important role. In general, the upper part of the structure used for buildings is as follows:

1. Roof

The roof is the cover of the building above or the object used to close the building. Thus, the roof can be interpreted as a structure located at the very top of a building and useful to cover the structure underneath.

The main function of the roof to protect the house from changes in weather is good heat, rain, snow, lightning, wind, dust, and so on. The roof also has a protective function to cover the space below, withstand excessive heat radiation, prevent rain, and reduce wind movement. In its development, the roof also has an important role in influencing the aesthetics of a building.

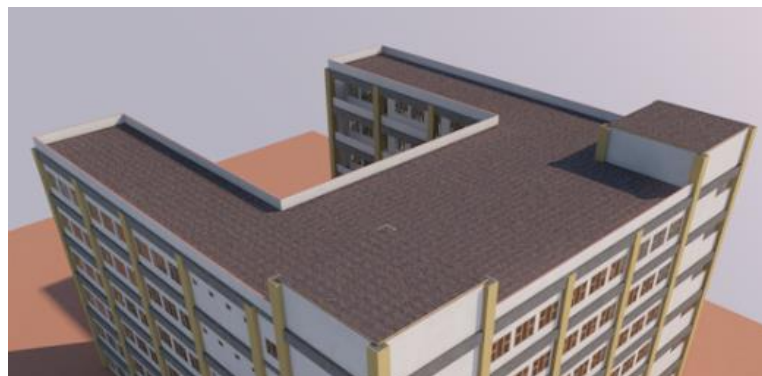


Figure 2.1 Rooftop

2. Slab

Slab is a floor that is not directly above the ground, so the floor is parallel. Slabs are supported by blocks resting on the columns of buildings.

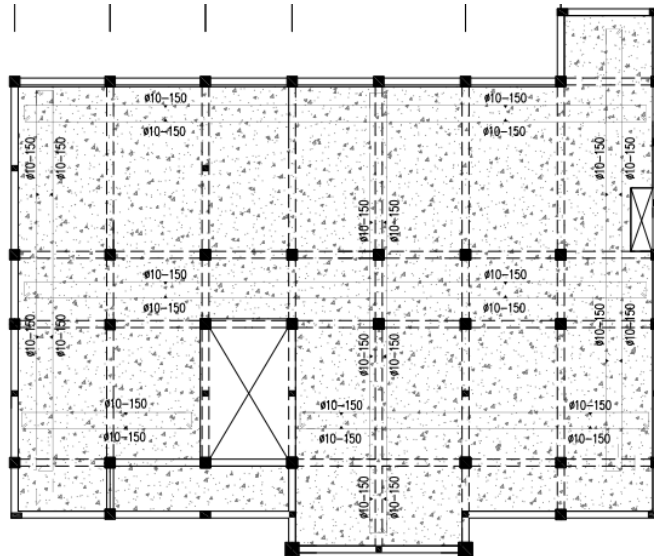


Figure 2.2 Example Plan of slab

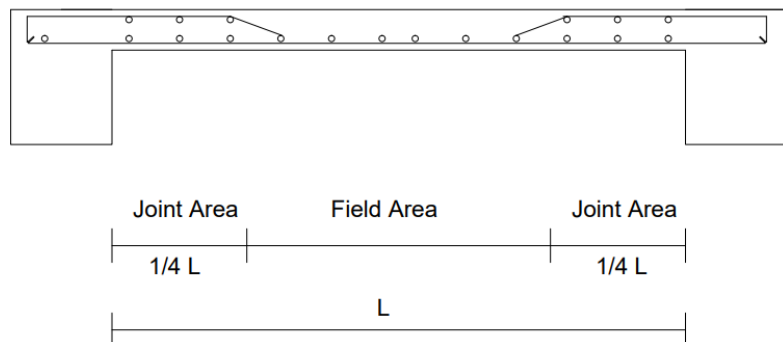


Figure 2.3 Reinforced of slab