

PUSHOVER STUDY ANALYSIS OF PGRI FACULTY OF ENGINEERING BUILDING

Dwi Kurniati ^{*, a,1} Pilipus Bali Loko ^{a,2}

^a Program Studi Teknik Sipil, Fakultas Sains dan Teknologi, Universitas Teknologi Yogyakarta

¹ dwiikurniatii@gmail.com*

Abstract

The Faculty of Engineering Faculty of Engineering Building of PGRI Yogyakarta (UPY) is planning to be on medium ground, with a height of 7 floors functioned as a lecture hall. This building needs to be simulated the thrust of the earthquake load, in order to know the performance of the building. The purpose of this research is to want to know the performance value of point direction x and direction y and performance level based on ATC 40 from upy engineering faculty building. Research method with the help of Etabs v16 software, in accordance with the guidelines of the National Standardization Agency namely SNI 1726-2012 and SNI 2847-2013. The results of the study obtained a performance point value for push x 0.004 and push y of 0.003. As well as the level of performance is Immediate Occupancy (IO) which can be interpreted that in the event of an earthquake the structure is able to withstand an earthquake, the building does not suffer structural and non structural damage so that the building can be directly reused.

Keywords: Immediate Occupancy, Performance Point, Pushover.

I. INTRODUCTION

Special Region of Yogyakarta has the designation as a student city, a city with more than a hundred universities and universities PGRI. PGRI University Yogyakarta (UPY) located in Jalan IKIP PGRI I Sonosewu No.117, Sonosewu, Ngestiharjo, Kasihan District, Bantul Regency, Special Region of Yogyakarta 55182. Along with the development of UPY era also equips itself with various campus facilities, among others with the establishment of engineering faculty building. This engineering faculty building is a seven-storey lecture building designed with strength, good material, solid building shape, making it possible to conduct pushover evaluation on this building.

Indonesia is known as the supermarket disaster because Indonesia has various types of disasters, this is driven because Indonesia is at the meeting of four main tectonic plates namely the Eurasian plate, Indo-Australia, Pacific, and Philippines this is often called the Ring of Fire. This location at the meeting of the world's great plates makes Indonesia rich in minerals and fertile soil. Not only that, Indonesia is also every day shaken by earthquakes ranging from 1 SR to 5 SR [1].

The growth of technology that demands a lot of innovation spurred the creation of an earthquake [2] load analysis simulated in a piece of software structure one of them Software Etabs. This software analyzes the shape of the melting of buildings if pushed with the earthquake load of the plan affected by the dead load, and the burden of life that exists on the building of the UPY faculty of engineering. This analysis was conducted to find out how the performance level of UPY faculty building performance in the event of an

earthquake, whether the structure of this building still stands strong and strong or even experienced collas how much performance point value in the direction x and direction y.

Condotel building is one of the public facilities that must be considered both in terms of safety and comfort. Various forms of condotel buildings are designed in such a way that it looks artistic so that it attracts a jumper to stay. The special area of Yogyakarta in the last ten years began to crowded the construction of many multi-storey buildings including apartments, hotels, condotels, even malls. Located in the location of the moderate earthquake area, then Awana Condotel Yogyakarta became the object of the investigation this time. Various regulations related to building safety have been issued by the government, this is to ensure the quality of both the quality and quantity of the building. The purpose of this study is to evaluate the performance of earthquake prisoners of Awana Condotel Yogyakarta building both from the x direction and the direction y, the second is how the pattern of collapse occurs. The method used is pushover analysis with the help of SAP 2000v.14 software [3] to calculate performance based design based on Applied Technology Council (ATC – 40) regulations [4]. Based on the results of the analysis, the performance point value for direction x and direction y is 0.002. The results of performance based design evaluation show that, Awana Condotel Yogyakarta building is included in IO performance, that is, in the event of an earthquake then the structural elements of the earthquake building remain standing koko, and non-structures also do not suffer damage, so that the building can be directly reused for activity [5].

Pushover analysis is a non-linear static analysis to determine the collapse behavior of a building or

structure [6]. The analysis is carried out by giving a static lateral load pattern to the structure, which is then gradually increased by a multiplier until a building movement target is reached. This final assignment research was conducted to determine the performance point based on ATC-40, to determine the performance level based on ATC-40 [7], and to determine the performance level based on FEMA 356. The research method used the response spectrum with the SAP2000 v14 program. The result of the performance point in building with the values of $S_a = 0,737$, and $S_d = 0,200$ for the push X, while the values of push Y $S_a = 0,680$, and $S_d = 0,225$. The calculation of ATC-40 in building shows the value of the drift ratio in the X direction 0,01165 and the drift ratio Y direction 0,0127 at the level of performance Immediate Occupancy (IO). The result of FEMA 356 calculation in building shows the value of the lateral displacement target structure of the X direction structure = 0,00437 (0,437 %), and the value of the lateral displacement target of the Y direction structure = 0,006 (0,6 %) and at the level of performance Immediate Occupancy (IO). Then it could be concluded that The Dental & Mouth Hospital of UGM Prof. Soedomo, was at the level of performance Immediate Occupancy (IO), meaning that the building was still safe and could be reused after the earthquake and don't occurred serious damage [8].

II. METHOD

The methodology in this study is to analyze the push force of earthquake load plan on the building object [9] of PGRI engineering faculty with the help of Etabs v16 software (Figure 1). The object of this research building is a building with 7 floors.

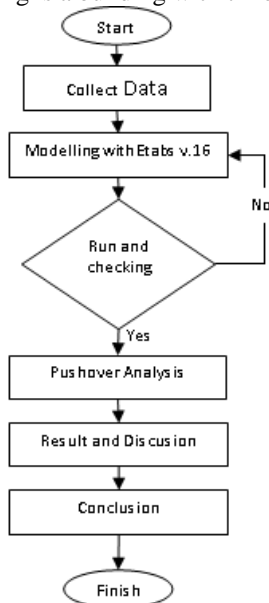


Figure 1. Research Flow Chart

III. RESULTS AND DISCUSSION

Capacity Curve and plastic joint sedation scheme can be seen in Figure 2 and 3.

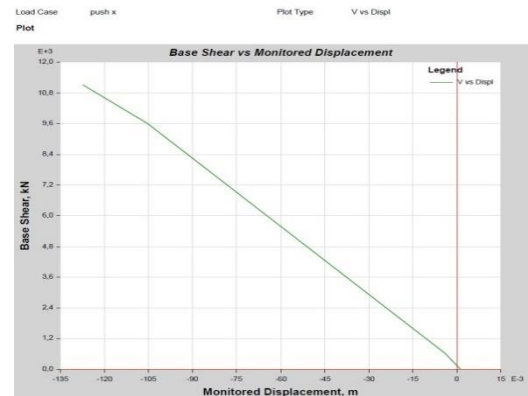


Figure 2. Capacity Curve Push X (Source: Etabs v16, 2020)

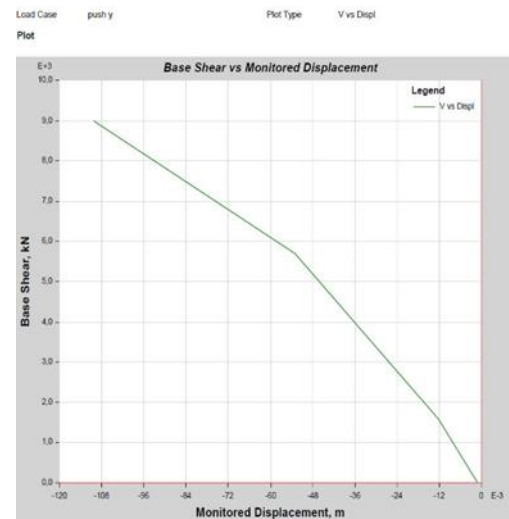


Figure 3. Capacity Curve arah Y (Source: Etabs v16, 2020)

Based on the calculation of pushover analysis of the maximum lateral force that is able to be held by the structure of 11115.2775 kN that occurs in step 3, with displacement of 0.127 m in the direction of X. Lateral force capable of being held for Y direction of 8989.3338 kN occurs at step 3, with a displacement of 0.110 m. Plastic joints are planned to fit the mechanism, the Beam Sway Mechanism (Strong Column Weak Beam). Which means that the column must be stronger than the beam, so that when an earthquake force occurs, the building does not immediately experience maximum collapse. Based on the response spectrum curve plan of the 2019 earthquake map for Yogyakarta region with moderate ground conditions for values $S_s = 1$ and $S_1 = 0.36$ as pushover analysis input in ADRS format (acceleration- displacement spectrum response) obtained values $C_a = 0.0938$ and $C_v = 0.3791$ for push X, while the push Y value for $C_a = 0.1022$ and $C_v = 0.2892$.

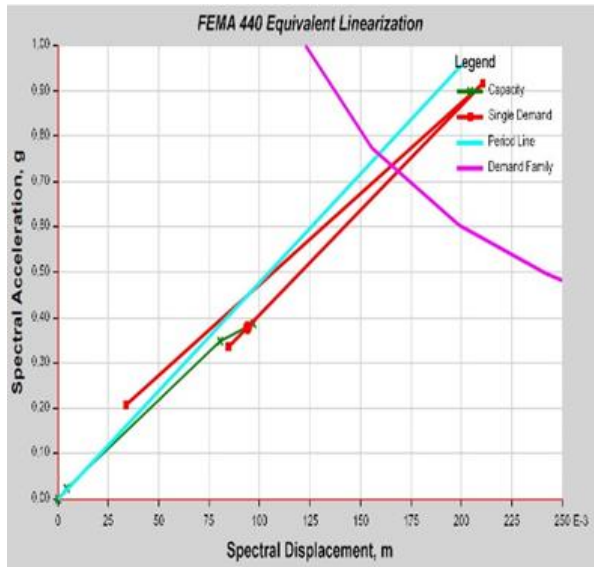


Figure 4. Response Spektrum Arah X (Source: Etabs v16, 2020)

Performance Point Push X values:

1. $V = 10822,467$
2. $D = -0.123$
3. $Sa = 0.3791$
4. $Sd = 0.093819$
5. $T_{eff} = 0.997$
6. $B_{eff} = 0.65$

TABLE I. PERFORMANCE POINT OF X AND Y

Value	Based Shear (kN)	Performance Point			
		V_t (kN)	D_t	B_{eff} (%)	T_{eff}
X	948,877	10822,467	0,123	6,4	0,997
Y	948,877	7465,043	0,086	6,5	1,164

(Source: Etabs v16, 2020)

Perform of the Faculty of Engineering Lecture Building of PGRI University Yogyakarta is included in the performance level of Immediate Occupancy (IO), the drift ratio limit on Immediate Occupancy (IO) is 0.005 greater than the maximum total drift value and Maximum inelastic drift for direction X and direction Y (shown in TABEL I). It can be concluded that if an earthquake occurs, the structure is able to withstand the earthquake, the structural elements and non-structural elements are not damaged, so that the building can be immediately reused.

IV. CONCLUSION

From the processing of the data obtained the following conclusion: 1.the level of performance obtained is Immediate Occupancy (IO), which means the structural elements and non-structural elements do not suffer damage so that the building of the UPY technical faculty can be directly reused.2.The results of pushover analysis with ETABS.v.16 software for push X with a base shear force of 948,877 kN were obtained as a result of structure performance (Performance

Point) with a shear force of 10822,467 kN, displacement (D_t) 0.123 m, effective damping (B_{eff}) 6.5% and effective time (T_{eff}) 0.997sec. Analysis results for 948,877 kN of basic shear force were obtained by performance points with a shear force of 7465,043 kN, displacement (D_t) of 0.086 m, effective damping (B_{eff}) of 6.4% and effective time (T_{eff}) of 1.164 seconds.

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