PAPER NAME

Evaluation.pdf

AUTHOR

edi indera

WORD COUNT

3433 Words

CHARACTER COUNT

15349 Characters

PAGE COUNT

9 Pages

FILE SIZE

927.7KB

SUBMISSION DATE

Oct 27, 2022 10:17 PM GMT+7

REPORT DATE

Oct 27, 2022 10:18 PM GMT+7

19% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

- 12% Internet database
- Crossref database
- 9% Submitted Works database
- 9% Publications database
- Crossref Posted Content database

Excluded from Similarity Report

- Manually excluded sources

Evaluation Of Structure Performance On Store Building With Spectrum Response Analysed Based On Etabs Software v.2013 Hotel Harris Batam Center

Edi Indra[1], Januarto[2], Reinold Palit[3]
[1,2,3] *Faculty of Engineering, Universitas Batam, Uniba Street No 5, Batam City, Indonesia*

ABSTRACT

Indonesia isearthquake-prone countries with different levels of seismic activity in each region. The earthquake area in Indonesia is divided into 6 (six) earthquake zones according to SNI– 1726 - 2002. Batam is included in the regionzone 1 (one) with a low level of seismicity, the high-rise building structure is planned for earthquakes that have been regulated in SNI 03-1726-2002 and SNI 03-2847-2002. Therefore, this study discusses the design of earthquake load-bearing structures with ordinary moment resisting frame systems with the aim of getting the best structural system in terms of strength, stiffness, durability and structural economy in high-rise buildings. The design of the building structure used the 2013 ETABS program with the adjustment of the strength parameters of the material used. Quality of concrete (f'c = 30MPa) & quality of reinforcing steel (fy=400MPa). From the structural design analysis, it is found that the stiffness.

Keyword: *Earthquake 2013 ETABS, Performance of Ordinary Moment Resistant Frame Structures and Systems*

1. INTRODUCTION

Indonesia is the largest archipelagic country in the world compared to other archipelagic countries which consist of 13,487 islands and has an area of 1,904,569 km². And geographically, Indonesia is located between two oceans, namely the Pacific Ocean and the Indian Ocean, and two continents, namely the Asian continent and the Australian continent. In addition, Indonesia is also located on three tectonic plates, including the Pacific plate, the Eurasian plate, and the Indo-Australian plate. The existence of these plates results in tectonic and volcanic activities so most of Indonesia is prone to earthquakes.

An earthquake is a vibration or movement that occurs on the earth's surface due to the sudden release of energy from within. There will be vibrations called seismic waves when this shift occurs and causes damage to building structures and casualties if these waves propagate in all directions away from the epicenter. In Indonesia, earthquakes often occur which result in very large damage and losses, therefore it is necessary to develop an earthquake analysis of the structure.

Several methods are often used in earthquake calculations including, Equivalent static analysis, a method of structural analysis in which the effect of an earthquake on the structure is considered as a horizontal static load obtained by only takes into account the response of the first variety of vibrations. Dynamic analysis is a structural analysis in which the distribution of seismic shear forces across levels is obtained by taking into account the dynamic influence of soil motion on the structure. Dynamic analysis is divided into 2, namely. Analysis of the spectrum response variance where the total response is obtained through the superposition of the responses of each type of vibration. Time history analysis is a dynamic analysis where the structural model is given a record of earthquake records and the response of the structure is calculated step by step at certain intervals. According to Widodo (2001), time history analysis is the closest method for predicting the parameter response of structures due to earthquakes. However, performing a time history analysis, takes a lot of calculations and takes a long time.

2. RESEARCH METHOD

2.1. Flow Chart System.

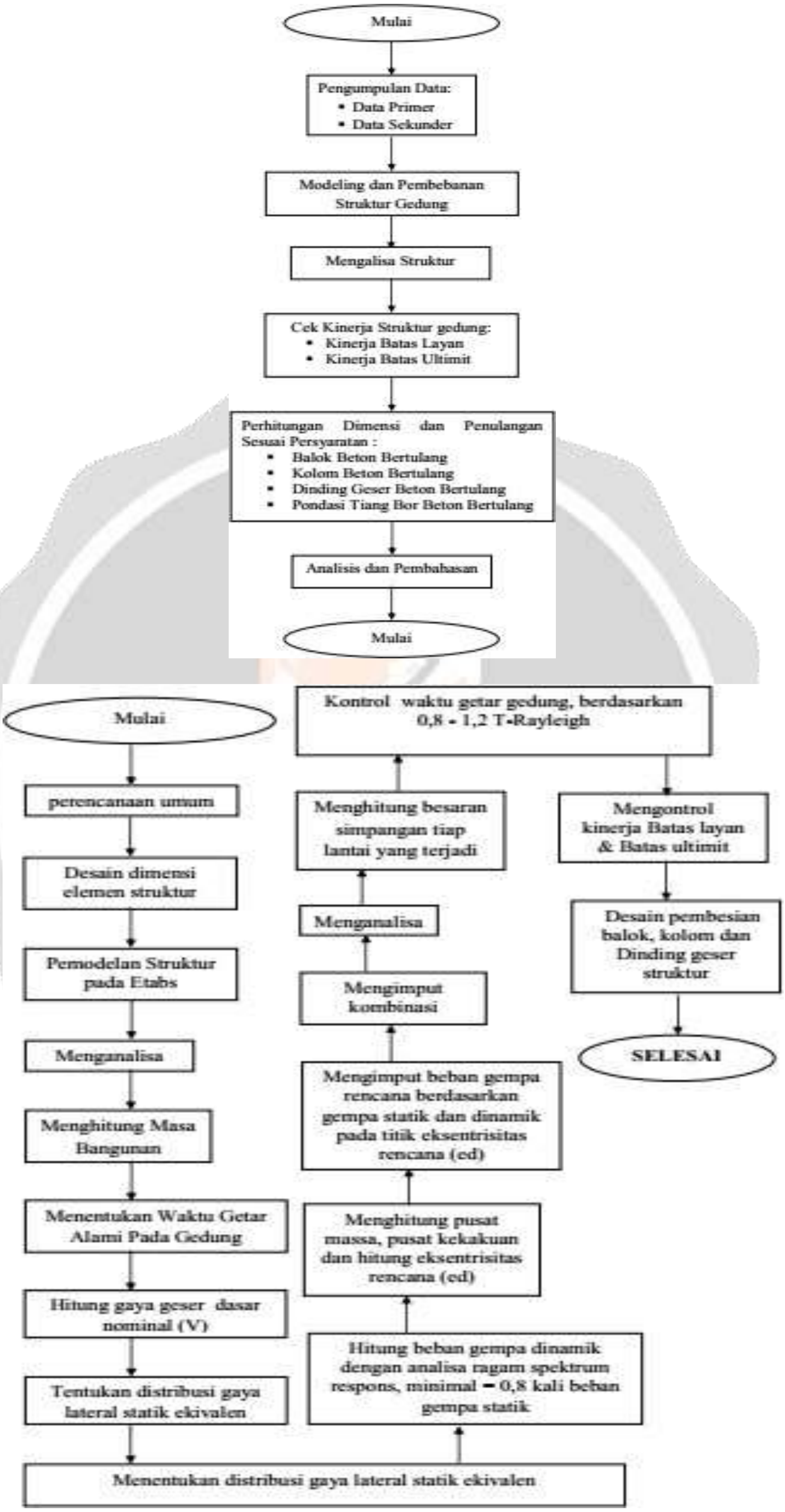


Figure 1. Research flow chart

2.2. PLANNING DATA

Planning location : Batam City - Indonesia
Earthquake area : Earthquake Region 1 (Low Seismic Risk)
Type of soil : Medium ground Building function: Hotel
Number of floors : Basement + 10 Floors + Dak Roof
Total height : 36,630 Meters
Structure type : Reinforced concrete
Structural system : Ordinary Moment Resistant Frame System (SRPMB)
Beam Length : L1 = 7.6 m 6.5 m
Column Height :

Basement Floor	: 3.20 m
1st floor	: 6.00 m
2nd floor to 10th floor	: 3.20 m
Rooftop	: 3.43 m
Basement Lt Plate Thickness	: 0.20m
Lt Plate Thickness 1 to 10	: 0.12m
Roof plate thickness	: 0.10m

2.3. Structural Material Quality

Reinforced concrete structures have two materials that have different properties, namely concrete and reinforcing steel. In this planning the quality of the material is selected based on the provisions stipulated in SNI 03–2847–2002, namely:

- Concrete quality (f'c) = 30 MPa (minimum 20 MPa for earthquake resistant design)
- Steel quality (fy) = 400 MPa (Based on SNI–2847-2002)

2.4. Beam Dimensioning

The dimensions of the main beam that carry the load due to the earthquake have the following requirements:

The height of the beam depends on the stretch, namely:

h= ln/12= 7.6m/12=0.633m 0.7m=700 mm The ratio of the width and height of the beam is required not to be less than 0.3 and the width is not less than 250mm or 0.25m.

b/h≥0.3 b=hx 0.3=0.7m x 0.3=0.21 m Because the result of the beam width in the calculation does not reach 0.25 m, the width of the beam is taken as 300 mm or 0, 3 m to avoid beams that are too thin anticipating shear and torsion hazards that occur. So that the requirements for the ratio of width and height as well as the minimum width of the beam are met.

The dimensions of the sub-beams that function as stiffeners for the main portal as well as load dividers from the slab to the main-port where the sub-beams are considered to be beams with two simple supports to the main beam. So the dimensions of the children's beams are as follows:

The height of the beam depends on the stretch, namely:

h= ln/16= 7,6m/16=0,475m 0,5=500mm The ratio of width and height of the beam is taken as 0.5 from the height (h), then the width of the child beam is:

b = 1/2 h bw 2/3 h 1/2 h = 1/2 x 0.5 = 0.25

2/3 h = 2/3 x 0.5 = 0.333 ………… 0.25 b

0.333

Take the width of the beam (b) = 0.3m = 300mm

2.5. Column Dimensioning

The initial column dimensions are assumed through dead load and live load approaches that work with a tributary area, so that the approximate dimensions of the column dimensions on the ground floor are obtained. Because the spans between columns vary, one column can be considered as a limitation the maximum size of the column to be used, which has the largest tributary area and is considered the heaviest working load. Then the calculation of the working load is described as follows:

Dead Load
Basement Floor Plate Weight up to 1
= 7.6m x 6.5m xhx c
= 49.5m2 x 0.20m x 2400 kg/m3 = 23712 kg Weight of Floor Slabs 1 to 10th Floor
= 7.5m x 6.5m xhx c
= 49.5m2 x 0.12m x 2400 kg/m3 = 14256 kg Weight of Dak Roof Plate
= 7.5m x 6.5m xhx c
= 49.5m2 x 0.10m x 2400 kg/m3 = 11880 kg Total Weight
= (23712kg) + (10 x 14256 kg) + 11880kg
= 178152 kg
Finishing Weight + Hanger:
1st floor to 10th floor
= 10 (7.5m x 6.5m x 125 kg/m2)
= 10 (6093.75kg) = 60937.5 kg
Dak Roof
= 7.5m x 6.5m x 38 kg/m2 = 1852.5 kg
Total Weight = 60937.5 kg + 1852.5 kg = 62790 kg Wall Weight (cellcon10)
= Height x Length x Weight per m2
= 2.5m x 7.5m x 115 kg/m2 = 2156.25 kg
Total Weight = 10 Floors x 2156.25 kg = 21562.5 kg Total Weight Dead Load
= 178152 kg + 62790 kg + 21562.5 kg
= 262504.5 kg
Live Load
Basement floor (parking)
= 7.5m x 6.5m x 400 kg/m2 = 19500 kg Floor 1 to Floor 10
= 10 (7.5m x 6.5m x 250 kg/m2)
= 10 (12187.5 kg) = 121875 kg
Roof Dak = 7.5m x 6.5m x 100 kg/m2 = 4875 kg Total Weight Live Load
= 19500 kg + 121875 kg + 4875 kg = 146250 kg
Factored load
= 1.2 DL + 1.6 LL
= 1.2 (262504.5 kg) + 1.6 (146250 kg)
= 315005.4 kg + 234000 kg = 549005.4 kg

The stress that occurs in the middle column on the ground floor is taken based on the quality of the concrete used at fc' = 30Mpa, but the amount of allowable stress (stress that the concrete can bear) must be considered to experience a decrease in quality by taking the concrete strength of 40% to 40%.
60%. Then take a reduction of 50%, so f'c = 30MPa x 0.5 = 15 MPa.
=P/A ⇔ A=P/σ
A=(549005.4 kg)/(15 x 0.102 kg/mm2)
=358827.05 mm2

Columns are required to have a minimum width of 300mm, but with consideration of the required column cross-sectional area the results of the above calculation. Then use a column width of 600mm so that the required length (h) of the column is:
A=bxh (↔) h= A/b
h= 358827.05mm2 / 600mm h= 600mm 900mm
So the dimensions of the columns used on the ground floor are width (b) 600mm and length (h) 900mm.
The loads acting on the structure consist of live loads and dead loads. Dead load is the structure's own weight and additional dead load. The self-weight of the structure is calculated automatically by the program while

the additional dead load is inputted to the floor slab. The additional live and dead loads that are calculated are as follows:

Live load : 250 kg/m2 (hotel function)

Additional slab dead load: 120 kg/m2 (screed and mechanical load)

Architectural wall load : 115 kg/m2 (cellcon10 wall)

3. EQUIVALENT STATIC EARTHQUAKE ANALYSIS

3.1. Building Weight Calculation

The total weight of the building (Wt) due to its own weight can automatically be calculated by ETABS which produces the weight of the building for each floor and the total weight of the building. By Display – Show Table – Building Data – Group – Table : Group Masses And Weights

Table 4.1. Building Weight and Mass Each Floor

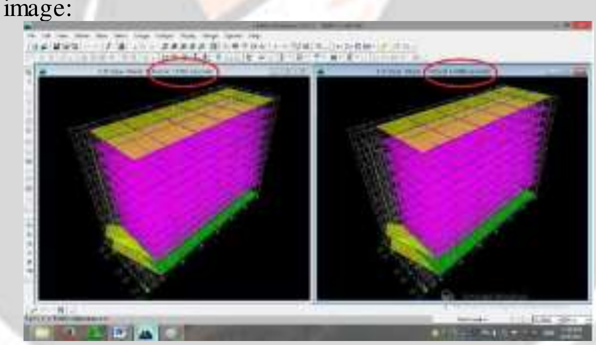
Floor	Weight (kg)
BASEMENT	647419.297
STORY 1	690559.154
STORY 2	534031.541
STORY 3	534031.541
STORY 4	534031.541
STORY 5	534031.541

3.2. Natural Shake Time

From the results of ETABS analysis, the natural vibration time of the structure in the direction of x = 1.5762 and direction of y = 1.4988.

By means of Analyze - Run Analyze – Display – *Show Mode Shapes.*

As shown in the following image:



Figures 2. *Structure Natural Vibration Time*

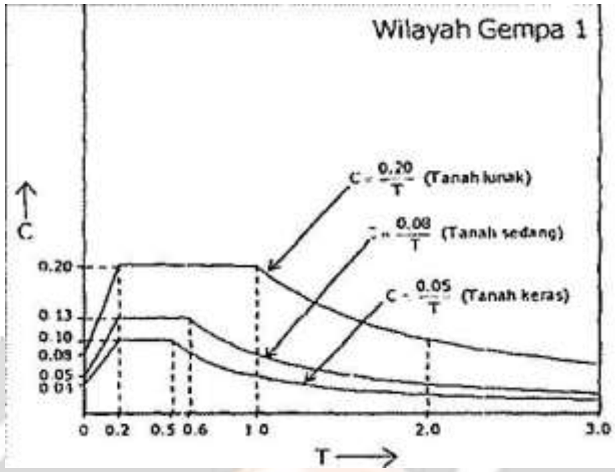
In Article 5.6 of SNI Earthquake, it is stated that the time of the fundamental natural vibration must be limited to prevent the use of a building structure that is too flexible with the requirements of T1 <, where n is the number of floors and the coefficient depends on the earthquake zone.

Tables 2.Coefficient which limits the fundamental natural vibration time of the building structure

Wilayah Gempa	ς
1	0,20
2	0,19
3	0,18
4	0,17
5	0,16
6	0,15

The location of the building is in zone 1, then = 0.20 Then T1 < xn
1.5762 < 0.20 x 11
1.5762< 2.2 OK →

The value of the earthquake response factor based on the earthquake area and soil type is determined as follows:



Figures 3. Image of SNI regulations for earthquake areas

Because the vibration time of the structure for the X and Y directions is different, the value of the earthquake response factor is also different.

- Earthquake direction X (Mode 1), T1 = 1.5762 seconds C1 = 0.20/1.5762 = 0.1269
- Y direction earthquake (Mode 2), T1 = 1.4988 seconds C1 = 0.20/1.4988 = 0.1334

3.3. Nominal Slide Style

The magnitude of the basic shear force due to static loads is calculated using the following equation:

V= (C .I)/R Wt

The magnitude of the nominal shear force due to the weight of the building, the function of the building, and the earthquake area is calculated using the following equation:

Vx = (C .I)/R Wt
Vx = ((0,1269)(1))/3.5 x 6117736.252 Vx = 221811.64 tons
Vy = (C .I)/R Wt
Vy = ((0,1334)(1))/3.5 x 6117736.252 Vy = 233173.15 tons

The magnitude of the earthquake shear force coefficient for the X and Y directions can be calculated as follows:

Direction X = C1 x I/R = 0.1269 x 1/8.5 = 0.0149 Direction Y = C2 x I/R = 0.1334 x 1/8.5 = 0.0157

3.4. Plan Eccentricity (ed)

The magnitude of the eccentricity is influenced by the center of mass and the center of rigidity of the structure. If the center of mass and the center of stiffness are in unequal coordinates, then there is eccentricity, so it is necessary to review article 5.4.3 of the Standard for Earthquake Resistance Planning for Buildings, SNI 03 – 1726 – 2002 regarding the eccentricity between center of mass and center of rotation to obtain the design eccentricity.

1). For e < 0.3 b, the formula is used:
ed =1.5e + 0.05b or ed = e – 0.05b 2). For e > 0.3 b, the formula is used:
ed =1.33e + 0.1b or ed = 1.17e – 0.1b The center of mass and the center of stiffness are determined using the ETABS program, by means of Display – Print Table – Analysis Results – Building Output – Center Mass Rigidity. So that the results of the ETABS output are then processed and can be seen as follows:

***Table.3**. Center of mass and center of stiffness*

story	center of mass		Center of Rotation		Eccentricity	
	X	Y	X	Y	X	Y
BASE	26.037	8,291	24,568	8,372	1.469	-0.081

1	25,947	8,303	24,831	8,274	1.116	0.029
2	27,198	8075	24,961	8,246	2.237	-0.171
3	27,198	8075	25,362	8,214	1,836	-0.139
4	27,198	8075	25,678	8.189	1.52	-0.114
5	27,198	8075	25,907	8.171	1,291	-0.096
6	27,198	8075	26.077	8.157	1.121	-0.082
7	27,198	8075	26,206	8.146	0.992	-0.071
8	27,198	8075	26,308	8.138	0.89	-0.063
9	27,197	8075	26,392	8.13	0.805	-0.055
10	27,203	8075	26,472	8.124	0.731	-0.049

3.5. Structure Performance Analysis

1. Service Limit Performance (s)

Based on SNI-03-1726-2002 Article 8.1.2, to meet the requirements, s deviation between levels should not be greater than:

s 0.03/R x hi (High level)

or 30 mm (chosen the smallest)

To find the magnitude of the deviation, the results of the ETABS analysis are used, namely by Analyze – Run Analyze – Display – Show Story Response Plots .

s roof = deviation of the roof floor – the deviation of the floor below it

= 16.48 – 15.93 = 0.55 mm

3.6. Ultimate Limit Performance (Δm)

Based on SNI-03-1726-2002 Article 8.2.2, the deviation and deviation between stories must be calculated from the deviation of the building structure due to loadingnominal earthquake, multiplied by a factor as follows:

m = sx multiplier factor

For a regular building structure = 0.7 R

Condition : m 0.02 x level height

m roof = s roof x 0.7R

= 0.55 x 0.7 x 3.5 = 1.35 mm

4. DESIGN OF STRUCTURAL COMPONENTS OF ORIGINAL MOMENT RESISTING FRAME SYSTEMS

Plate Planning

a. Determining the Plate Thickness

Length of span Ix = 7600 mm Length of span Iy = 6500 mm

Height of beam (h) = 700 mm

beam width (b) = 300 mm

Plate thickness (h) = 120 mm

Ix/Iy = 7600/6500 = 1.17 < 2 (Two-way plate) So the type of plate is a two-way plate. m = (E_cb I_b)/(E_cs I_s)

=(4700√30x1/12 x 300 x 700²)/ (4700√30 x 1/12 x 7600 x 120²)

= 1.34 > 0.2 but < 2

Based on SNI-03-2847-2002 for am greater than 0.2 but not more than 2.0, thickness plate minimum mustmeet : h=(ln⬚(0,8+f_y/1500))/(36+5β(am-0.2))

and must not be less than 120 mm h=(7300⬚(0.8+240/1500))/(36+5x1(1.34- 0.2))

= 129 mm

A plate thickness of 120 mm is used.

b. Calculating the Effective Height of the Plate (d)

Main reinforcement is used 10 d = h – ts – 0,5D

= 120 – 20 – 5 = 95 mm

c. Floor Plate Loading

The types of loads acting on the floor slabs are dead loads and live loads with the following calculations:
Dead load (DL)

- Plate self weight
= 0.12 x 2400 = 288 kg/m2
- Plaster (2.5 cm)
= 0.025 x 1600 = 40 kg/m2
- Ceramic (1 cm)
= 0.01 x 2200 = 22 kg/m2
- M/E Installation
= 25 kg/m2
- Ceiling and hanging = 18 kg/m2

Total dead load on floor slab = 393 kg/m2 Live Load (LL) = 250 kg/m2 Planned Load (qu)
= 1.2DL + 1.6LL
= (1,2x393) + (1,6x250) = 871.6 kg/m2

d. Finding the Moment Value

plate weight
qD = 0.12.2400 = 288 kg/m2
Load need
qu = 1.2.qD + 1.6.qL
= (1.2 x 399)+ (1.6 x 250) = 871.6 kgm
Fully clamped plate support condition, Iy/Ix = 7.6/6.5 = 1
From the plate table (PBI-1971) it is obtained
CIx = 25, CIy = 21, Ctx = 59 and Cty = 54. Moments need:
MIx(+) = 0.001.CIx.qu.Ix2
= 0.001 x 25 x 871.6 x 7.62 = 1258.59 kgm MIy(+) = 0.001.CIy.qu.Ix2
= 0.001 x 21 x 871.6 x 7.62 = 1057.21 kgm
Mtx(-) = 0.001.Ctx.qu.Ix2
= 0.001 x 59 x 871.6 x 7.62 = 2970.27 kgm
Mty(-) = 0.001.Cty.qu.Ix2
= 0.001 x 54 x 871.6 x 7.62 = 2718.55 kgm

e. Plate reinforcement

Reinforcement area:
US
=(1/4.π.D^2.S)/s=(1/4.π.6^2.1000)/115=245.864
mm〗^2 >A_(sb,u) (OK) So use :
principal reinforcement As = D10-70 = 1121.43 mm2 reinforcement for Asb = D6-115 = 245.864 mm2

5. CONCLUSION

Based on the results of the analysis and planning that has been carried out, several conclusions are obtained regarding the planning of industrial buildings (workshops) that carry crane loads as follows:

1. The stresses and deflections that occur in the runway beams are less than the allowable stresses and deflections by using a combination of WF and Channel profiles.
2. The analysis of runway beams which are considered as continuous beams actually results in a more economical design, but the application in the field with perfectly clamped position conditions is still not convincing so that considerations of safety take precedence over economic considerations.
3. The shock coefficient contained in the 1984 Indonesian Steel Building Planning Regulations should be included in the calculation because it has a large enough value, namely an increase in moment of 15%, from the initial value of 34.15tm to 39.27tm.

6. REFERENCES

Agus Setiawan, 2008, Steel Structure Planning with LRFD Method (Based on SNI 03-1729-2002), Erlangga, Jakarta.

Joseph E. Bowles, 1985, Structural Steel Design, Erlangga, Jakarta.

Salmon Charles G, and Johnson John E, 1994, Steel Structure Design and Behavior 1, PT. Gramedia Pustaka Utama, Jakarta.

S. Aryza,, Irwanto, M., Lubis, Z., Siahaan, A. P. U., Rahim, R., & Furqan, M. (2018). A Novelty Design Of Minimization Of Electrical Losses In A Vector Controlled Induction Machine Drive. In IOP Conference Series: Materials Science and Engineering (Vol. 300, No. 1, p. 012067). IOP Publishing.

Salmon Charles G, and Johnson John E, 1994, Steel Structure Design and Behavior 2, PT. Gramedia Pustaka Utama, Jakarta.

SNI 03-1729-2002, Procedures for Designing Steel Structures for Buildings, Ministry of Public Works.

SNI-03-2847-2002, Procedure for Calculation of Concrete Structures for Buildings, Ministry of Public Works.

Ir. Oentoeng, 2000, Steel Construction, LPPM Petra Christian University Surabaya and ANDI.

19% Overall Similarity

Top sources found in the following databases:

- 12% Internet database
- 9% Publications database
- Crossref database
- Crossref Posted Content database
- 9% Submitted Works database

TOP SOURCES

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Yenny Nurchasanah, Muchammad Lextito Harnadi. "Assessment of Vis...	Crossref	2%
2	media.neliti.com	Internet	2%
3	VIT University on 2019-03-12	Submitted works	2%
4	garuda.kemdikbud.go.id	Internet	2%
5	Universitas International Batam on 2019-03-22	Submitted works	2%
6	ijmr.net.in	Internet	1%
7	knepublishing.com	Internet	1%
8	scribd.com	Internet	<1%

9	T Rochman, N Rasidi, S Sumardi, F Purnomo. "A new form of steel bas... Crossref	<1%
10	wahyuseptiadi919.wordpress.com Internet	<1%
11	Wahyu Mahendra Trias Atmadja, Herman Parung, Rita Irmawaty, A.Arw... Crossref	<1%
12	University of Melbourne on 2014-09-03 Submitted works	<1%
13	Texas A&M University, College Station on 2009-04-29 Submitted works	<1%
14	civilenglineering.files.wordpress.com Internet	<1%
15	University of Bradford on 2012-09-12 Submitted works	<1%
16	ajer.org Internet	<1%
17	eprints.polsri.ac.id Internet	<1%
18	soil-water.com Internet	<1%
19	Tena-Colunga, A.. "Dynamic torsional amplifications of base-isolated s... Crossref	<1%
20	repository.its.ac.id Internet	<1%

21	scholar.ppu.edu Internet	<1%
22	Universitas International Batam on 2018-03-13 Submitted works	<1%
23	A P. U. Siahaan, Nogar Silitonga, Muhammad Iqbal, Solly Aryza et al. "A... Crossref	<1%
24	jurnal.unissula.ac.id Internet	<1%
25	University of Hertfordshire on 2010-05-26 Submitted works	<1%

Excluded from Similarity Report

- Manually excluded sources

EXCLUDED SOURCES

ijariie.com Internet	95%