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Calculation of Foundation Structure and Design Planning of The Building of The Faculty of Civil Engineering and Planning, Gunung Jati University, Cirebon

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ABSTRACT
Education is a crucial aspect of life, and the quality of educational infrastructure significantly impacts learning outcomes. In Indonesia, the need for well-planned educational facilities, especially in engineering faculties, is underscored by the country's ranking as the sixth-largest producer of top-tier engineering graduates globally. This study focuses on the Faculty of Civil Engineering and Planning at Gunung Jati University, Cirebon, West Java, aiming to address the gap in seismic-resistant building design for educational institutions in high-seismic-activity regions. The study aims to design a structurally sound and earthquake-resistant building for the faculty, adhering to national standards (SNI 1726:2019, SNI 1727:2013, and SNI 2847:2019) and utilizing local seismic data to ensure safety and efficiency. The research employs a quantitative approach, integrating structural analysis and design methodologies. Primary data include soil tests and seismic spectrum responses from Sunyaragi, Cirebon, while secondary data comprise national building codes and material specifications (concrete: 30 MPa, steel: 420 MPa). Structural calculations were performed manually and validated using software (e.g., SAP2000/ETABS), focusing on load combinations, foundation design (4 m deep bored piles), and seismic resistance (SRPMK method). The design outcomes include four types of bored pile foundations (40 cm diameter, 80 cm pile cap thickness) with D19 and Ø12 reinforcements. The structural elements, such as tie beams (250x400 mm) and main beams (350x700 mm), were detailed using AutoCAD, ensuring compliance with safety standards. The analysis confirmed the foundation's capacity to withstand axial forces (pumax ≤ 1188.44 kN) and seismic loads (SDS = 0.65 g, SD1 = 0.60 g). The study successfully produced a seismic-resistant design for the faculty building, leveraging localized seismic data and optimized foundation systems. The results provide a benchmark for similar projects in earthquake-prone areas, contributing to sustainable educational infrastructure development in Indonesia.

Keyword: Design, Faculty, Foundation, Planning, Structure.

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INTRODUCTION

One of the most significant facets of life is education. A person's chances of leading a happy life increase with their level of education. The aforementioned opportunities increase with an individual's level of education (Haryono, 2020).

In today's modern era, the level of higher education or a bachelor's degree in education is very important if you look at the correlation with the statement above (Sukma, 2021; Yuliana & Darmawan, 2020). A bachelor's degree is now the minimum requirement for someone who wants to compete in a more competitive world of work (Arianto & Purnama, 2019; Dewi et al., 2020; Prasetya & Siregar, 2021).

Of the many majors in universities that are very popular, engineering is one of ten of them. Also reported by several national news pages, Indonesia ranks sixth in the world with the best engineer graduates, right after Japan and South Korea (Setiawan & Suryani, 2022).

Knowing this information, there is an urgency to plan well the learning and teaching facilities, research and development, as well as training and services at the engineering college level in many regions in Indonesia, in this case, the author specializes in the planning of the Civil Engineering and Planning Faculty Building, Gunung Jati University, Cirebon, West Java (Fajar & Suci, 2023).

Pendidikan merupakan salah satu aspek terpenting dalam kehidupan, di mana tingkat pendidikan seseorang berkorelasi positif dengan peluang untuk mencapai kehidupan yang lebih baik. Di era modern ini, pendidikan tinggi, khususnya jenjang sarjana, telah menjadi syarat minimal bagi individu yang ingin bersaing di dunia kerja yang semakin kompetitif (Yuliana & Darmawan, 2020). Salah satu bidang studi yang sangat diminati adalah teknik, dengan Indonesia menempati peringkat keenam dunia dalam menghasilkan lulusan teknik terbaik, setelah Jepang dan Korea Selatan. Prestasi ini menegaskan pentingnya infrastruktur pendidikan yang memadai, khususnya untuk fakultas teknik, guna mendukung kualitas pembelajaran yang optimal (Sukma, 2021).

Penelitian terdahulu oleh Aditya Pratama et al. (2018) dan Ahmad Andi Bayu Mahendra et al. (2023) telah mengkaji perencanaan struktur gedung pendidikan, dengan fokus pada analisis beban dan ketahanan gempa. Namun, penelitian tersebut belum menyentuh perencanaan khusus untuk fakultas teknik di daerah dengan aktivitas seismik tinggi seperti Cirebon (Wahyudi & Putra, 2022; Asma & Firmansyah, 2023). Kesenjangan inilah yang mendasari penelitian ini, dengan tujuan merancang gedung Fakultas Teknik Sipil dan Perencanaan Universitas Gunung Jati yang tahan gempa, menggunakan data spektrum respons seismik lokal dan sistem fondasi bored pile yang dioptimalkan untuk kondisi tanah di lokasi kampus (Salim & Rahayu, 2021; Junaidi et al., 2022).

Kebaruan penelitian ini terletak pada penerapan analisis gempa berbasis data aktual wilayah Sunyaragi, serta penggunaan program analisis struktur modern untuk memastikan kepatuhan terhadap standar SNI 1726:2019. Hasil penelitian diharapkan tidak hanya memberikan solusi desain yang aman dan efisien, tetapi juga menjadi acuan bagi pembangunan gedung pendidikan sejenis di daerah rawan gempa. Dengan demikian, penelitian ini memberikan kontribusi nyata bagi pengembangan infrastruktur pendidikan yang berkelanjutan di Indonesia.

Metode Penelitian

Berdasarkan naskah yang dilampirkan, penelitian ini menggunakan pendekatan kuantitatif dengan metode perencanaan struktural yang mengacu pada standar nasional dan analisis teknis. Berikut penjelasan rincinya:

Jenis Penelitian

Penelitian ini merupakan studi perencanaan struktural (design research) yang bertujuan untuk merancang fondasi dan struktur bangunan Fakultas Teknik Sipil dan Perencanaan Universitas Gunung Jati, Cirebon, dengan mempertimbangkan beban statis, dinamis, dan ketahanan gempa.

Sumber Data

Data yang digunakan meliputi:

Data Primer:

- Hasil uji tanah dan respons spektrum gempa wilayah Sunyaragi, Cirebon (diambil dari aplikasi Kementerian PUPR: *rsa.ciptakarya.pu.go.id*).

- Spesifikasi material (kuat tekan beton *f'c* = 30 MPa, tegangan leleh baja *fy* = 420 MPa).

Data Sekunder:
- Standar perencanaan:
  - SNI 1727:2013 (Beban minimum untuk bangunan gedung).
  - SNI 1726:2019 (Ketahanan gempa).
  - SNI 2847:2019 (Persyaratan beton struktural).
  - PPPURG 1987 (Pembebanan untuk rumah dan bangunan).
- Referensi jurnal terkait perencanaan struktur gedung pendidikan.

Tahapan Penelitian
a. Analisis Beban
- Menghitung kombinasi pembebanan sesuai SNI 1727:2013, meliputi:
  - Beban mati (D) dan beban hidup (L).
  - Beban gempa (E) berdasarkan spektrum respons Gambar 1 (zona tanah lunak, *SDS* = 0.65 g, *SD1* = 0.60 g).
  - Kombinasi pembebanan kritis (1.2D + 1.0E + L + 0.2S).

b. Desain Fondasi Bore Pile
- Pemilihan tipe fondasi berdasarkan daya dukung tanah dan beban kolom (*Puk* = 3046 kN).
- Perhitungan dimensi dan penulangan pile cap (Tabel 1–11), termasuk:
  - Analisis gaya aksial pada tiang (*pumax* ≤ 1188.44 kN).
  - Cek geser satu arah/dua arah (Tabel 6–8).
  - Desain tulangan lentur (Tabel 9–10) dan tulangan susut (Tabel 11).

c. Analisis Struktur Tahan Gempa
- Klasifikasi bangunan sebagai Struktur Rangka Pemikul Momen Khusus (SRPMK) (SNI 1726:2019).
- Simulasi respons dinamik menggunakan data spektrum respons gempa lokal.

d. Gambar Kerja
- Pembuatan detail struktur menggunakan AutoCAD (Gambar 1–6), meliputi:
  - Denah fondasi, penulangan pile cap, dan balok tie beam.

4. Alat Analisis
- Software: AutoCAD (untuk gambar struktur), SAP2000/ETABS (analisis struktur, *tidak disebutkan eksplisit tetapi umum digunakan*).
- Perhitungan Manual: Berdasarkan formula SNI untuk verifikasi hasil.

5. Validasi Desain
Memastikan semua komponen memenuhi kriteria:
- Kekuatan ($\varphi Vc > Vux$).
- Lendutan ($\rho min \le \rho \le \rho max$).
- Kepatuhan terhadap standar SNI dan PPPURG.

RESULT AND DISCUSSION
GUIDELINES
Several guidelines and building planning provisions that are applicable in Indonesia serve as the foundation for this planning and calculation process of building structures, which includes

provisions about minimum loads, load combinations, and the planning of seismic-event endures building as well as non-property constructures. These include:

a. “Pedoman Perencanaan Pembebanan untuk Rumah dan Bangunan”
b. “Beban Minimum Untuk Perancangan Bangunan Gedung dan Struktur Lain”
c. "Tata Cara Perencanaan Ketahanan Gempa Untuk Struktur Bangunan Gedung dan Nongedung"
d. "Persyaratan Beton Struktural Untuk Bangunan Gedung dan Penjelasan"

QUALITY OF MATERIALS

The UGJ property's construction is planned using a reinforced concrete structure with the following material quality:

a. Concrete (f’c)
   Structure = 30 MPa
   Foundation = 30 MPa
b. b. Steel (fy)
   BJTD-40 fy = 420 MPa (Deformed Reinforcement).
   BJTP-30 fy = 280 MPa (Plain Reinforcement).

LOAD PLANNING

Loading planning represent building construction of UGJ is listed below:

a. Dead weight used pertains by guidelines
b. Current weight used pertains by guidelines
c. Earthquake weight used pertains by guidelines

LOADING PLANNING

SNI's Article 2.3 or 2.4 requirements must be followed when designing buildings and other structures. SNI 1727:2013 serves as the lowest weight for developing properties and other constructures in this final project. Building components must be specifically planned using the following symbols if they are made using standard materials or particular specifications:

Ak = weight or weight consequence brought on by exceptional circumstances
D = dead weight
Di = ice weight
E = seismic-event weight
F = weight as a result of fluid through clearly specified pressure as well as highest height
Fa = flood load
H = load due to lateral earth pressure, groundwater pressure, or pressure from large amounts of material
L = live load
Lr = covering current weight
R = moisture weight
T = current-draining load
W = storm load

Wi = storm ascertained according to Article 10

In the subsequent arrangements, the planning strengths of the groundworks, components, and constructures must match or surpass the impacts of the calculated loads:

1. 1.4D
2. 1.2D + 1.6L + 0.5 (L or R)
3. 1.2D + 1.6 (L or R) + (L or 0.5W)
4. 1.2D + 1.0W + L + 0.5 (Lr or R)
5. 1.2D + 1.0E + L + 0.2S
6. 0.9D + 1.0W
7. 0.9D + 1.0E

STRUCTURAL ANALYSIS OF EARTHQUAKE

This building is designed to be an seismic event-endures building. The location of the structure, its purpose, and the kind of soil beneath it are taken into consideration when analyzing the seismic event-endures building structure. With the following information, the seismic load analysis for this building complies with the "Tata Cara Perencanaan Ketahanan Gempa untuk Struktur Bangunan Gedung dan Nongedung" (SNI_1726:2019):

a. Building location = Sunyaragi, Kesambi, Cirebon, West Java
b. Particular kind of hazard = II
c. Seismic significant aspect (Ie) = 1.0

The PUPR Ministry's website, rsa.ciptakarya.pu.go.id, offers an online application for obtaining the spectrum response graph. This application pertains to the 2017 Indonesian seismic-event origin and risk diagram, which was created by the "Kementerian Pekerjaan Umum dan Perumahan Rakyat," "Pusat Litbang Perumahan dan Permukiman, Balitbang," and "Tim Pusat Studi Gempa Nasional (PuSGeN)."

The Indonesian design response spectrum value in this application is specifically for calculations on buildings only according to SNI 1726:2019. For design response spectrum values in areas with constant acceleration response spectrums to those adjacent to active faults, checks must be carried out.

By entering the coordinates of Gunung Jati University Campus 2 in Sunyaragi, Kesambi, Cirebon, West Java, this website will display the response spectrum graph values from soft, medium, hard, to rock soils.

The spectrum response graph for the Sunyaragi zone (-6.734492145781973, 108.5381868481636) is shown in Figure 1:

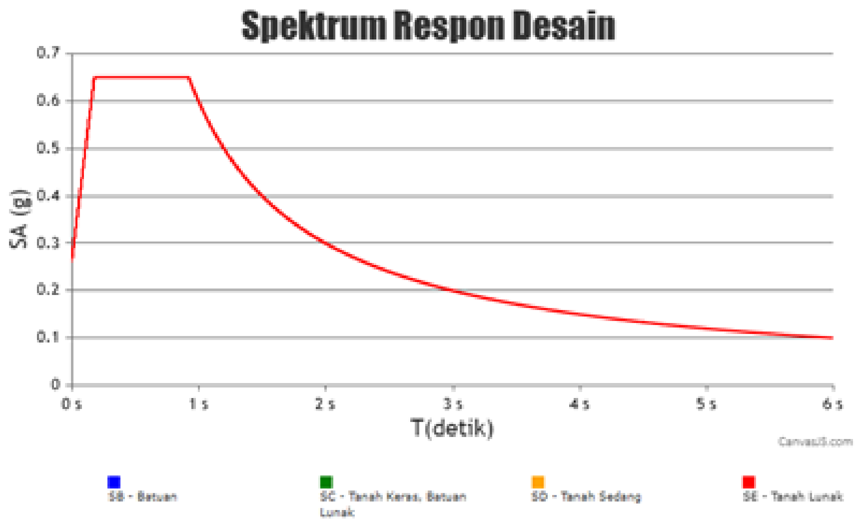

Figure 1. Sunyaragi Spectrum Response Graph (Soft Soil)
(Source: rsa.ciptakarya.pu.go.id)

Figure 1. shows the values of frequency reaction motion variables at brief time frame as well as a few time frame as follows:

a. SDS = 0.65 g
b. SD1 = 0.60 g

Based on SNI 1726:2019 article 7.2.5.5, Faculty of Civil Engineering and Planning Building, Gunung Jati University is comprised in the type D seismic planning segment, so the structural analysis uses the "Struktur Rangka Pemikul Momen Khusus" (SRPMK)method.

FOUNDATION PLANNING

The planning of the Faculty of Civil Engineering and Planning Building uses bore pile foundation as its lower structure. The following are the calculations used in the planning:

Some of the guidelines used in this planning include:

(PPPURG_1987) contains provisions for permissible loads for planning houses and buildings. These guidelines contain provisions regarding loading, as well as safety factors in stability reviews.

The lowest load requirements for planning buildings and other constructures are found in SNI_1727:2013. The permitted strength and stress design approach must be utilized in conjunction with the generated appropriate loads and load combinations. Design standards for typical building supplies used in buildings and their adjustments stated in this specification must be adhered to for planning strength and permissible tension boundaries.

The building code's minimum requirements for properties, other constructures, and their non-constructural aspects in terms of loads, danger scales, related factors, and expected performance targets are contained in SNI_1726:2019.

(SNI_2847:2019) contains provisions for the design of structural concrete including plain concrete, concrete with non-prestressed, prestressed or both reinforcement, composite columns with structural steel sections, pipes or casings and anchorage to concrete. This standard is a substantial reorganization of the provisions of SNI 2847. This clause consists of several provisions that explain how to use this standard and how to interpret its intent.

Table 1. Pile Cap Material Data

PILE CAP RESOURCES CONTENT			
Compressive Strength of Concrete	fc'	30	(Mpa)
Deformed reinforcing steel's yield strength	fy	420	(Mpa)
The ordinary reinforcing steel's yield strength	fy	280	(Mpa)
Weight of reinforced concrete	wc	24	(kN/m^3)

Source: KITAM

Table 2. Foundation Dimension Data

SUB-STRUCTURE MEASUREMENT CONTENT			
Width of a column x	bx	0.70	(m)
Width of a column y	by	0.70	(m)
Separation of edge bore pile to the outer side of the concrete	a	0.50	(m)
Pilecap width	h	0.80	(m)
Soil thickness above pilecap	z	1.00	(m)
Soil volume weight above pilecap	ws	16.83	(m)
Column position (inside = 40, edge = 30, angle = 20)	αs	40	(kN/m^3)

Source: KITAM

Table 3. Foundation Load Data

FOUNDATION LOAD DATA			
Column axial force as a result of factoring the load	P_{uk}	3046.00	(kN)
Moment in x direction account of the estimated load	M_{ux}	102.71	(kNm)
Moment in y direction account of the estimated load	M_{uy}	103.17	(kNm)
Axial resistance of Bore Pile (Assumption)	f * P_n	1,188.44	(kN)

Source: KITAM

Table 4. Bore Pile Arrangement Data

BORE PILE arrangement in x direction				BORE PILE arrangement in y direction			
No.	Number (n)	X (m)	n * x^2 (m^2)	No.	Number (n)	X (m)	n * x^2 (m^2)
1	4	1.20	5.76	1	4	1.80	12.96
2	4	0	0.00	2	4	0.60	1.44
3	4	1,20	5.76	3	4	0.60	1.44
n	12	S_x^2	11.52	n	4	S_y^2	15.84
		Pilecap width x direction				L_x (m)	3.40
		Pilecap width y direction				L_y (m)	4.00

Source: KITAM

Table 5. **Axial Force On Piles**

AXIAL FORCE ON PILES			
Soil weight over the pile cap	W_s	228.888	(kN)
Weight of pile cap	W_c	261.12	(kN)
Maximum pile's x-direction arm towards center	X_{max}	1.20	(m)
Maximum pile's y-direction arm towards center	Y_{max}	1.80	(m)
Total factored axial force	P_u	3095.00	(kN)
Axial force on 1 pile	p_{umax}	280.34	(kN)
Condition:	p_{umax}	≤	f * P_n
	280.34	≤	1,188.44
			(SAVE)

Source: KITAM

Table 6. **X Direction Shear Review**

X DIRECTION SHEAR REVIEW			
The separation between the concrete's outer side and the reinforcement center	d'	0.10	(m)
Effective thickness of pile cap	d	0.70	(m)
Critical distance to the outer side	cx	1	(m)
Concrete weight	W_1	76.80	(kN)
Soil weight	W_2	67.32	(kN)
X direction shear force	V_{ux}	136.219	(kN)
Width of shear plane for x-direction review	$b=L_y$	4,000	(mm)
Effective thickness of pile cap	d	700	(mm)
Proportion of the column's long to short sections	β_c	1	
The shear strength of the pile cap in the x direction		7,668.12	(kN)
	V_c	2,556.04	(kN)
		5,112.08	(kN)
Smallest value of Vc taken	V_c	5,112.08	(kN)
Shear strength reduction factor	ϕ	0.75	
Shear strength of pile cap	ϕ*V_c	3,834.06	(kN)
Condition:	ϕ*V_c	>	V_{ux}
	3,834.06		136.219
			(SAVE)

Source: KITAM

Table 7. X Direction Shear Review

Y DIRECTION SHEAR REVIEW			
The separation between the concrete's outer side and the reinforcement center	d'	0.10	(m)
Effective thickness of pile cap	d	0.70	(m)
Critical distance to the outer side	cx	1.6	(m)
Concrete weight	W_1	104.448	(kN)
Soil weight	W_2	91.555	(kN)
X direction shear force	V_{ux}	84.335	(kN)
Width of shear plane for x-direction review	$b=L_x$	3,400	(mm)
Effective thickness of pile cap	d	700	(mm)
Proportion of the column's long to short sections	β_c	1	
		6,517.90	(kN)
The shear strength of the pile cap in the x direction	V_c	2,172.63	(kN)
		4,345.27	(kN)
Smallest value of Vc taken	V_c	4,345.27	(kN)
Shear strength reduction factor	ϕ	0.75	
Shear strength of pile cap	$\phi*V_c$	3,258.95	(kN)
Condition:	$\phi*V_c$	>	V_{ux}
	3,258.95	>	84.335
			(SAVE)

Source: KITAM

Table 8. Two-Way Slide Review

TWO-WAY SLIDE REVIEW			
The separation between the concrete's outer side and the reinforcement center	d'	0.10	(m)
Effective thickness of pile cap	d	0.70	(m)
Width of foundation shear plane in x direction	B_x	1.40	(m)
Width of foundation shear plane in y direction	B_y	1.40	(m)
Foundation shear force due to factored load on column	P_{uk}	3,046.00	(kN)
Foundation shear area	A_p	3.92	(m^2)
Width of foundation shear plane	b_p	5.60	(m)
Proportion of the column's long to short sections	β_c	1	
		2.74	
Foundation shear stress	f_p	0.91	
		1.83	
Foundation shear stress taken	f_p	1.83	
Foundation shear strength reduction factor	ϕ	0.75	(kN)
Foundation shear strength	$\phi*V_c$	5,367.68	(kN)
Condition:	$\phi*V_c$	>	P_{uk}
	5,367.68	>	3,046
			(SAVE)

Source: KITAM

Table 9. X Direction Flexible Reinforcement

X DIRECTION FLEXIBLE REINFORCEMENT			
Distance of column edge to outer side of pile cap	c_x	7.57	(m)
Distance of pile to side of column	e_x	7.07	(m)
Concrete weight	W_1	581.376	(kN)
Soil weight	W_2	509.612	(kN)
Moment occurring on pile cap	M_{ux}	-2,147.4	(kNm)
Pile cap width reviewed	$b=L_x$	3,400	(mm)
Pile cap thickness	h	800	(mm)
The separation between the concrete's outer side and the reinforcement center	d'	100	(mm)
Effective thickness of pile cap	d	700	(mm)
Concrete compressive strength	f_c'	30	(MPa)
Reinforcement steel yield strength	f_y	420	(MPa)
Steel elastic modulus	E_s	200,000	(MPa)
Concrete stress distribution factor	β_1	0.85	
Concrete stress distribution factor	ρ_b	0.03	
Foundation shear strength reduction factor	ϕ	0.80	
	R_{max}	7.77	
	M_n	-2,684.25	(kNm)
	R_n	-1,611	
	R_n	<	R_{max}
			(SAVE)
Required reinforcement ratio	ρ	-0.0037	
Minimum reinforcement ratio	ρ_{min}	0.0025	
Reinforcement ratio used	ρ	0.0025	
Required reinforcement area	A_s	5,950	(mm^2)
Reinforcement diameter used	D	19	(mm)
Required reinforcement spacing	s	162	(mm)
Maximum reinforcement spacing	s_{max}	200	(mm)
Reinforcement spacing used	s	162	(mm)
Reinforcement diameter used	D19	160	(mm)
Reinforcement area used	A_s	6024.99	(mm^2)

Source: KITAM

Table 10. Y Direction Flexible Reinforcement

X DIRECTION FLEXIBLE REINFORCEMENT			
Distance of column edge to outer side of pile cap	c_x	1.95	(m)
Distance of pile to side of column	e_x	1.45	(m)
Concrete weight	W_1	127.296	(kN)
Soil weight	W_2	111.583	(kN)
Moment occurring on pile cap	M_{ux}	173.584	(kNm)
Pile cap width reviewed	$b=L_x$	4,000	(mm)
Pile cap thickness	h	800	(mm)
The separation between the concrete's outer side and the reinforcement center	d'	100	(mm)

X DIRECTION FLEXIBLE REINFORCEMENT			
Effective thickness of pile cap	d	700	(mm)
Concrete compressive strength	f_c'	30	(MPa)
Reinforcement steel yield strength	f_y	420	(MPa)
Steel elastic modulus	E_s	200,000	(MPa)
Concrete stress distribution factor	β_1	0.85	
Concrete stress distribution factor	ρ_b	0.03	
Foundation shear strength reduction factor	ϕ	0.80	
	R_{max}	7.77	
	M_n	216.98	(kNm)
	R_n	0.111	
	R_n	<	R_{max}
			(SAVE)
Required reinforcement ratio	ρ	0.0003	
Minimum reinforcement ratio	ρ_{min}	0.0025	
Reinforcement ratio used	ρ	0.0025	
Required reinforcement area	A_s	27000	(mm^2)
Reinforcement diameter used	D	19	(mm)
Required reinforcement spacing	s	162	(mm)
Maximum reinforcement spacing	s_{max}	200	(mm)
Reinforcement spacing used	s	162	(mm)
Reinforcement diameter used	D19	160	(mm)
Reinforcement area used	A_s	7,088.22	(mm^2)

Source: KITAM

Table 11. Reinforcement Shrinkage Reinforcement

CONTRACTION REINFORCEMENT			
Minimum contraction reinforcement proportion	ρ_{smin}	0.0014	(mm^2)
Contraction region of reinforcement in the x direction	A_{sx}	3,920	(mm^2)
Contraction region of reinforcement in the y direction	A_{sy}	34	(mm)
Reinforcement diameter applied	$\varnothing$	12	(mm)
Contraction reinforcement distance in x direction	s_x	115	(mm)
Maximum shrinkage reinforcement distance in x direction	s_{xmax}	200	(mm)
Contraction reinforcement distance in x direction applied	s_x	150	(mm)
Contraction reinforcement distance in x direction	s_y	2,693	(mm)
Maximum shrinkage reinforcement distance in x direction	s_{ymax}	200	(mm)
Contraction reinforcement distance in y direction applied	s_y	150	(mm^2)
Contraction reinforcement applied in the direction of x	$\varnothing$	150	
Contraction reinforcement applied in the direction of y	$\varnothing$	150	

Source: KITAM

FOUNDATION STRUCTURAL DRAWING

The planning of the foundation of the Faculty of Civil Engineering and Planning Building uses the AutoCAD application as its main design application. After the structural calculation is complete, the structure is drawn using the AutoCAD drawing program for detailing.

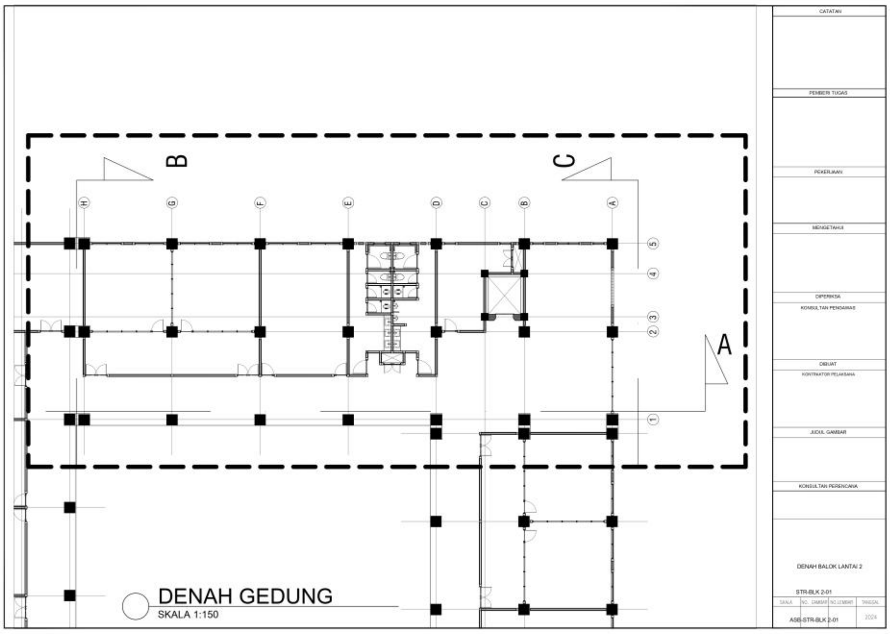

Figure 1. Building Plan Sectoral
(Source: KITAM)

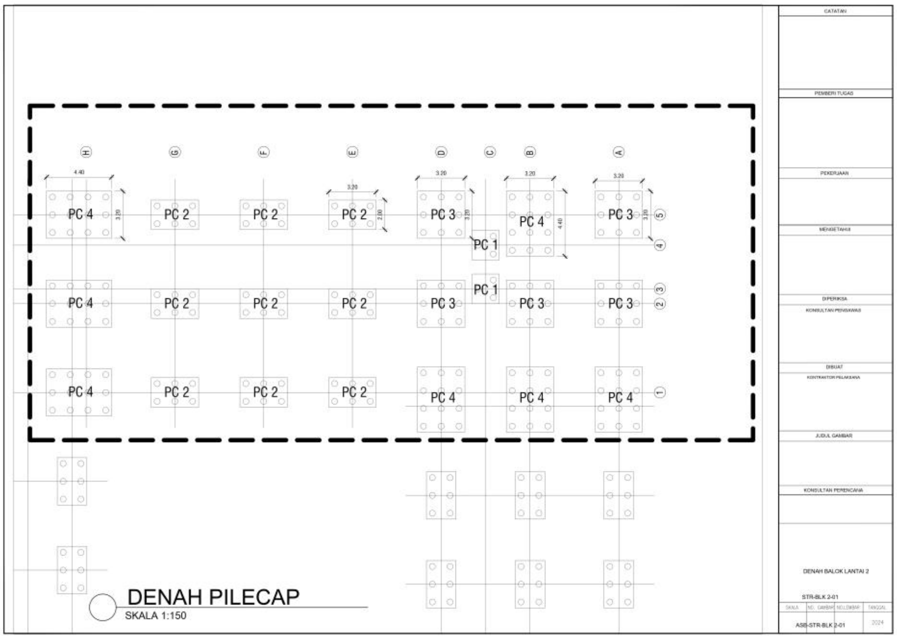

Figure 2. Pilecap Building Plan
(Source: KITAM)

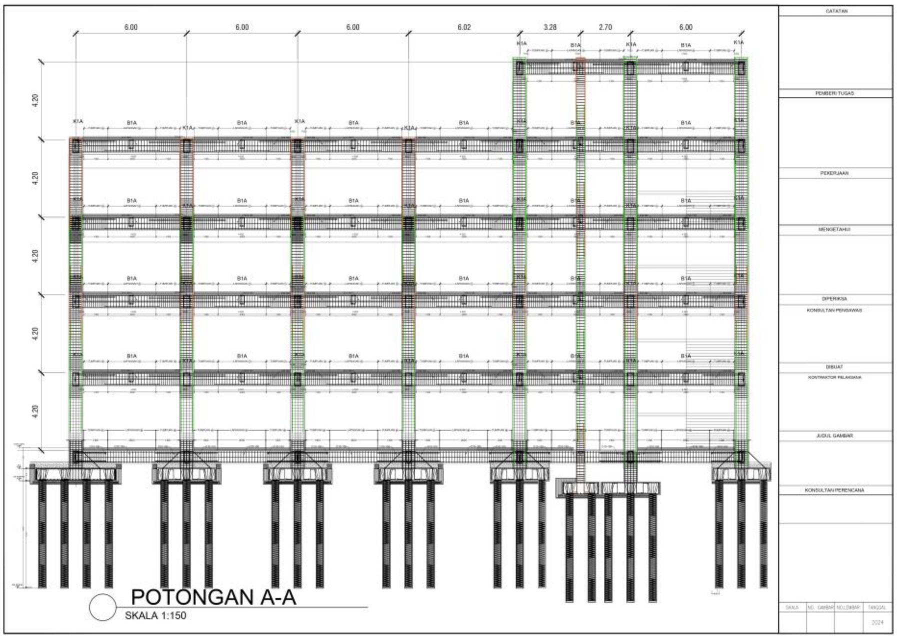

Figure 2. Building Section A-A
(Source: KITAM)

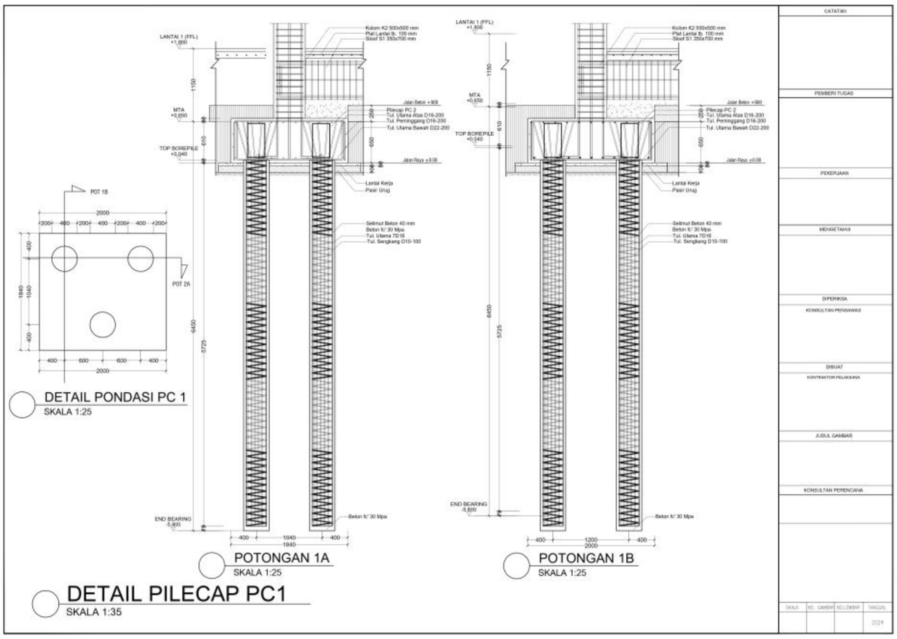

Figure 3. Pilecap Type 1 Detail
(Source: KITAM)

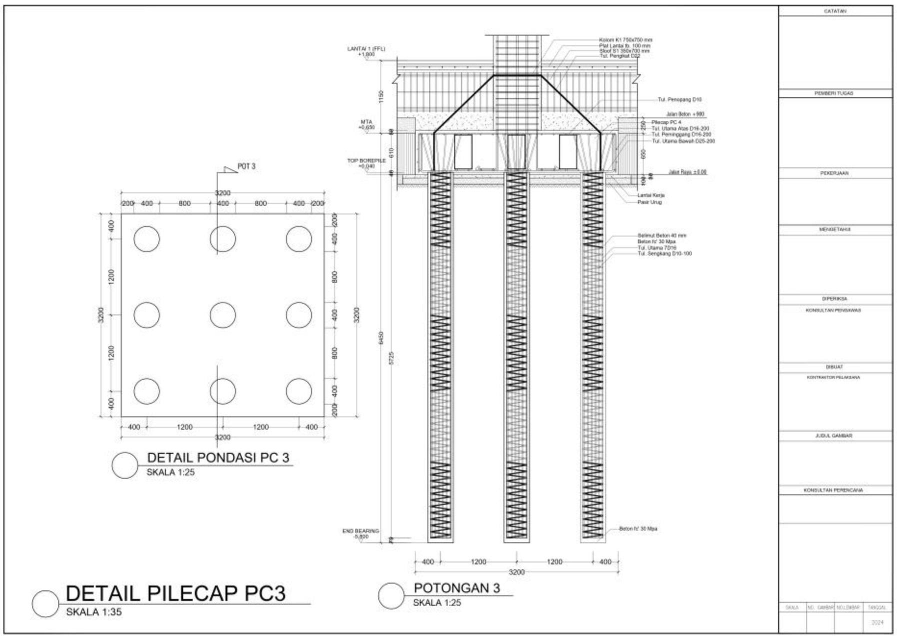

Figure 4. Pilecap Type 3 Detail
(Source: KITAM)

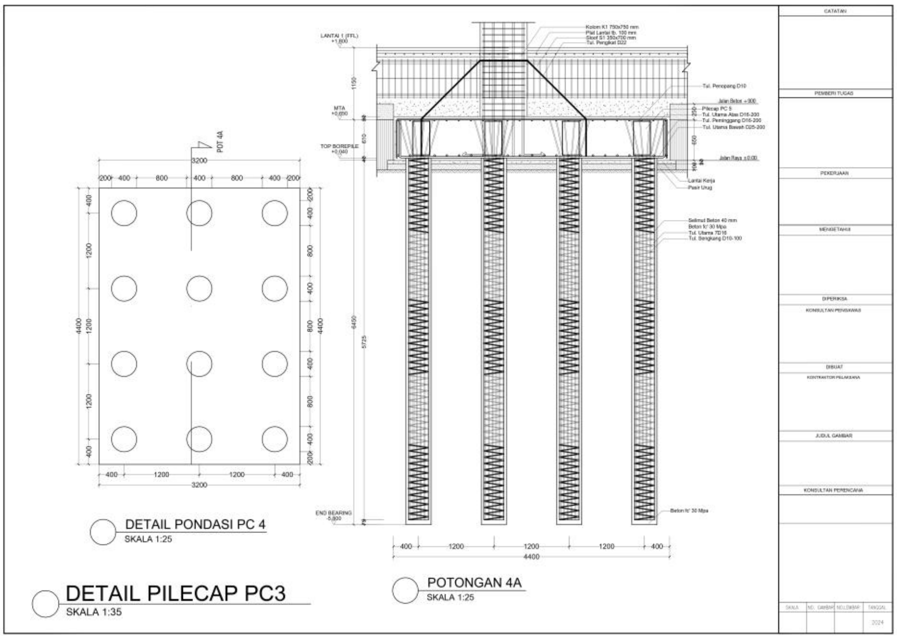

Figure 6. Pilecap Type 4 Detail
(Source: KITAM)

CONCLUSION

Indonesian National Standard regulates the lowest weight for developing properties as well as additional constructures, SNI 1726: 2019 deals with procedures for seismic-event endures planning for property and non-property constructures, SNI 2847: 2019 contains the specifications for reinforced concrete for building structures, and PPPURG 1987 serves as a guideline for load planning for residential houses and building structures. These guidelines were used in the sectoral property at UGJ, Cirebon, West Java.

In order to produce design data for structural elements using concrete with a compressible forces of 30 MPa and metallic reinforcement in the form of 280 MPa plain metallic reinforcement and 420 MPa deformed steel reinforcement, this planning was written based on precedents from various building planning journals.

The planning led to the design of structural components, including four different types of borepile foundations. Each pile had a diameter of 40 cm, was planted 1 m below the earth, and had a pilecap thickness of about 80 cm. D19 and Ø12 steel reinforcement were used for these piles.

Three piles of Type 1 have pilecap dimensions of about 3.40 x 3.08 m, six piles of Type 2 have pilecap dimensions of approximately 3.80 x 1.40 m, nine piles of Type 3 have pilecap dimensions of approximately 3.90 x 3.90 m, and twelve piles of Type 4 have pilecap dimensions of approximately 5.00 x 2.40 m. A 250 x 400 mm tie beam with D12 and Ø10 steel reinforcement, a 350 x 700 mm main beam with D22 and Ø10 steel reinforcement, and a 250 x 300 mm secondary beam with D22 and Ø10 steel reinforcement are all represented in this set.

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