LAMPIRAN

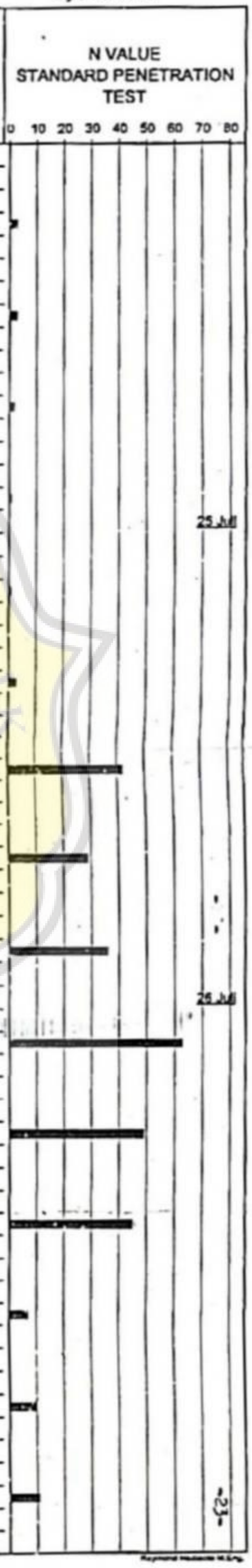
BORING LOG & SPT DIAGRAM

PROJECT : HOTEL NOVOTEL DAN HOTEL IBIS 12 LANTAI (TERMASUK SEMI BASEMENT)
LOCATION : YOGYAKARTA INTERNATIONAL AIRPORT, KULON PROGO - YOGYAKARTA
HOLE : DB I
DATE of TEST : 24 - 26 JULI 2019

By : Mahmud

DB1

DEPTH (M)	LAYER THICKNESS (M)	ELEVATION (M)	SOIL CLASSIFICATION (▼ - 1.40 M dari Jalan Raya)	q_p (kgf/cm^2)	SAMPLE ELEVATION (M)	% RECOVERED	N VALUE EVERY 15 CM			N VALUE 30 CM
1	1.00	1.00	SILT, coklat, silt pasir halus.			70				
2			LEMPUNG, abu-abu, coklat, kuning, lempung silt, soft.		2.00	100 / 89 / 70	1	1	2	3
3	2.50	3.50								
4			LEMPUNG, abu-abu, coklat, hitam, lempung silt dengan pasir halus dan organis, soft.		4.00	100 / 89 / 70	1	1	2	3
5										
6	2.50	6.00			6.00	100 / 89 / 70	1	1	1	2
7										
8			LEMPUNG, abu2, lempung silt dengan pasir halus dan kulit kerang, very soft + soft.		8.00	100 / 89 / 70	0	0	1	1
9										
10					10.00	100 / 89 / 70	0	0	1	1
11										
12	6.00	12.00			12.00	100 / 89	1	1	2	3
13										
14			PASIR, abu-abu, pasir halus dengan kulit kerang, dense + medium dense.		14.00	89	6	16	26	42
15										
16	4.00	16.00			16.00	89	5	10	19	29
17			PASIR, abu-abu, pasir halus + kasar dengan kerikil, dense.							
18	2.00	18.00			18.00	89	6	16	20	36
19										
20					20.00	89	10	25	38	63
21			PASIR, abu-abu, hitam, pasir halus sedikit kerikil, very dense + dense.							
22					22.00	89	13	24	25	49
23										
24					24.00	•	10	23	22	45
25	7.00	25.00								
26	1.50	26.50	LEMPUNG, abu2, lempung silt dengan pasir halus dan kulit kerang, konsistensi medium.		26.00	100 / 89 / 70	2	3	4	7
27										
28			LEMPUNG, abu-abu, hitam, lempung silt, stiff.		28.00	100 / 89 / 70	3	4	6	10
29										
30	3.50	30.00			30.00	100 / 89	3	4	7	11



PT SUBSOUND SAKTI JAKARTA

UNDISTURBED SAMPLE
STANDARD PENETRATION TEST
CORE SAMPLE
DISTURBED SAMPLE

SILT
LEMPUNG
PASIR
CEMENTED
PUING
KEMBANG KARANG
BATU KARANG

KULIT KERANG
KARANG
ORGANIC
GUMPALAN CADAS
KERIKIL
KORAL
BATU

MUKA AIR TANAH = - 0.70 M

BORING LOG & SPT DIAGRAM

PROJECT : HOTEL NOVOTEL DAN HOTEL IBIS 12 LANTAI (TERMASUK SEMI BASEMENT)
LOCATION : YOGYAKARTA INTERNATIONAL AIRPORT, KULON PROGO - YOGYAKARTA
HOLE : DB II
DATE of TEST : 27 - 29 JULI 2019

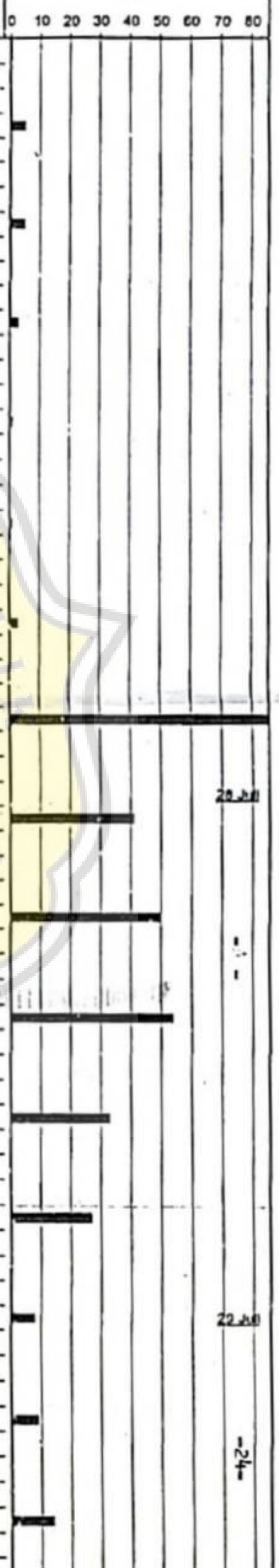
By : Mahmud

DB2

- 1.40 M dari Jalan Raya

DEPTH (M)	LAYER THICKNESS (M)	ELEVATION (M)	SOIL CLASSIFICATION	q_p (kg/cm²)	SAMPLE ELEVATION (M)	% RECOVERED	N VALUE EVERY 15 CM			N VALUE 30 CM
1	1.00	1.00	SILT, coklat, silt pasir halus.			70				
2			LEMPUNG, abu-abu, coklat, lempung silt, konsistensi medium.		2.00	100 / 89	1	2	3	5
3						70 / •				
4					4.00	100 / 89	1	2	3	5
5	4.00	5.00				70				
6			LEMPUNG, coklat, lempung silt dengan pasir halus dan kulit kerang, soft.		6.00	100 / 89	1	1	2	3
7	2.00	7.00				70				
8			LEMPUNG abu2, lempung silt dengan kulit kerang, very soft + soft.		8.00	100 / 89	0	0	1	1
9						70				
10					10.00	100 / 89	0	0	1	1
11						70				
12	5.50	12.50			12.00	100 / 89	1	1	2	3
13			PASIR, abu-abu, hitam, pasir halus dengan kulit kerang, very dense + dense.							
14					14.00	89	17	41	52	93
15										
16	4.00	28-07 / 16.50			16.00	89	9	17	24	41
17			PASIR, abu-abu hitam, pasir halus + kasar dengan kerikil, very dense.							
18					18.00	89	8	20	30	50
19	2.50	19.00	SILT, abu-abu, hitam, silt pasir halus dengan kulit kerang, hard.							
20	1.00	20.00			20.00	89	7	19	35	54
21			PASIR, abu-abu, pasir halus, dense + medium dense.							
22					22.00	89	10	14	19	33
23										
24					24.00	89	9	11	16	27
25	5.00	25.00								
26		29-07	LEMPUNG, abu2, lempung silt dengan pasir halus dan kulit kerang, konsistensi medium.		26.00	100 / 89	2	4	4	8
27	2.00	27.00				70				
28			LEMPUNG, abu-abu, hitam, lempung silt sedikit organis, stiff.		28.00	100 / 89	3	4	5	9
29						70				
30	3.00	30.00			30.00	100 / 89	4	5	9	14

N VALUE STANDARD PENETRATION TEST



- UNDISTURBED SAMPLE
- STANDARD PENETRATION TEST
- CORE SAMPLE
- DISTURBED SAMPLE
- SILT
- LEMPUNG
- PASIR
- CEMENTED
- PUING
- KEMBANG KARANG
- BATU KARANG
- KULIT KERANG
- KARANG
- ORGANIC
- GUMPALAN CADAS
- KERIKIL
- KORAL
- BATU

MUKA AIR TANAH = - 0.80 M

BORING LOG & SPT DIAGRAM

PROJECT : HOTEL NOVOTEL DAN HOTEL IBIS 12 LANTAI (TERMASUK SEMI BASEMENT)
LOCATION : YOGYAKARTA INTERNATIONAL AIRPORT, KULON PROGO - YOGYAKARTA
HOLE : DB III
DATE of TEST : 30 - 31 JULI 2019

By : Mahmud

▼ - 1.40 M dari Jalan Raya

DEPTH (M)	LAYER THICKNESS (M)	ELEVATION (M)	SOIL CLASSIFICATION	q_c (kg/cm²)	SAMPLE ELEVATION (M)	% RECOVERED	N VALUE EVERY 15 CM			N VALUE 30 CM
1			LEMPUNG, coklat, abu-abu, kuning, lempung silt sedikit pasir halus, soft.			70				
2					2.00	100 / 89	1	2	2	4
3						70				
4					4.00	100 / 89	1	1	2	3
5	4.50	4.50	LEMPUNG, coklat, lempung silt dengan organis, soft.			70				
6	1.00	5.50	LEMPUNG, coklat, lempung silt dengan kulit kerang & organis, soft.		6.00	100 / 89	1	1	1	2
7	1.50	7.00				70				
8					8.00	100 / 89	1	1	1	2
9			LEMPUNG, abu2, lempung silt dengan kulit kerang, soft.			70				
10					10.00	100 / 89	1	2	2	4
11						70				
12	5.50	12.50			12.00	100 / 89	1	1	2	3
13										
14			PASIR, abu-abu, hitam, pasir halus, dense - very dense.		14.00	89	6	14	28	42
15										
16	3.50	16.00			16.00	89	13	21	31	52
17			PASIR, abu-abu, hitam, pasir halus - kasar dengan kerikil, very dense.							
18					18.00	89	7	23	44	67
19	3.00	19.00								
20					20.00	89	5	18	25	43
21			PASIR, abu-abu, hitam, pasir halus, dense - medium dense.							
22					22.00	89	6	20	22	42
23										
24	5.00	24.00			24.00	89	5	8	15	28
25			LEMPUNG, abu2, lempung silt, very stiff.			70 / 100				
26	2.00	26.00			26.00	89	10	11	12	23
27						70				
28			LEMPUNG, abu-abu, hitam, lempung silt dengan organis, very stiff - stiff.		28.00	100 / 89	5	8	10	18
29						70				
30	4.00	30.00			30.00	100 / 89	3	8	9	13

N VALUE STANDARD PENETRATION TEST

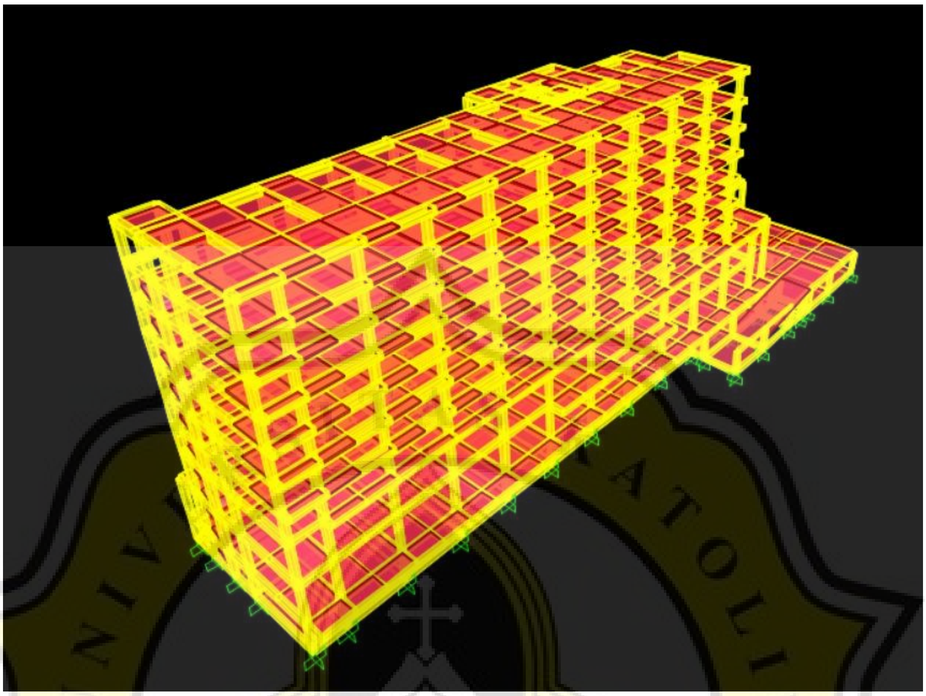
PT SOILFOUND SAKTI JAKARTA

Legend:

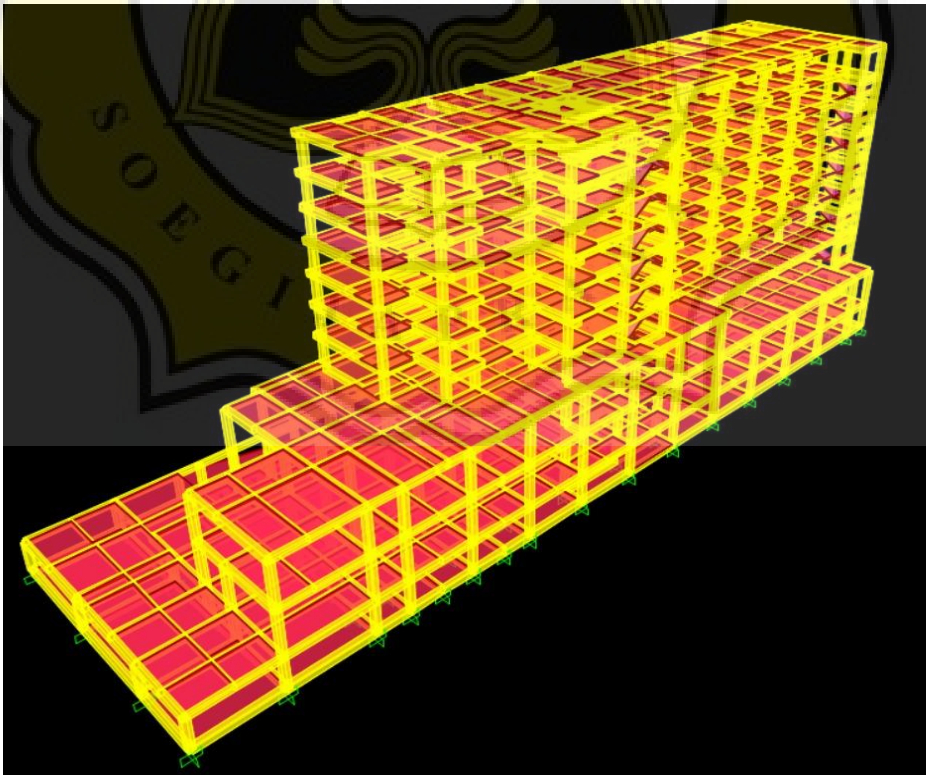
- UNDISTURBED SAMPLE
- STANDARD PENETRATION TEST
- CORE SAMPLE
- DISTURBED SAMPLE
- SILT
- LEMPUNG
- PASIR
- CEMENTED
- PUING
- KEMBANG KARANG
- BATU KARANG
- KULIT KERANG
- KARANG
- ORGANIC
- GUMPALAN CADAS
- KERIKIL
- KORAL
- BATU

MUKA AIR TANAH = - 0.60 M

Pemodelan pada SAP2000

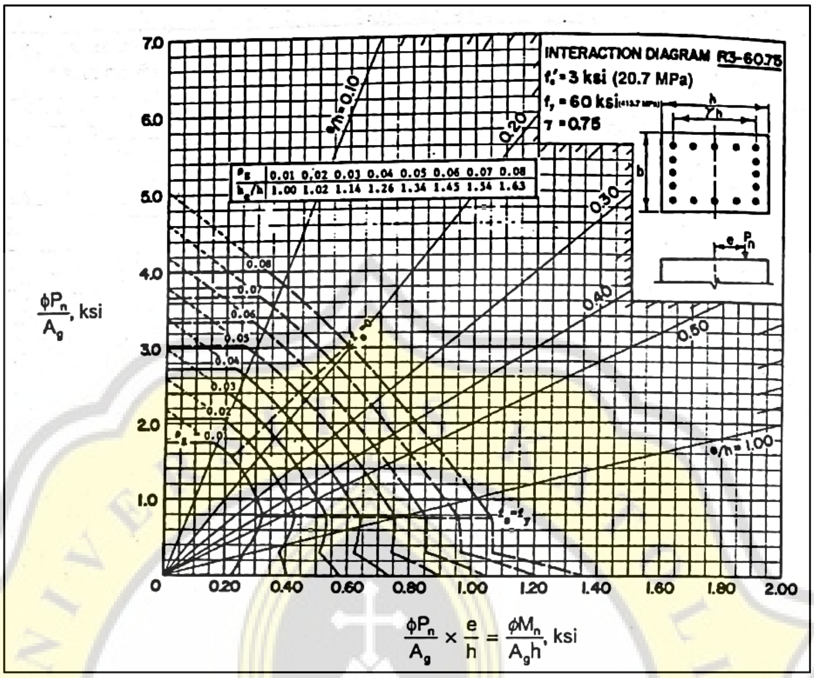


Gambar 1. Pemodelan 3D Pada SAP2000

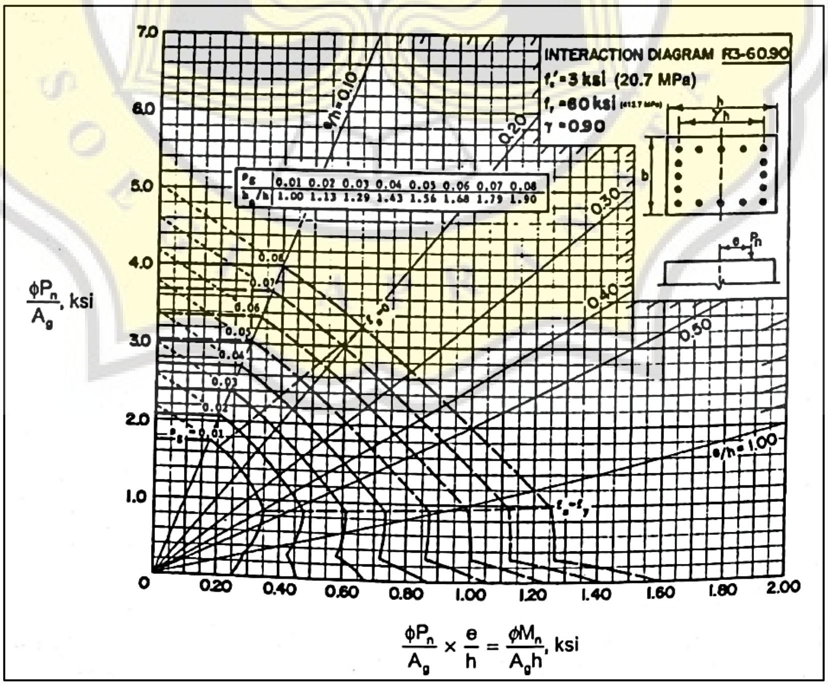


Gambar 2. Pemodelan 3D Pada SAP2000

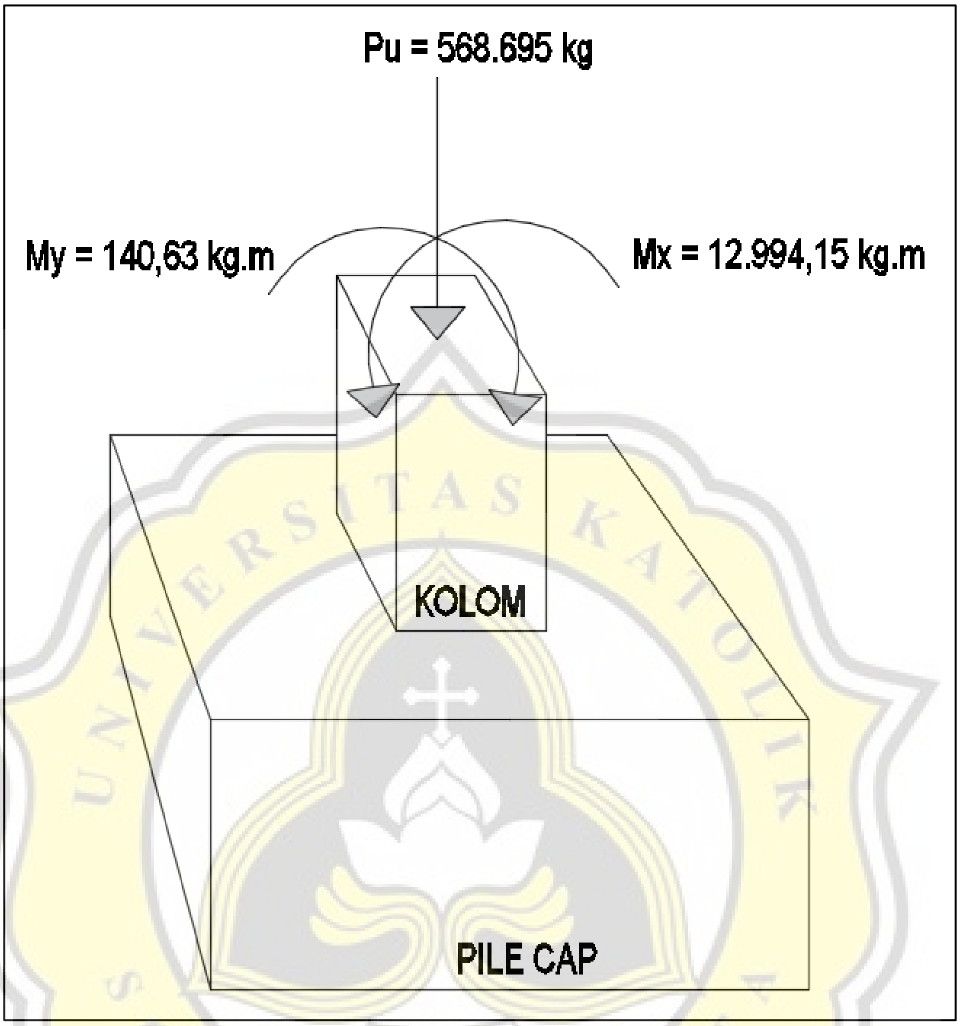
Grafik diagram interaksi kolom



Gambar 3.Diagram Interaksi Kolom Untuk Kolom Persegi Dengan Tulangan Pada Empat Sisi



Gambar 4.Diagram Interaksi Kolom Untuk Kolom Persegi Dengan Tulangan Pada Empat Sisi

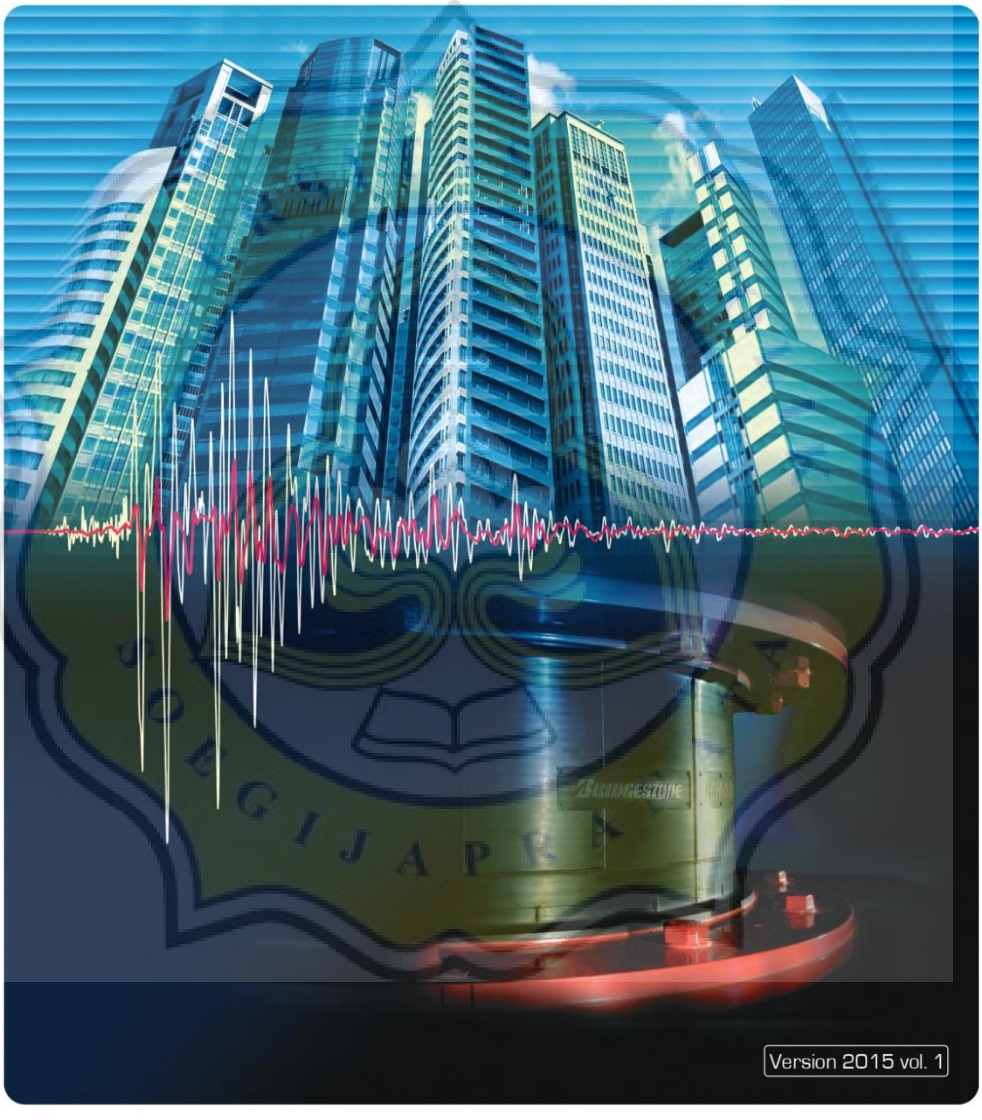


Gambar 5. Ilustrasi $P_{u,}$ M_x dan M_y

BRIDGESTONE

Seismic Isolation Product Line-up

High Damping Rubber Bearing   Lead Rubber Bearing
Natural Rubber Bearing   Elastic Sliding Bearing



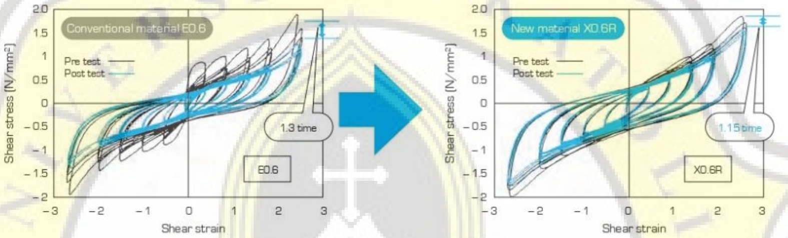
Product & System Introduction

High Damping Rubber Bearing X Series

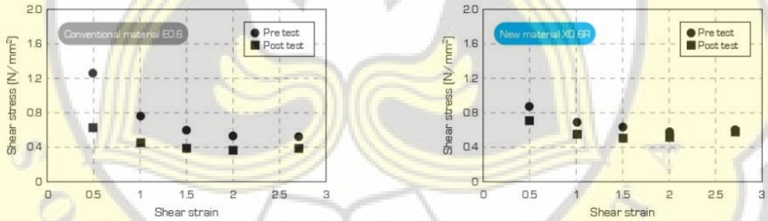
Features of High Damping Rubber Bearing X Series

High damping rubber bearing is a laminated rubber structure that includes a special filler compound in the rubber itself to provide energy absorption performance. It combines damping and spring charateristics and is widely adopted as a seismic isolator.
However, the conventional high damping rubber shows loading hysteresis dependency, where its rate of change of stiffness has become reduced and restoration becomes progressively worse after repeated loading under increasing deformation.
With Bridgestone's next-generation of high damping rubber X series, the effect of loading hysteresis dependency is greatly reduced and the properties become much simpler to manage. Furthermore, it is also more accommodating to the reduction in ultimate properties caused by bi-directional loading.

● Reduction in Loading Hysteresis Dependency



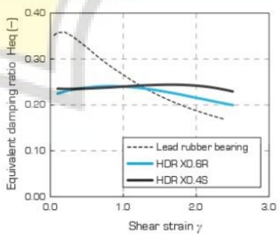
Compared to conventional high damping rubber, the change of equivalent shear stiffness (1cycle/3cycle) in repeated loading is greatly reduced. The properties of seismic isolation bearings are defined by the 3rd cycle and it is able to reduce the load variation during initial deformation.



Conventional high damping rubber shows shear stress reduction after large deformation due to the effect of loading hysteresis dependency, but the next-generation high damping rubber is able to minimize the change in properties before and after large deformation. By reducing the effect of loading hysteresis dependency, the accuracy of the overall seismic isolation design can be improved.

● Increasing of Equivalent Damping Ratio

Compared to conventional high damping rubber, the equivalent damping ratio (at shear strain $\gamma = \pm 100\%$) of high damping rubber X0.4S, X0.6R are increased (X0.4S:0.220 → 0.240, X0.6R:0.225 → 0.240). Furthermore, compared to the same diameter of lead rubber bearing (lead diameter/outer diameter = 0.2), a higher damping ratio can be obtained in the range of $\gamma \geqq 130\%$.



Ultimate Properties of High Damping Rubber Bearings by Horizontal Bi-directional Loading

● Outline

The ultimate deformation of high-damping rubber is degraded by applying bi-directional loading compared to unidirectional loading. Through a horizontal bi-directional loading test with a full scale model high-damping rubber bearing, torsional deformation can be seen in the side view of the rubber. Compared with unidirectional loading, the phenomenon of breaking at early stage by bi-directional loading has been identified. The standard value of the ultimate properties, influenced by bi-directional loading is shown below and the ultimate compressive stress is confirmed.

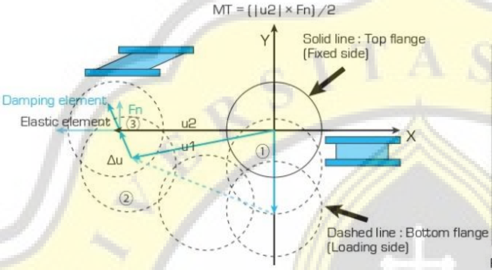


Figure 1: The mechanism of torsional deformation

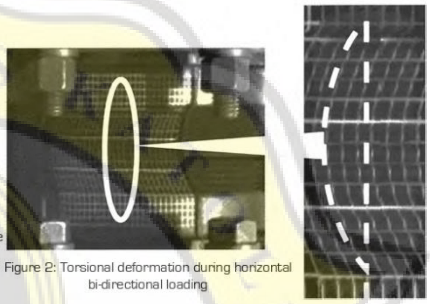


Figure 2: Torsional deformation during horizontal bi-directional loading

As shown in Figure 1, when the bi-directional loading is applied on a high damping rubber bearing, the elastic force occurs in the shear deformation direction, while the damping force occurs in the tangential direction of the deformation trajectory. The torsional moment created by the damping elements and the shear deformation is present at each rubber layer of the laminated structure. The additional shear strain γ_a caused by torsional deformation is added to the shear strain caused by the rubber shear deformation itself. Thus, it will rupture relatively early compared to the unidirectional loading test. However, the torsional deformation caused by bi-directional loading does not affect the buckling ultimate strain, as verified experimentally.

● Ultimate Property of Horizontal Bi-directional Loading

According to the Japan Society of Seismic Isolation (JSSI) guidelines, the final ultimate strain is determined by the minimum of the ultimate strain γ_L by unidirectional loading and the ultimate strain γ_{Bo} by bi-directional loading.

● Ultimate strain by unidirectional loading
Ultimate strain by unidirectional loading is defined as shown in Table 1.

Table 1: Standard value of ultimate strain by unidirectional loading

Compound	Ultimate strain by unidirectional loading γ_L
X0.4S	$S_2 \times 0.9 \times 100\%$ $(0.9 \times S_2 < 4)$ 400% $(0.9 \times S_2 \geq 4)$
X0.6R	$S_2 \times 0.9 \times 100\%$ $(S_2 < 4.5)$ 400% $(S_2 \geq 4.5)$

S_2: Second shape factor

● Ultimate strain by bi-directional loading
Ultimate strain by bi-directional loading is defined as shown in Table 2.

Table 2: Standard value of ultimate strain by bi-directional loading

Compound	Formula of ultimate strain by bi-directional loading γ_{Bo}
X0.4S	$\gamma_{BO} = (5.80 \times S_2 + 9.05) / (S_2 + 4.49)$
X0.6R	$\gamma_{BO} = (5.00 \times S_2 + 9.05) / (S_2 + 4.49)$

S_2: Second shape factor

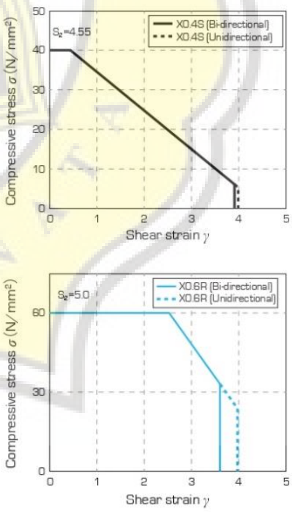


Figure 3: Comparison example of ultimate property diagram

Product Specification & Description of Performance Characteristics

High Damping Rubber Bearing (HDR)

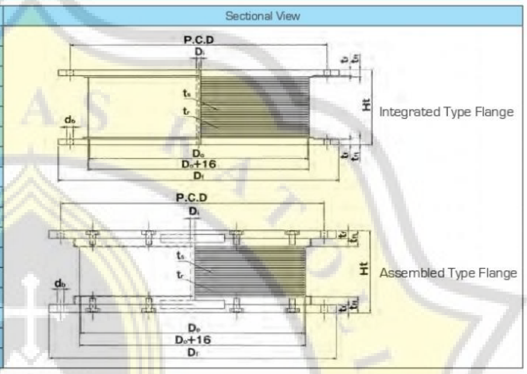
Seismic isolation material certification number by Ministry of Land, Infrastructure and Transport, Japan

MVBR-0516 (X0.3R Series)	**Acquired in December 2014**
MVBR-0510/MVBR-0519 (X0.4S Series)	**Acquired in December 2014**
MVBR-0514/MVBR-0520 (X0.6R Series)	**Acquired in December 2014**

●Product Dimension

Characteristics		
Physical Dimensions	Outer diameter	: D_o (mm)
	Inner diameter	: D_i (mm)
	Number of inner diameter	: n_i
	Effective plane area	: A (× 10²mm²)
	Thickness of one rubber layer	: t_r (mm)
	Number of rubber layers	: n
	Total rubber thickness	: $H = n \cdot t_r$ (mm)
	First shape factor $S_1 = (D_o^2 - n_i \cdot D_i^2) / (4 \cdot t_r \cdot (D_o + n_i \cdot D_i))$	
	Second shape factor $S_2 = D_o / (n \cdot t_r)$	
	Diameter of flange	: D_f (mm)
	Thickness of flange: edge/center	: t_f / t_{fc} (mm)
	Connecting bolt PCD	: PCD (mm)
	Diameter of connecting bolt hole × qty	: d_b (mm) × qty
	Bolt size (assumption)	: M (d_b −3)
	Thickness of each reinforced steel plate	: t_s (mm)
	Total height	: H_t (mm)
	Total weight 1 (kN) = 1 / 9.80665 (tonf)	

Sectional View



●Rubber Material

Notation of rubber kind (standard temperature 20°C standard strain γ = 100%)

Compound name	Rubber code	Shear modulus G_{eq} (N/mm²)	Equivalent damping ratio H_{eq}
X3R	X0.3R	0.300	0.17
X4S	X0.4S	0.392	0.24
X6R	X0.6R	0.620	0.24

Composition of rubber materials (weight ratio %)

Rubber code		Natural rubber Synthetic rubber	Filler, Reinforcement agent	Vulcanization agent and others
Inner Rubber	X0.3R	35 and above	15 and above	50 and below
	X0.4S	35 and above	20 and above	45 and below
	X0.6R	35 and above	25 and above	40 and below
Cover rubber		40 and above	15 and above	40 and below

Properties of rubber materials

Item		Tensile strength (N/mm²)	Elongation at Break (%)	Hardness (JIS A)	100% modulus (N/mm²)	Young's modulus E (N/mm²)	Bulk modulus E_∞ (N/mm²)	Correction factor for apparent Young's modulus according to hardness, k
Test Standard		JIS K6251	JIS K6251	JIS K6253	JIS K6251	–	–	–
Inner Rubber	X0.3R	7 and above	700 and above	34 ± 8	0.53 ± 0.2	4.0	1150	1.0
	X0.4S	7 and above	840 and above	37 ± 8	0.43 ± 0.2	6.2	1300	1.0
	X0.6R	8.5 and above	780 and above	53 ± 5	0.73 ± 0.2	7.6	1500	1.0
Cover rubber		12 and above	600 and above	–	–			

●Steel Material

Steel material for each part

	Material
Reinforced steel plate	SS400 (JIS G 3101)
Flange*1*2	SS400 (JIS G 3101)
Connecting plate*1	SS400 (JIS G 3101)

*1: Optionally SM490A (JIS G 3106).
*2: Optionally special thickness other than standard thickness.

Anti-rust treatment of flange

Preparation	Remove rust up to blasting quality of SSPC-SP-10 (SIS Sa 2 1/2)
Primer	Zinc-rich paint 75μm × 1 coat
Middle coat	Epoxy resin paint 60μm × 1 coat
Finishing	Epoxy resin paint 35μm × 1 coat
Total film thickness	170μm and above

*1: Standard color is gray.
*2: Other kinds of anti-rust treatment are also available. Please contact us for more details.

●Precautions

- For mid-storey isolation, fire resistant cover is necessary (according to JSSI provision, HS110X4S cannot apply any fire resistant cover). Please contact fire resistant cover manufacturer who are listed in the JSSI manufacturer list for more details. (http://www.jssi.or.jp/bussiness/kigyou_detail/to-si-base.htm)
- There are two certification numbers for X0.4S, X0.6R due to difference of some manufacturing process. Although their properties values are the same, please fill the certification number as shown in the table on the right in the design documents.

	Rubber size Ø1000 and below	Rubber size Ø1100 and above
X0.4S	Both MVBR-0510/MVBR-0519	MVBR-0510 only
X0.6R	Both MVBR-0514/MVBR-0520	MVBR-0514 only

●Shear Properties

Equivalent shear stiffness K_{eq}, equivalent damping ratio H_{eq}, initial stiffness K_1, post-yield stiffness K_2, characteristic strength Q_d, Function giving ratio of characteristic strength to maximum shear force of a loop u

Shear properties of HDR is dependent on shear strain amplitude. The shear strain dependency of each property is expressed by the following equations.

●Rubber material X0.3R ($0.1 \leqq \gamma \leqq 3.0$)

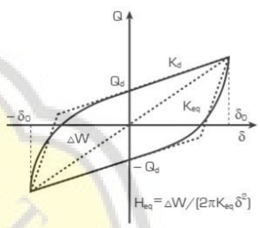
$$G_{eq}(\gamma) = 0.0255\gamma^4 - 0.2213\gamma^3 + 0.7283\gamma^2 - 1.1028\gamma + 0.8703$$
$$H_{eq}(\gamma) = -0.005\gamma^3 + 0.015\gamma^2 - 0.006\gamma + 0.166$$
$$u(\gamma) = -0.0087\gamma^3 + 0.0262\gamma^2 - 0.0105\gamma + 0.2720$$

●Rubber material X0.4S ($0.1 \leqq \gamma \leqq 2.7$)

$$G_{eq}(\gamma) = 0.054\gamma^4 - 0.416\gamma^3 + 1.192\gamma^2 - 1.583\gamma + 1.145$$
$$H_{eq}(\gamma) = -0.007\gamma^3 + 0.020\gamma^2 - 0.009\gamma + 0.236$$
$$u(\gamma) = -0.0132\gamma^3 + 0.0401\gamma^2 - 0.0190\gamma + 0.4001$$

●Rubber material X0.6R ($0.1 \leqq \gamma \leqq 2.7$)

$$G_{eq}(\gamma) = 0.620 \times (0.1364\gamma^4 - 1.016\gamma^3 + 2.903\gamma^2 - 3.878\gamma + 2.855)$$
$$H_{eq}(\gamma) = 0.240 \times (0.02902\gamma^3 - 0.1804\gamma^2 + 0.2364\gamma + 0.9150)$$
$$u(\gamma) = 0.408 \times (0.03421\gamma^3 - 0.2083\gamma^2 + 0.2711\gamma + 0.9028)$$



Based on above equations, each shear properties shall be determined by the following equations.

Equivalent shear stiffness : $K_{eq} = G_{eq} \cdot A/H$

Equivalent damping ratio : $H_{eq} = \Delta W/(2\pi \cdot K_{eq}\delta^2)$

Initial stiffness : $K_1 = 10 \times K_2$

Post-yield stiffness : $K_2 = K_{eq}(1-u)$

Characteristic strength : $Q_d = u \cdot K_{eq} \cdot H \cdot \gamma$

Temperature dependency

Each shear properties shall be corrected to the value at standard temperature of 20°C by the following equations.
(Applicable range: $-10 \leqq T \leqq 40$°C) (T : Temperature during inspection)

●Rubber material X0.3R

: K_{eq} (T°C) = K_{eq} (standard value at 20°C) × $(1.139 - 9.653 \times 10^{-3} \cdot T + 1.721 \times 10^{-4} \cdot T^2 - 1.847 \times 10^{-6} \cdot T^3)$

: H_{eq} (T°C) = H_{eq} (standard value at 20°C) × $(1.050 - 2.790 \times 10^{-3} \cdot T + 4.678 \times 10^{-5} \cdot T^2 - 1.613 \times 10^{-6} \cdot T^3)$

●Rubber material X0.4S/X0.6R

: K_{eq} (T°C) = K_{eq} (standard value at 20°C) × $(1.205 - 1.862 \times 10^{-2} \cdot T + 5.991 \times 10^{-4} \cdot T^2 - 8.991 \times 10^{-6} \cdot T^3)$

: H_{eq} (T°C) = H_{eq} (standard value at 20°C) × $(1.065 - 4.134 \times 10^{-3} \cdot T + 1.096 \times 10^{-4} \cdot T^2 - 3.102 \times 10^{-6} \cdot T^3)$

●Standard value of temperature dependency (Standard temperature (20°C))

Properties values	Equivalent shear stiffness K_{eq}				Equivalent damping ratio H_{eq}			
	−10°C	0°C	30°C	40°C	-10°C	0°C	30°C	40°C
X0.3R	within +25%	within +14%	within −5%	within −9%	within +8%	within +5%	within −4%	within −9%
X0.4S	within +46%	within +21%	within −6%	within −16%	within +12%	within +7%	within −4%	within −12%
X0.6R	within +46%	within +21%	within −6%	within −16%	within +12%	within +7%	within −5%	within −13%

Performance variation

The rate of change of main causes (manufacturing variation, aging, temperature change) which affect shear properties as shown below.

Rubber materials		X0.3R		X0.4S		X0.6R	
		Equivalent shear stiffness, K_{eq}	Equivalent damping ratio, Heq Function giving ratio of characteristic strength to maximum shear force, u	Equivalent shear stiffness, K_{eq}	Equivalent damping ratio, Heq Function giving ratio of characteristic strength to maximum shear force, u	Equivalent shear stiffness, K_{eq}	Equivalent damping ratio, Heq Function giving ratio of characteristic strength to maximum shear force, u
Manufacturing variation*1		±10%	∓10%	±10%	∓10%	±10%	∓10%
Aging*2		+10%	−10%	+10%	−10%	+10%	−10%
Ambient temperature variation 20°C ± 20°C	(+) side	+14%	+5%	+21%	+7%	+21%	+7%
	(−) side	−9%	−9%	−16%	−12%	−16%	−13%
Total	(+) side*3	+34%	−15%	+41%	−13%	+41%	−13%
	(−) side*3	−19%	+1%	-26%	−2%	−26%	−3%

*1: The variation of each product (standard value) shall be within ±20% and variation of total units of products per project (total of standard values) shall be within ±10%. However, if the total units of products is less than 8 units per project, the variation (total of standard values) shall be within ±15%.
(For H_{eq}, $\Sigma(H_{eq} \times K_{eq}) / \Sigma K_{eq}$ shall be within ±15% from the standard value)
Note: For compressive stiffness Kv,variation of each product (standard value) shall be within ±30%.

*2: Predicted rate of change after 60 years at 20°C standard temperature.

*3: The equivalent shear stiffness Keq and equivalent damping ratio Heq is dependent to each other. The indicated rate of change of Heq are corresponding to both maximum and minimum rate of change of Keq respectively.

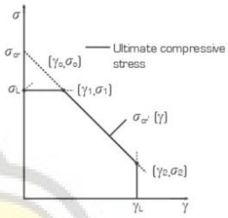
●Compressive Properties

Compressive stiffness K_V

●Compressive stiffness Kv is determined by the following equation.

$$Kv = Ec \cdot \frac{A}{H} \qquad Ec = \frac{E(1+2\kappa S_1^2)}{1+E(1+2\kappa S_1^2)/E_\infty}$$

Ultimate compressive stress



●Critical stress σ_{cr} at zero shear strain is determined by the following equation.

$$\sigma_{cr} = \alpha_c \cdot \frac{\pi}{4} (G_{eq} \cdot E_b)^{0.5} \cdot S_2$$

However, $E_b = E_{cr} (1 + 2/3 \cdot \kappa \cdot S_1^2) / \{1 + E_{cr} (1 + 2/3 \cdot \kappa \cdot S_1^2) / E_\infty\}$

(Note) S_1 is defined as 35.0 (for X0.4S, X0.6R) and 28.0 (for X0.3R) as standard value.

α_c : Correction factor determined from our test data

Rubber material X0.3R : $\alpha_c = 1.0$ (if $S_2 \geqq 5$) $\alpha_c = (1 - 0.2 (5 - S_2))$ (if $5 > S_2$)

Rubber material X0.4S : $\alpha_c = 0.88$ (if $S_2 \geqq 5$) $\alpha_c = 0.88 (1 - 0.07 (5 - S_2))$ (if $5 > S_2$)

Rubber material X0.6R : $\alpha_c = 1.45$ (if $S_2 \geqq 5$) $\alpha_c = 1.45 - 0.3 (5 - S_2)$ (if $5 > S_2$)

$E_{CR} = 3 \times G_{eq}$ (for X0.4S, X0.6R) $E_{CR} = 2.2$ (for X0.3R)

●Ultimate compressive stress at any shear strain $\sigma_{cr}'(\gamma)$ is determined by σ_{cr} by the following equation.

$$\sigma_{cr}'(\gamma) = \sigma_{cr} \cdot (1 - \frac{\gamma}{S_2})$$

●The ultimate compressive stress shall not exceed the upper limit σ_L determined as below and the strain region corresponding to the ultimate strain γ_L at 0 compressive stress.

Rubber material X0.3R : $\sigma_L = 40$ (if $S_2 \geqq 5.0$) $\sigma_L = 40 + 10 (S_2 - 5)$ ($5.0 > S_2 \geqq 3.0$)
γ_L is defined as minimum value among ⌈400%⌋, ⌈$S_2 \times 0.9 \times 100\%$⌋, ⌈$(5.80 \times S_2 + 7.10)/(S_2 + 3.45) \times 100\%$⌋

Rubber material X0.4S : $\sigma_L = 45$ (if $S_2 \geqq 4.9$) $\sigma_L = 45 + 10 (S_2 - 5)$ (if $4.9 > S_2 \geqq 4.0$) $\sigma_L = 40 + 10 (S_2 - 5)$ (if $4.0 > S_2 \geqq 3.0$)
γ_L is defined as minimum value among ⌈400%⌋, ⌈$S_2 \times 0.9 \times 100\%$⌋, ⌈$(5.80 \times S_2 + 9.05)/(S_2 + 4.49) \times 100\%$⌋

Rubber material X0.6R : $\sigma_L = 60$ (if $S_2 \geqq 4.9$) $\sigma_L = 48 + 14 (S_2 - 4)$ (if $4.9 > S_2 \geqq 4.0$)
$\sigma_L = 24 + 24 (S_2 - 3)$ (if $4.0 > S_2 \geqq 3.5$) $\sigma_L = 22 + 28 (S_2 - 3)$ (if $3.5 > S_2 \geqq 3.0$)
γ_L is defined as minimum value among ⌈400%⌋, ⌈$S_2 \times 0.9 \times 100\%$⌋, ⌈$(5.00 \times S_2 + 9.05)/(S_2 + 4.49) \times 100\%$⌋

Specification of flange (edge thickness / center thickness)

Outer diameter of rubber bearing (Ø)※1	(600)	(650)	700	750	800	850	900	950	1000	1100	1200	1300
Standard thickness	22/28	22/28	22/28	22/28	24/32	24/32	28/36	28/36	28/36	30/38	32/40	32/40
Special thickness (option)	(26/32)	(26/32)	26/32	30/36	32/40	32/40	37/45	37/45	42/50	42/50	42/50	42/50

※1 For adoption of special thickness in regard to those sizes that stated in the ( ), delivery time will be longer due to mold preparation.
※2 For Ø 1400 and above, assembled type flange will be used.
※3 Compared to the standard spefication, total height & weight of product for special thickness will be changed.

MVBR-0514/MVBR-0520 (X0.6R)

Note: There are 2 certification numbers due to difference of some manufacturing process.
Please refer to "Precautions" in page 6 for the certificate number that used for design document.

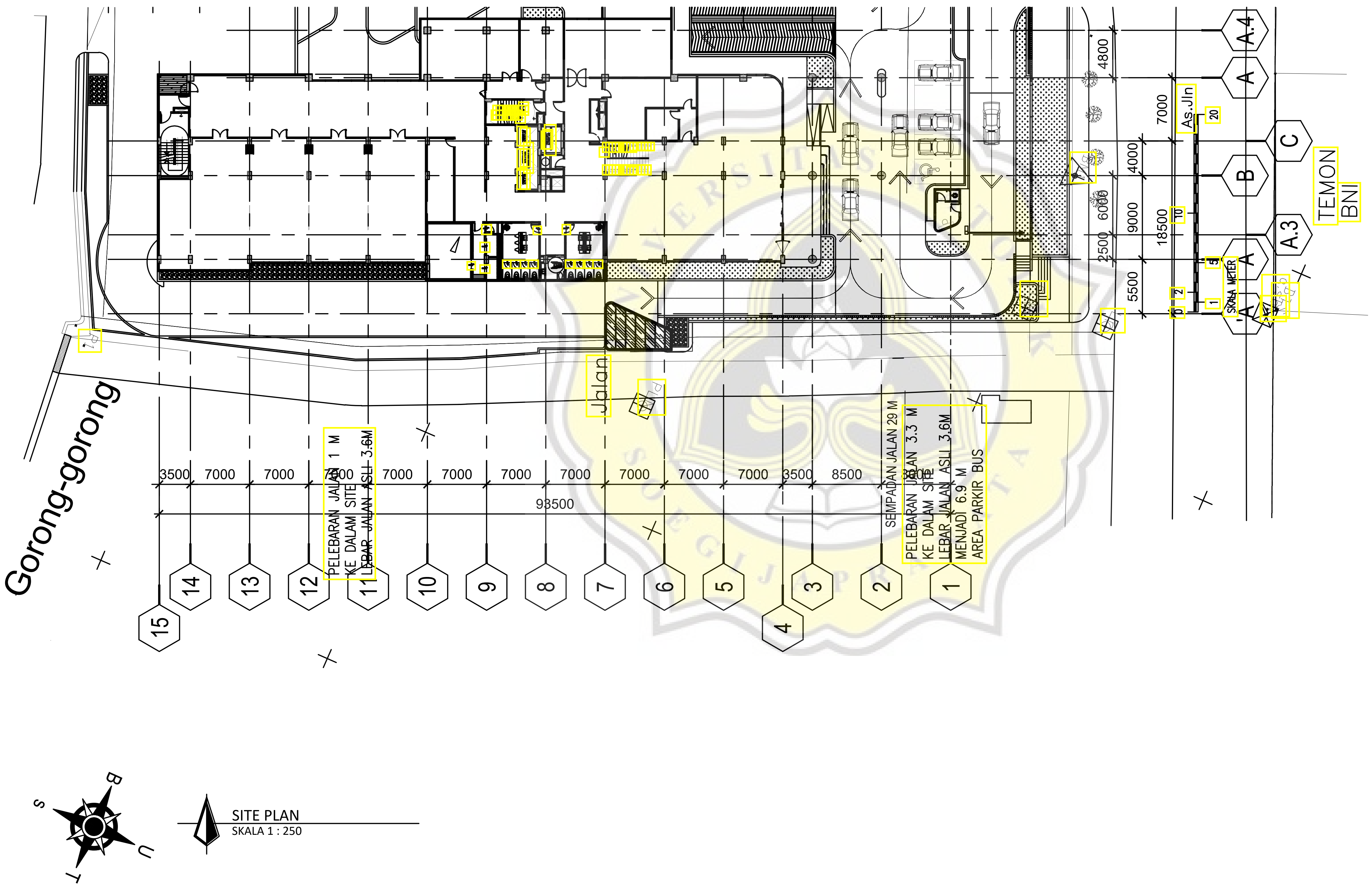
Code

Compound name	Rubber code	Shear modulus (N/mm²)	Equivalent damping ratio
X6R	X0.6R	0.620	0.240

●HH Series (Total Rubber Thickness 20cm)

Characteristics			HH060X6R	HH065X6R	HH070X6R	HH075X6R	HH080X6R	HH085X6R	HH090X6R	HH095X6R	HH100X6R	HH110X6R	HH120X6R	HH130X6R	HH140X6R	HH150X6R	HH160X6R
Physical Dimensions	Outer diameter	(mm)	600	650	700	750	800	850	900	950	1000	1100	1200	1300	1400	1500	1600
	Inner diameter	(mm)	15	15	15	15	20	20	20	20	25	55	55	55	65	65	80
	Effective plane area	(×10² mm²)	2826	3317	3847	4416	5023	5671	6359	7085	7849	9480	11286	13249	15361	17638	20056
	Thickness of one rubber layer	(mm)	4.0	4.4	4.7	5.0	5.4	5.7	6.0	6.4	6.7	7.4	8.0	8.7	9.5	10.0	10.4
	Number of rubber layers	(–)	50	45	43	40	37	35	33	31	30	27	25	23	21	20	19
	Total rubber thickness	(mm)	200	198	202	200	200	200	198	198	201	200	200	200	200	200	198
	First shape factor	(–)	36.6	36.1	36.4	36.8	36.1	36.4	36.7	36.3	36.4	35.3	35.8	35.8	35.1	35.9	36.5
	Second shape factor	(–)	3.00	3.28	3.46	3.75	4.00	4.26	4.55	4.79	4.98	5.51	6.00	6.50	7.02	7.50	8.10
	Diameter of flange	(mm)	900	950	1000	1100	1150	1200	1250	1300	1400	1500	1600	1700	1800	1900	2000
	Thickness of flange※1 (edge/center)	(mm)	22/28	22/28	22/28	22/28	24/32	24/32	28/36	28/36	28/36	30/38	32/40	32/40	37/45	42/50	50/110
	Connecting bolt PCD	(mm)	775	825	875	950	1000	1050	1100	1150	1250	1350	1450	1550	1650	1750	1800
	Diameter of connecting bolt hole × qty	(mm)	Ø33×12	Ø33×12	Ø33×12	Ø33×12	Ø33×12	Ø33×12	Ø33×12	Ø33×12	Ø39×12	Ø39×12	Ø39×12	Ø39×12	Ø42×12	Ø42×16	Ø45×12
	Bolt size (assumption)	(–)	M30	M30	M30	M30	M30	M30	M30	M30	M36	M36	M36	M36	M39	M39	M42
	Thickness of each reinforced steel plate	(mm)	3.1	3.1	3.1	3.1	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	5.8	5.8	5.8
	Total height	(mm)	**407.9**	**390.4**	**388.3**	**376.9**	**422.2**	**413.1**	**410.8**	**402.4**	**400.6**	**390.2**	**385.6**	**376.9**	**405.5**	**410.2**	**522.0**
	Total weight	(tonf)	**0.66**	**0.72**	**0.80**	**0.90**	**1.21**	**1.31**	**1.49**	**1.59**	**1.77**	**2.05**	**2.38**	**2.65**	**3.46**	**4.05**	**6.64**
	Total weight	(kN)	**6.5**	**7.0**	**7.9**	**8.9**	**11.9**	**12.9**	**14.6**	**15.6**	**17.3**	**20.1**	**23.3**	**26.0**	**33.9**	**39.7**	**65.1**
Compression Properties	Critical stress (N/mm²)	σ_{cr} when $\gamma = 0$	43	52	58	69	78	89	102	113	122	136	148	160	173	185	200
	Ultimate compressive stress (N/mm²)	(γ_0, σ_0)	(0.22)	(0.30)	(0.35)	(0.42)	(0.48)	(0.52)	(0.56)	(0.59)	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)
		(γ_1, σ_1)	(1.5,22)	(1.4,30)	(1.4,35)	(1.5,42)	(1.6,48)	(1.8,52)	(2.1,56)	(2.3,59)	(2.5,60)	(3.1,60)	(3.6,60)	(3.8,60)	(3.8,60)	(3.9,60)	(3.9,60)
		(γ_2, σ_2)	(2.7,4)	(3.0,5)	(3.1,6)	(3.4,7)	(3.4,11)	(3.5,17)	(3.5,23)	(3.6,29)	(3.6,34)	(3.7,46)	(3.7,56)	–	–	–	–
	Compressive stiffness	(×10³kN/m)	1970	2340	2660	3090	3510	3970	4490	4980	5450	6590	7860	9220	10700	12300	14200
	Nominal long term compressive stress	(N/mm²)	6.6	8.1	9.1	10.7	12.0	13.4	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
	Nominal long term column load	(kN)	1860	2690	3500	4710	6050	7620	9540	10600	11800	14200	16900	19900	23000	26500	30100
	Allowable tensile stress (γ = 100%)	(N/mm²)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Shear Properties (γ = 100%)	Initial stiffness	(×10³kN/m)	5.19	6.15	6.99	8.10	9.23	10.4	11.8	13.1	14.3	17.4	20.7	24.3	28.3	32.4	37.3
	Post yield stiffness (γ = 100%)	(×10³kN/m)	0.519	0.615	0.699	0.810	0.923	1.04	1.18	1.31	1.43	1.74	2.07	2.43	2.83	3.24	3.73
	Characteristic Strength	(kN)	71.5	83.9	97.3	112	127	143	161	179	199	240	285	335	389	446	507
	Equivalent shear stiffness	(×10³kN/m)	0.876	1.04	1.18	1.37	1.56	1.76	1.99	2.21	2.42	2.94	3.50	4.11	4.77	5.47	6.29
	Equivalent damping ratio	(–)	0.240	0.240	0.240	0.240	0.240	0.240	0.240	0.240	0.240	0.240	0.240	0.240	0.240	0.240	0.240

※1 Special thickness for flange is available. Please refer to the table above for more details.



SITE PLAN
SKALA 1 : 250

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Jl. Pawiyatan Luhur IV/1 Bendan Dhuwur
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JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS
Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
SITE PLAN	1:250

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
FRIEDRICH ADESCANIUS S	17.B1.0122

DIPERIKSA OLEH :	TANDA TANGAN
Ir. David Widianto, M.T	
Daniel Hartanto, ST.,MT.	

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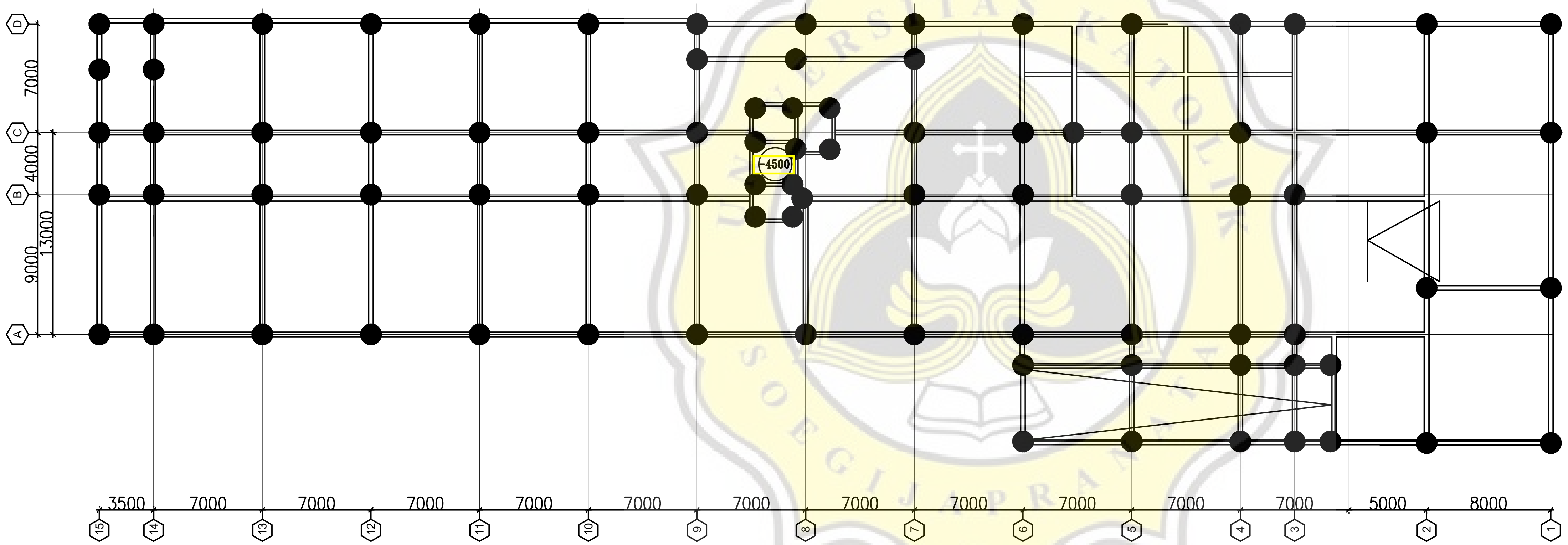
L- 14



DENAH BASE ISOLATOR
SKALA 1 : 250

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JUDUL GAMBAR	SKALA
DENAH BASE ISOLATOR	1:250

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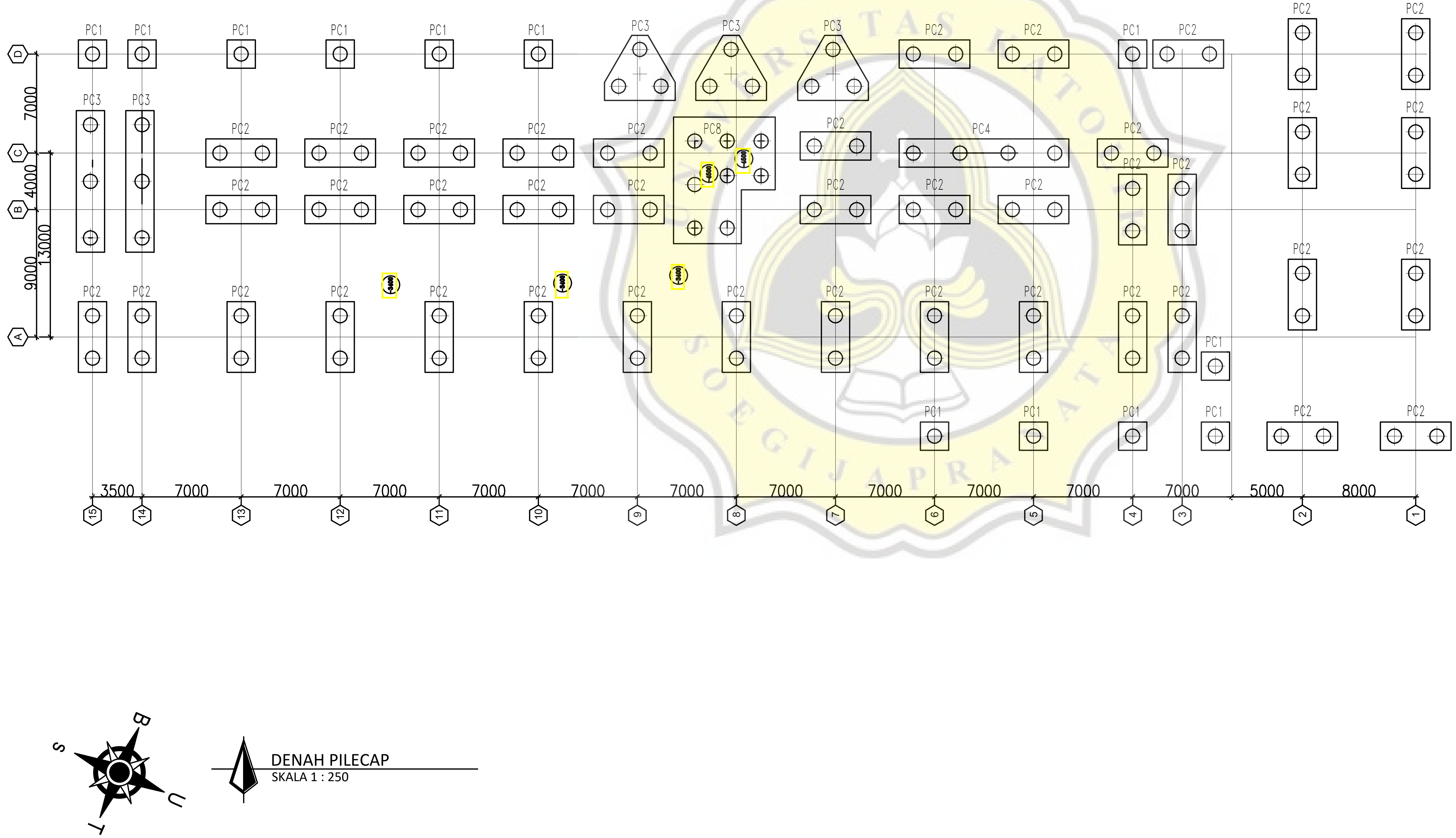

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PROYEK
PEMBANGUNAN HOTEL IBIS

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JUDUL GAMBAR	SKALA
DENAH PILECAP	1:250

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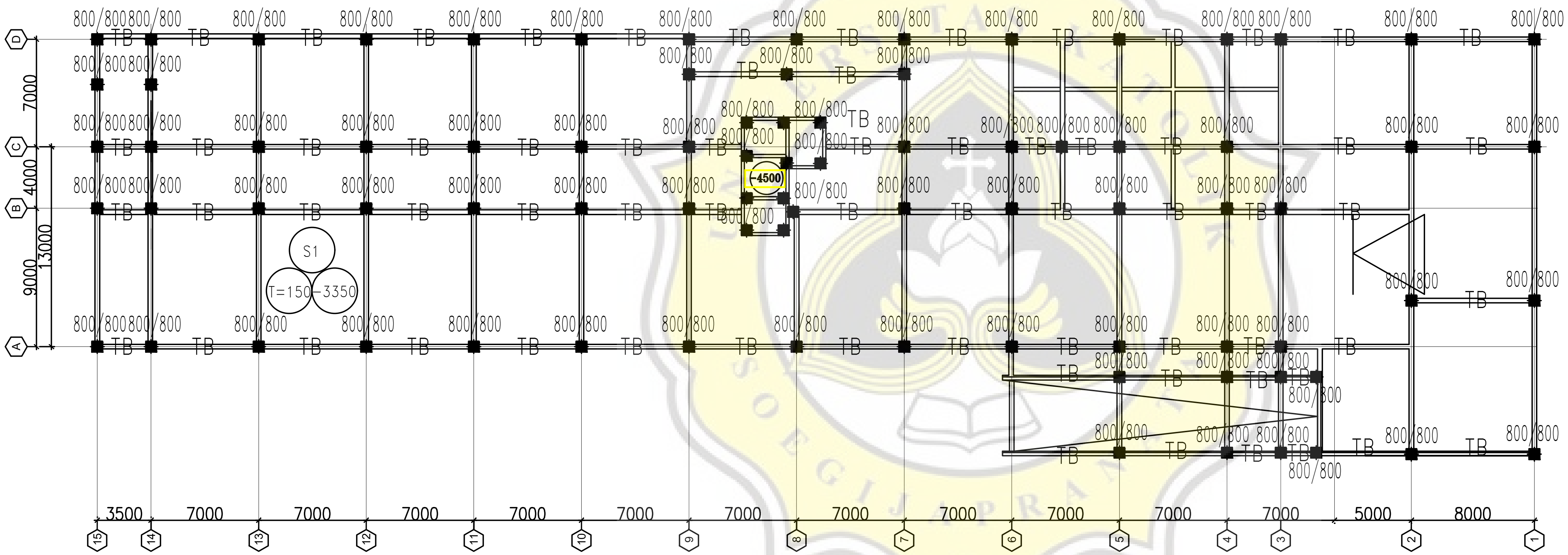
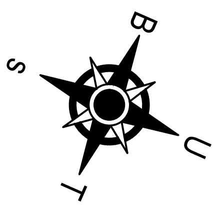
L- 16





DENAH LANTAI PARKIR
SKALA 1 : 250

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JUDUL PEKERJAAN

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Jalan Raya Yogyakarta-Purworejo
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JUDUL GAMBAR	SKALA
DENAH LANTAI PARKIR	1:250

DIGAMBAR OLEH :

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FRIEDRICH ADESCANIUS S	17.B1.0122

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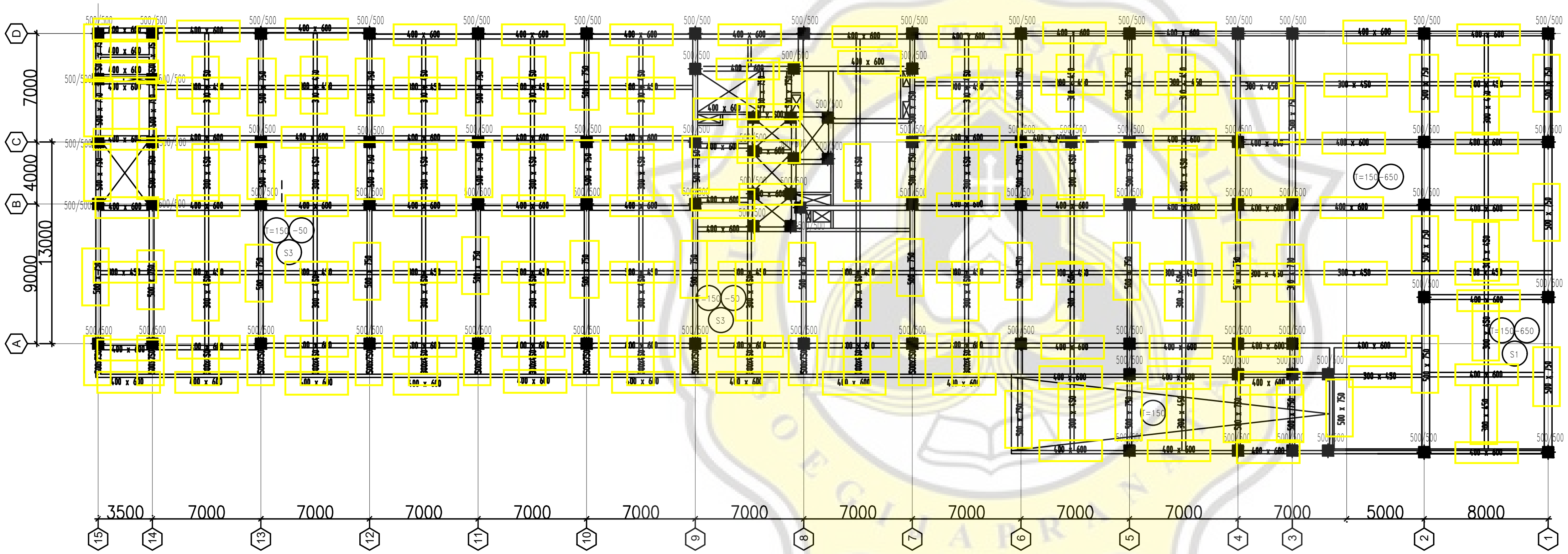

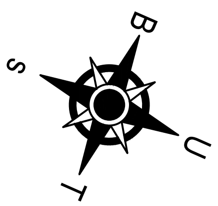

DENAH GROUND FLOOR

SKALA 1 : 250

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JUDUL PEKERJAAN

PROYEK
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JUDUL GAMBAR	SKALA
DENAH GROUND FLOOR	1:250

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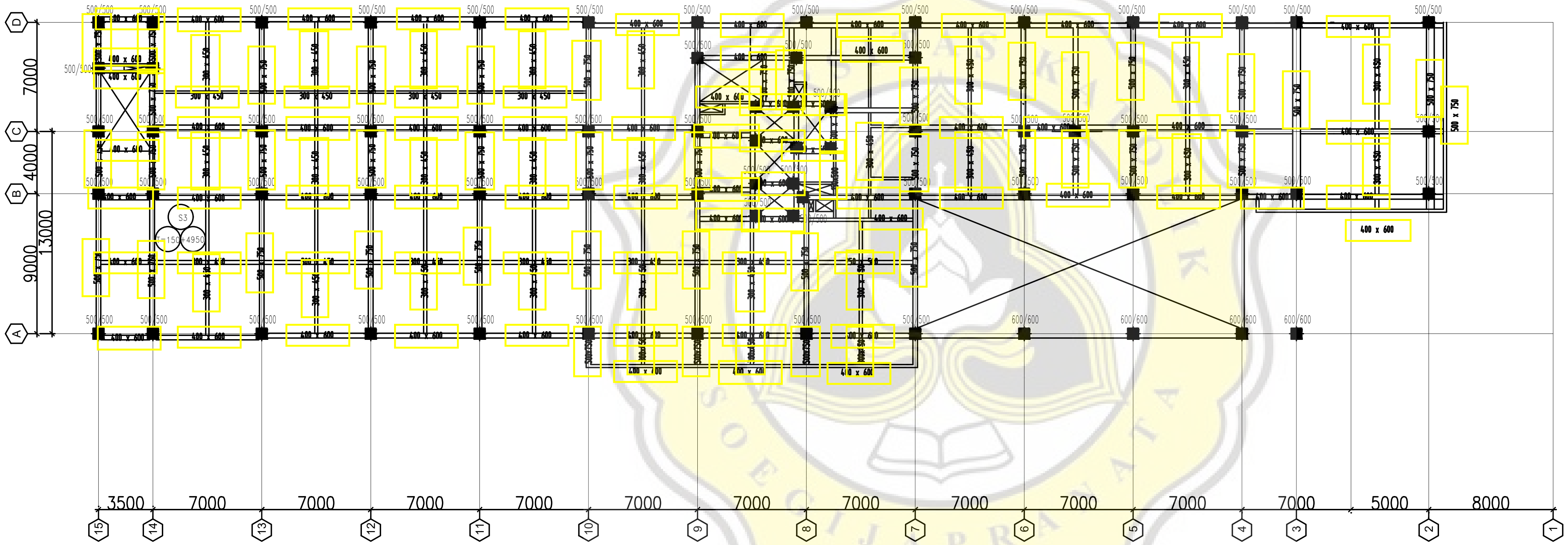

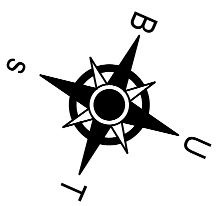

DENAH LANTAI 1
SKALA 1 : 250

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JUDUL GAMBAR	SKALA
DENAH LANTAI 1	1:250

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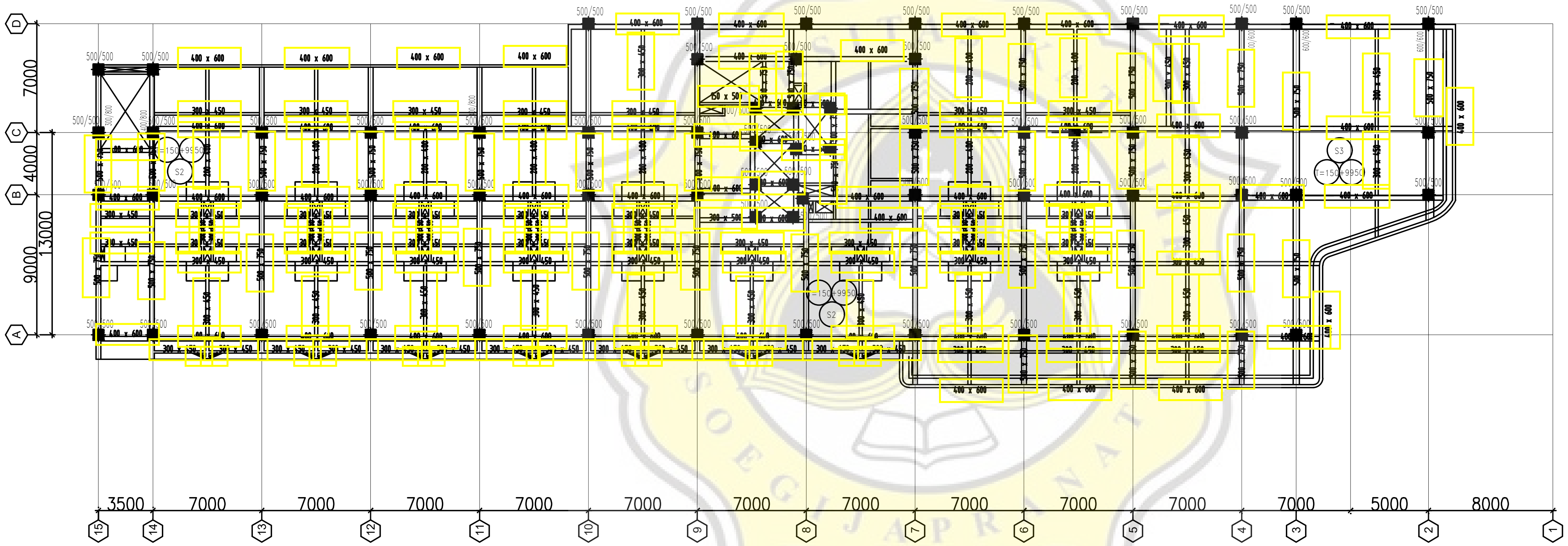

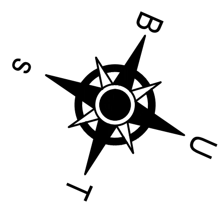

DENAH LANTAI 2
SKALA 1 : 250

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JUDUL PEKERJAAN

PROYEK
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Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
DENAH LANTAI 2	1:250

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
FRIEDRICH ADESCANIUS S	17.B1.0122

DIPERIKSA OLEH :	TANDA TANGAN
Ir. David Widianto, M.T	
Daniel Hartanto, ST.,MT.	

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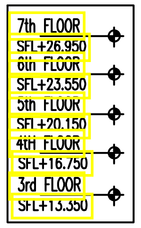
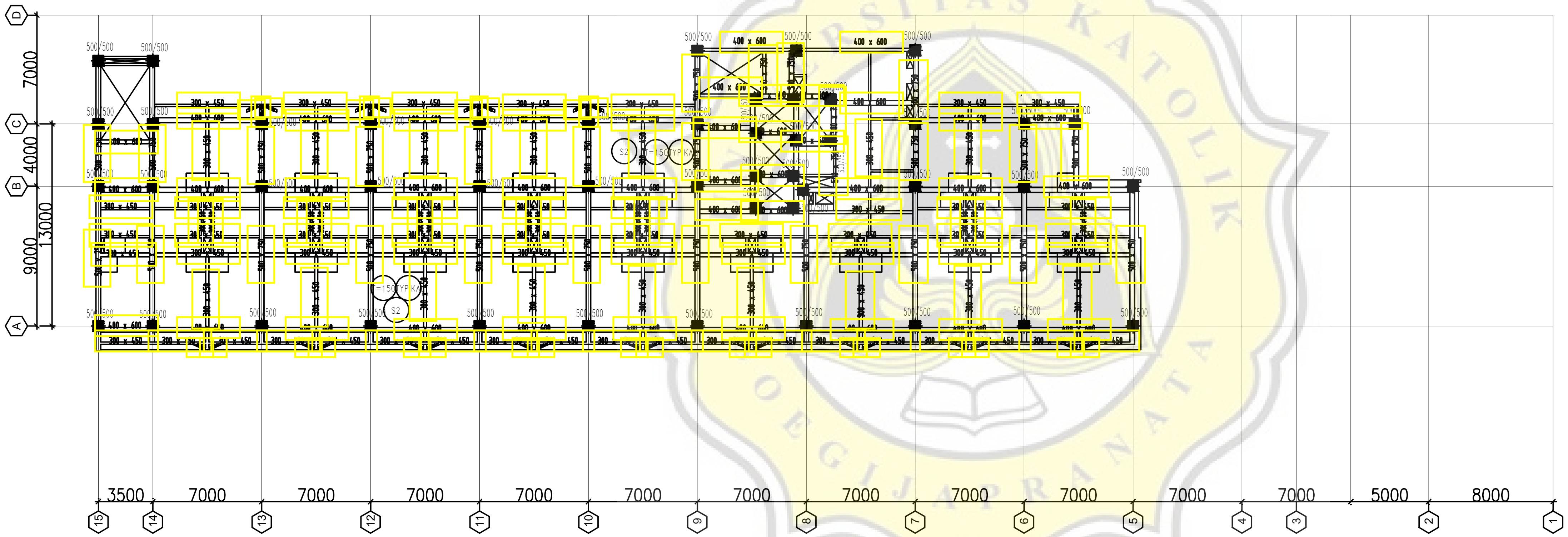
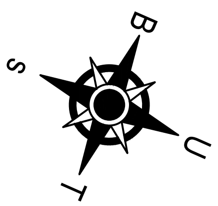
LEMBAR

L- 20







DENAH LANTAI 3-8
SKALA 1 : 250

UNIKA SOEGIJAPRANATA
Jl. Pawiyatan Luhur IV/1 Bendan Dhuwur
Telp. 024-8441555 , Semarang 50234

JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS
Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
DENAH LANTAI 3-8	1:250

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
FRIEDRICH ADESCANIUS S	17.B1.0122

DIPERIKSA OLEH :	TANDA TANGAN
Ir. David Widianto, M.T	
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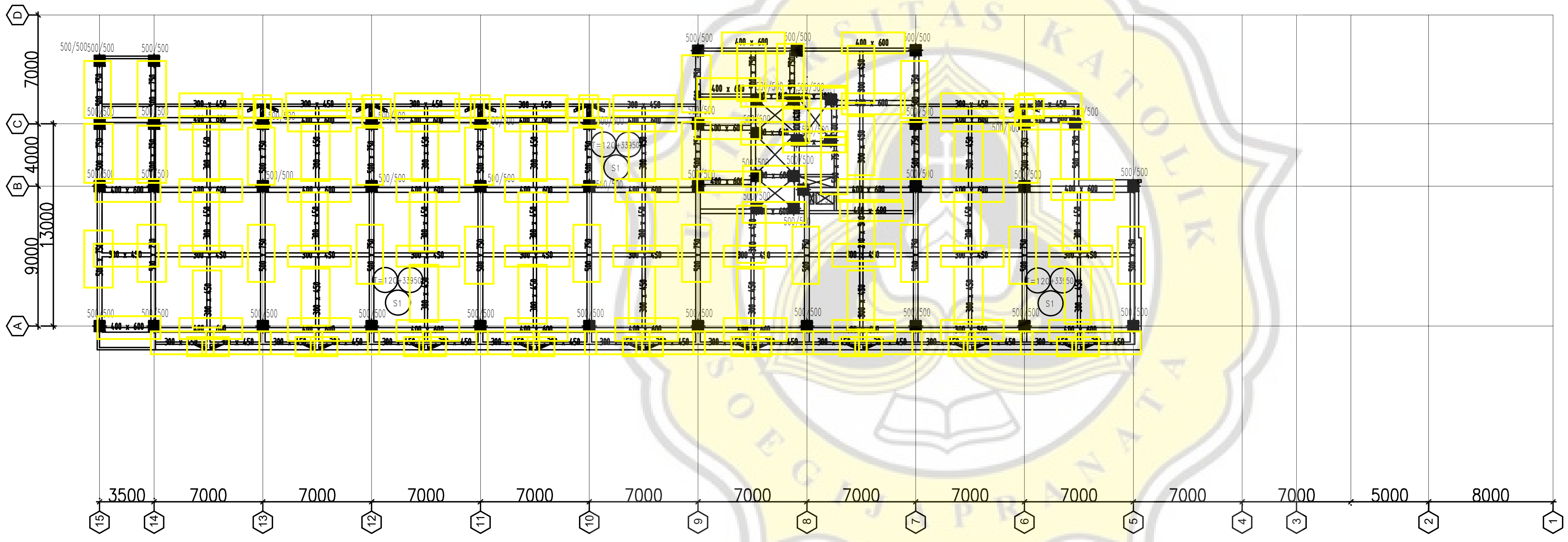

DENAH LANTAI ATAP
SKALA 1 : 250

UNIKA SOEGIJAPRANATA
Jl. Pawiyatan Luhur IV/1 Bendan Dhuwur
Telp. 024-8441555 , Semarang 50234

JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS
Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
DENAH LANTAI ATAP	1:250

DIGAMBAR OLEH :

TAVIO FORTINO T 17.B1.0047
FRIEDRICH ADESCANIUS S 17.B1.0122

DIPERIKSA OLEH :	TANDA TANGAN
Ir. David Widianto, M.T	
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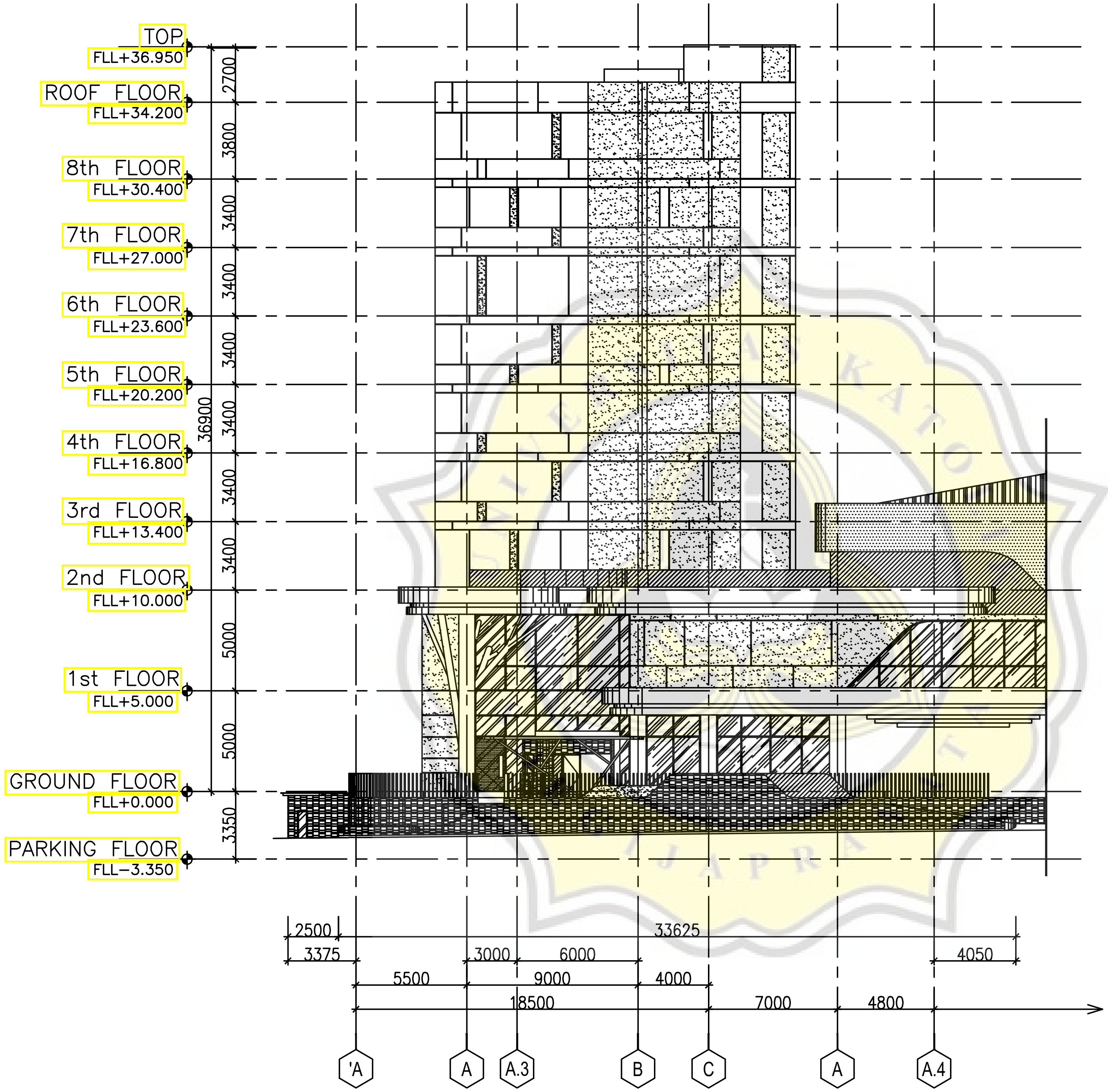
LEMBAR

L- 22



TAMPAK DEPAN

SKALA 1 : 200

UNIKA SOEGIJAPRANATA

Jl. Pawiyatan Luhur IV/1 Bendan Dhuwur

Telp. 024-8441555 , Semarang 50234

JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS

Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
TAMPAK DEPAN	1:200

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
FRIEDRICH ADESCANIUS S	17.B1.0122

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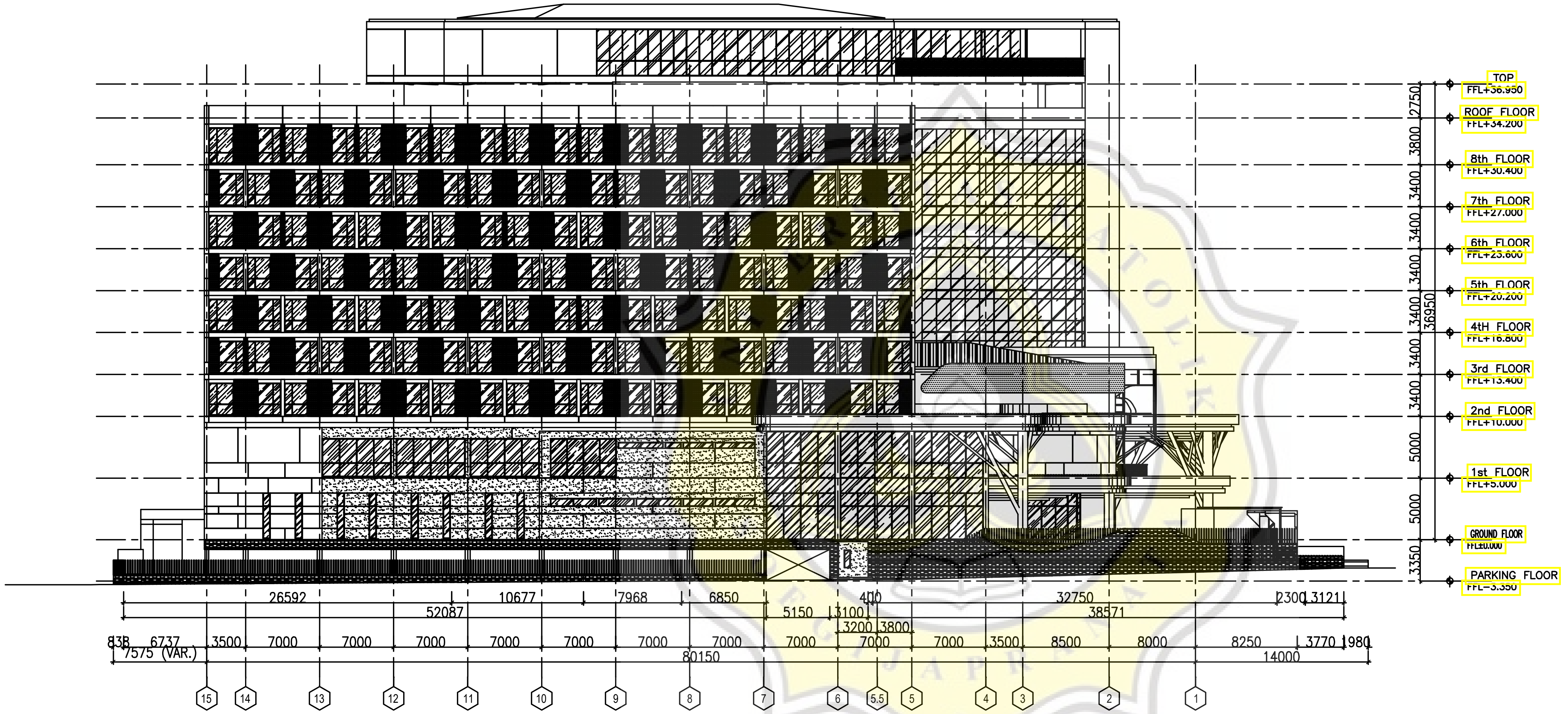

TAMPAK SAMPING
SKALA 1 : 200

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Jl. Pawiyatan Luhur IV/1 Bendan Dhuwur
Telp. 024-8441555 , Semarang 50234

JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS
Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
TAMPAK SAMPING	1:200

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
FRIEDRICH ADESCANIUS S	17.B1.0122

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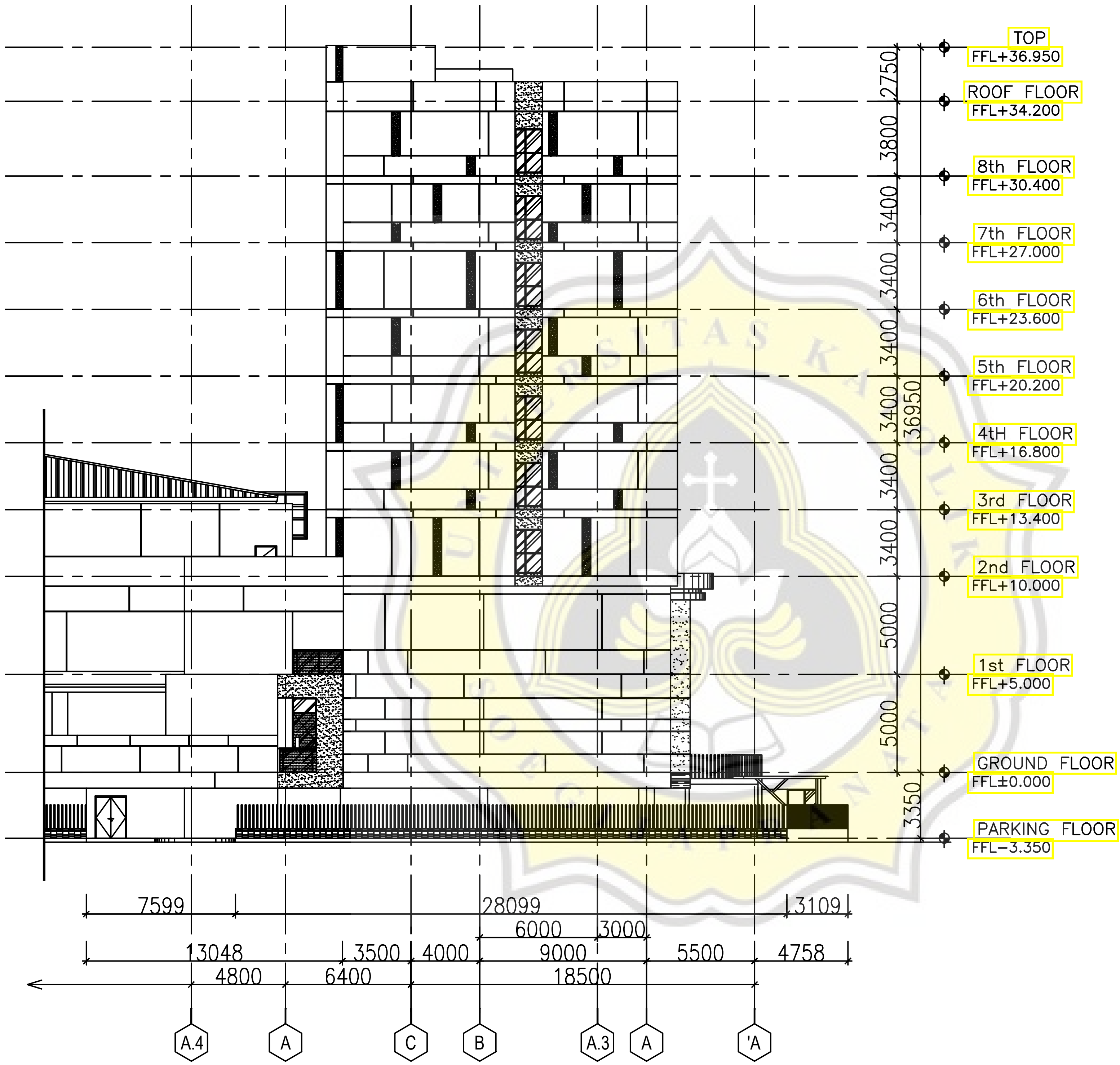

TAMPAK BELAKANG
SKALA 1 : 200

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JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS
Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
TAMPAK BELAKANG	1:200

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
FRIEDRICH ADESCANIUS S	17.B1.0122

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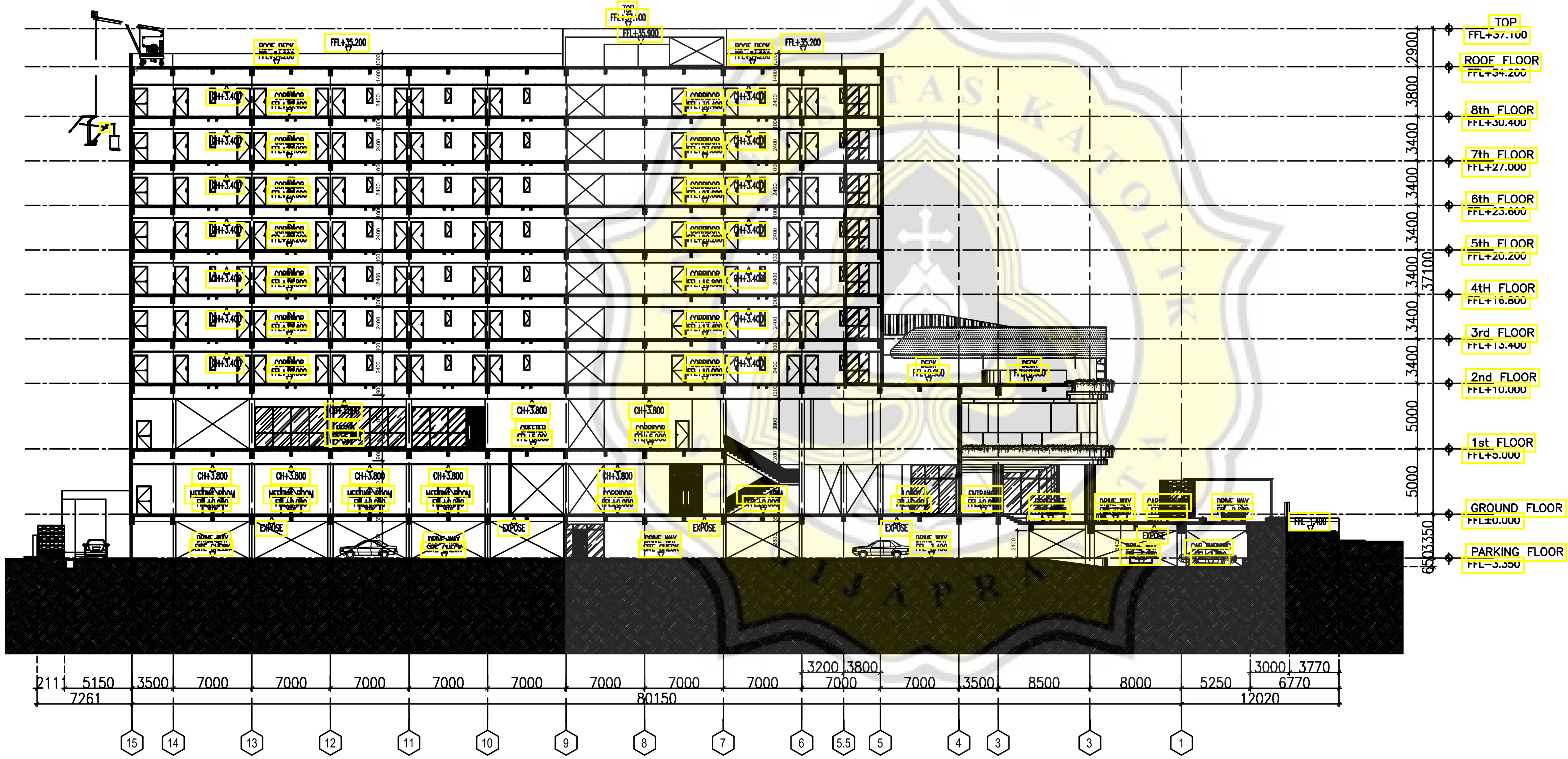

POTONGAN A-A
SKALA 1 : 200

UNIKA SOEGIJAPRANATA
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JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS
Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
POTONGAN A-A	1:200

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
FRIEDRICH ADESCANIUS S	17.B1.0122

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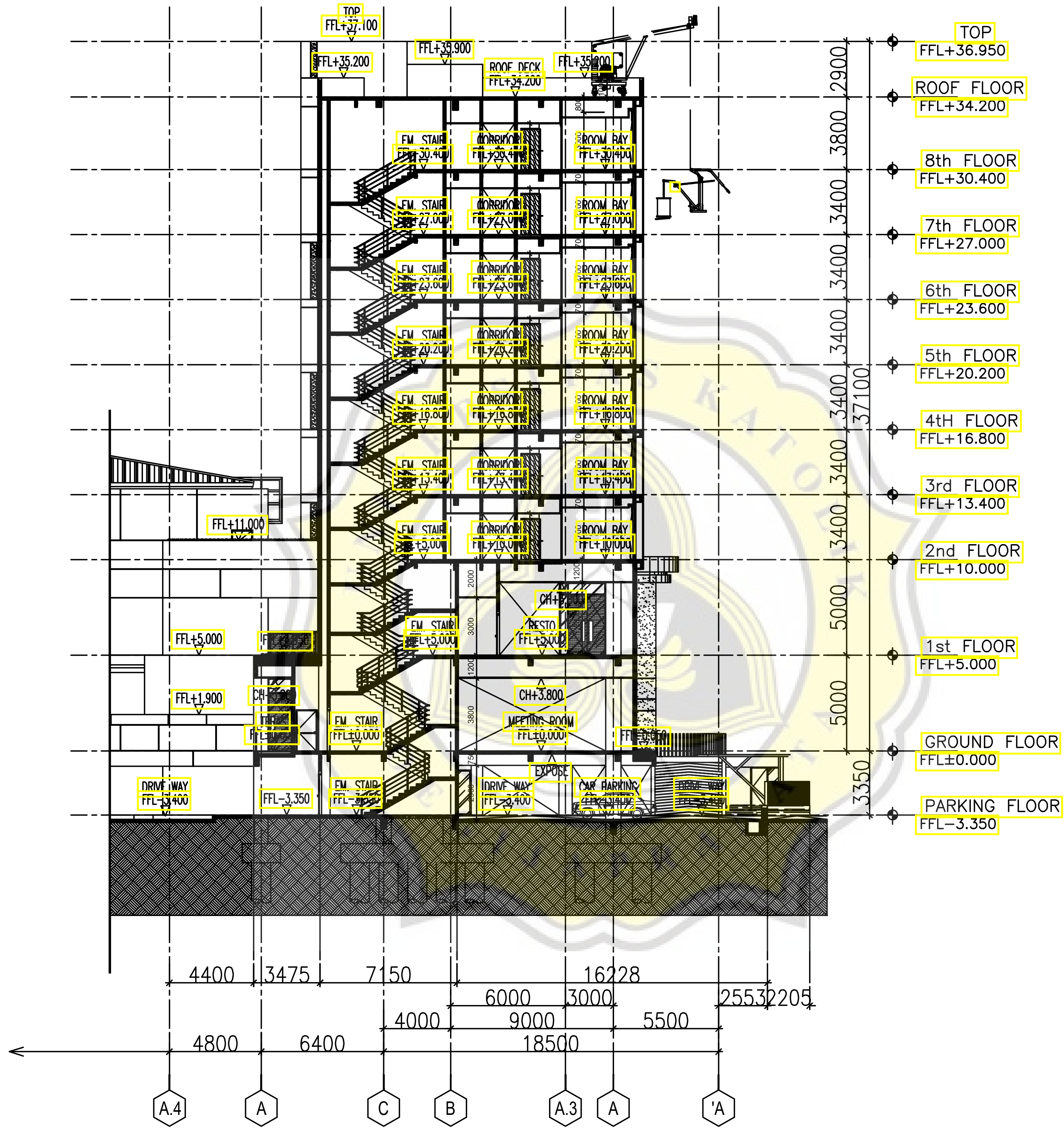
LEMBAR

L- 26



POTONGAN H-H
SKALA 1 : 200

UNIKA SOEGIJAPRANATA
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JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS
Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
POTONGAN H-H	1:200

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
FRIEDRICH ADESCANIUS S	17.B1.0122

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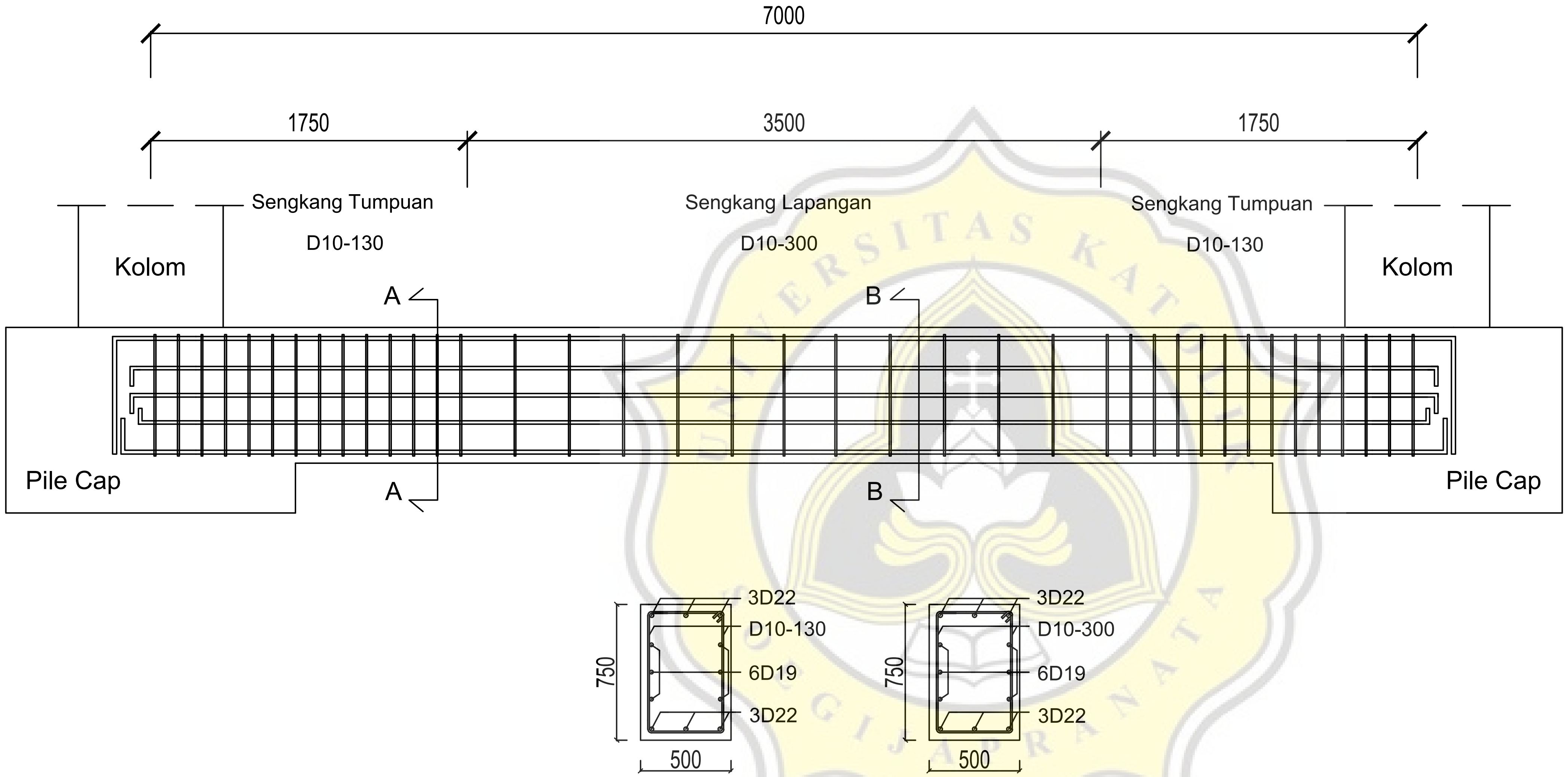
LEMBAR

L- 27



POT A-A
BALOK TUMPUAN

POT B-B
BALOK LAPANGAN

DETAIL TIEBEAM
SKALA 1 : 20

UNIKA SOEGIJAPRANATA
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Telp. 024-8441555 , Semarang 50234

JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS
Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
DETAIL TIEBEAM	1:20

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
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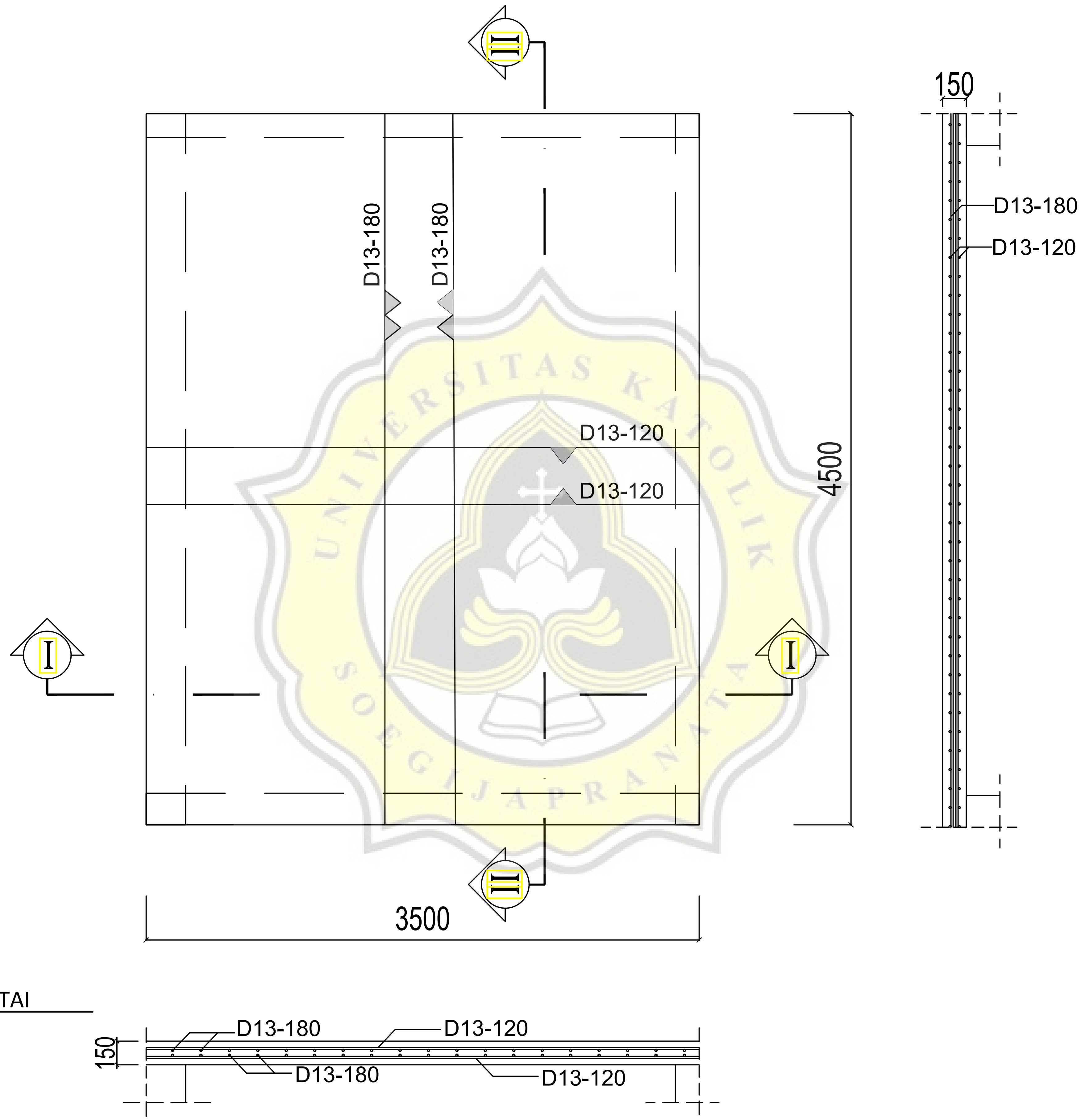
LEMBAR

L- 28



DETAIL PELAT LANTAI
SKALA 1 : 20

UNIKA SOEGIJAPRANATA
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JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS
Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
DETAIL PELAT LANTAI	1:20

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
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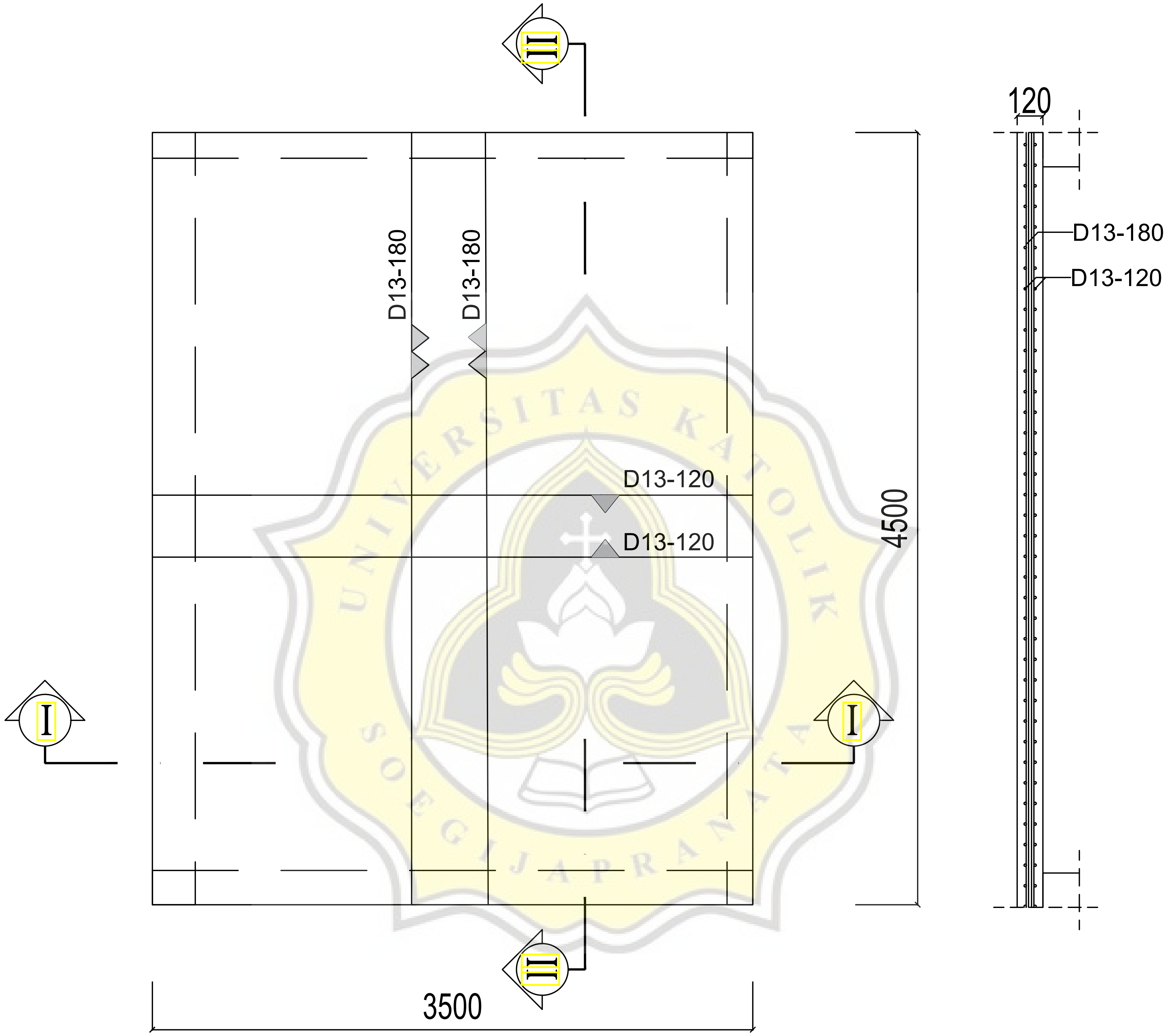
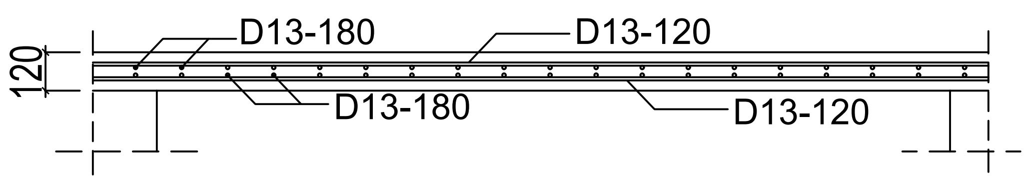
LEMBAR

L- 29



DETAIL PELAT ATAP
SKALA 1 : 20



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Telp. 024-8441555 , Semarang 50234

JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS
Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
DETAIL PELAT ATAP	1:20

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
FRIEDRICH ADESCANIUS S	17.B1.0122

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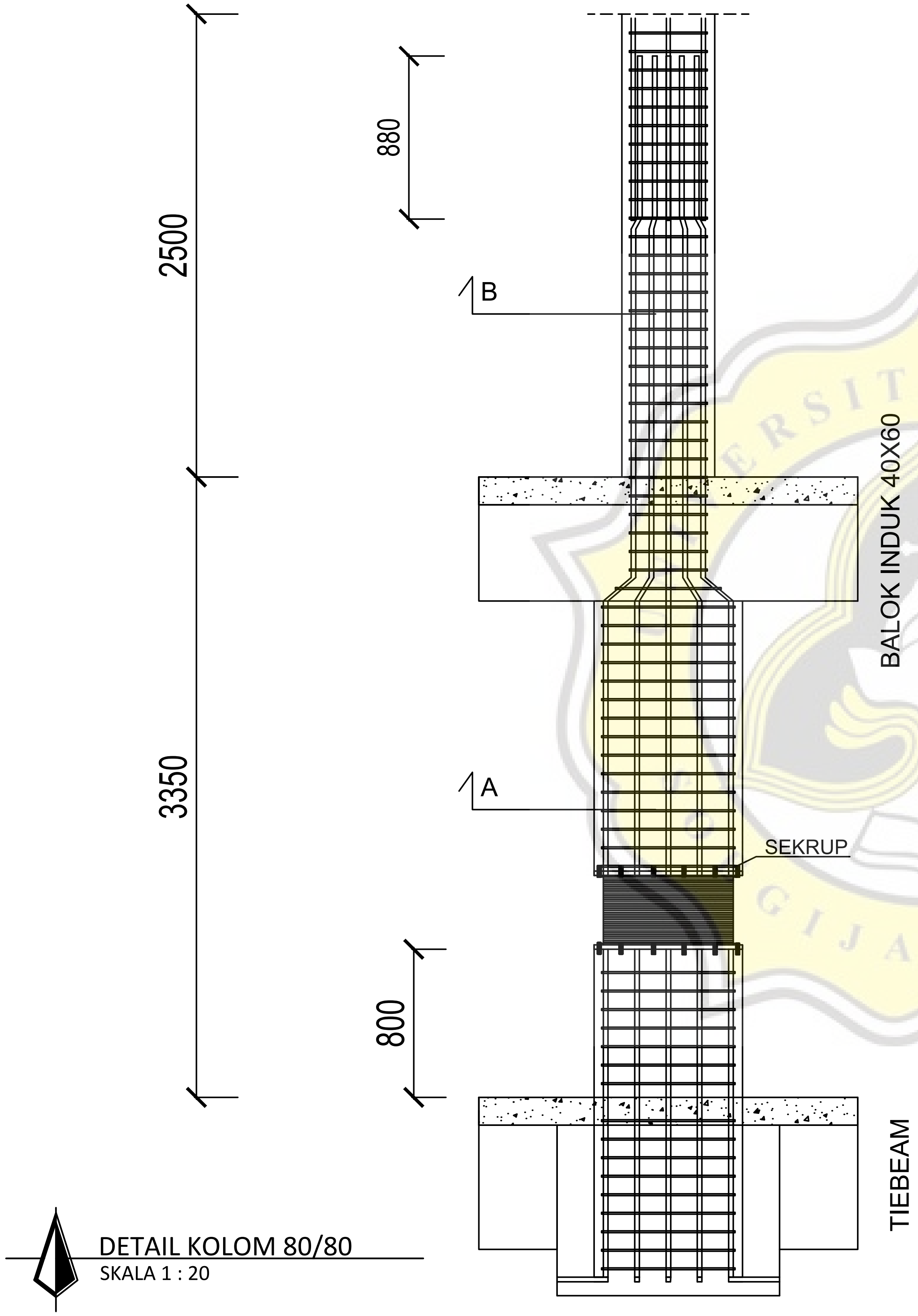
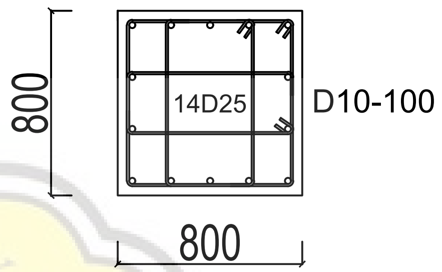
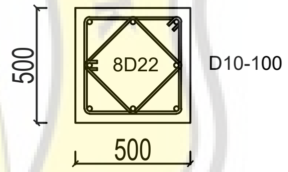
LEMBAR
L- 30



DETAIL KOLOM 80/80
SKALA 1 : 20



Potongan A-A



Potongan B-B

UNIKA SOEGIJAPRANATA
Jl. Pawiyatan Luhur IV/1 Bendan Dhuwur
Telp. 024-8441555 , Semarang 50234

JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS
Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
DENAH KOLOM 80/80	1:20

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
FRIEDRICH ADESCANIUS S	17.B1.0122

DIPERIKSA OLEH :	TANDA TANGAN
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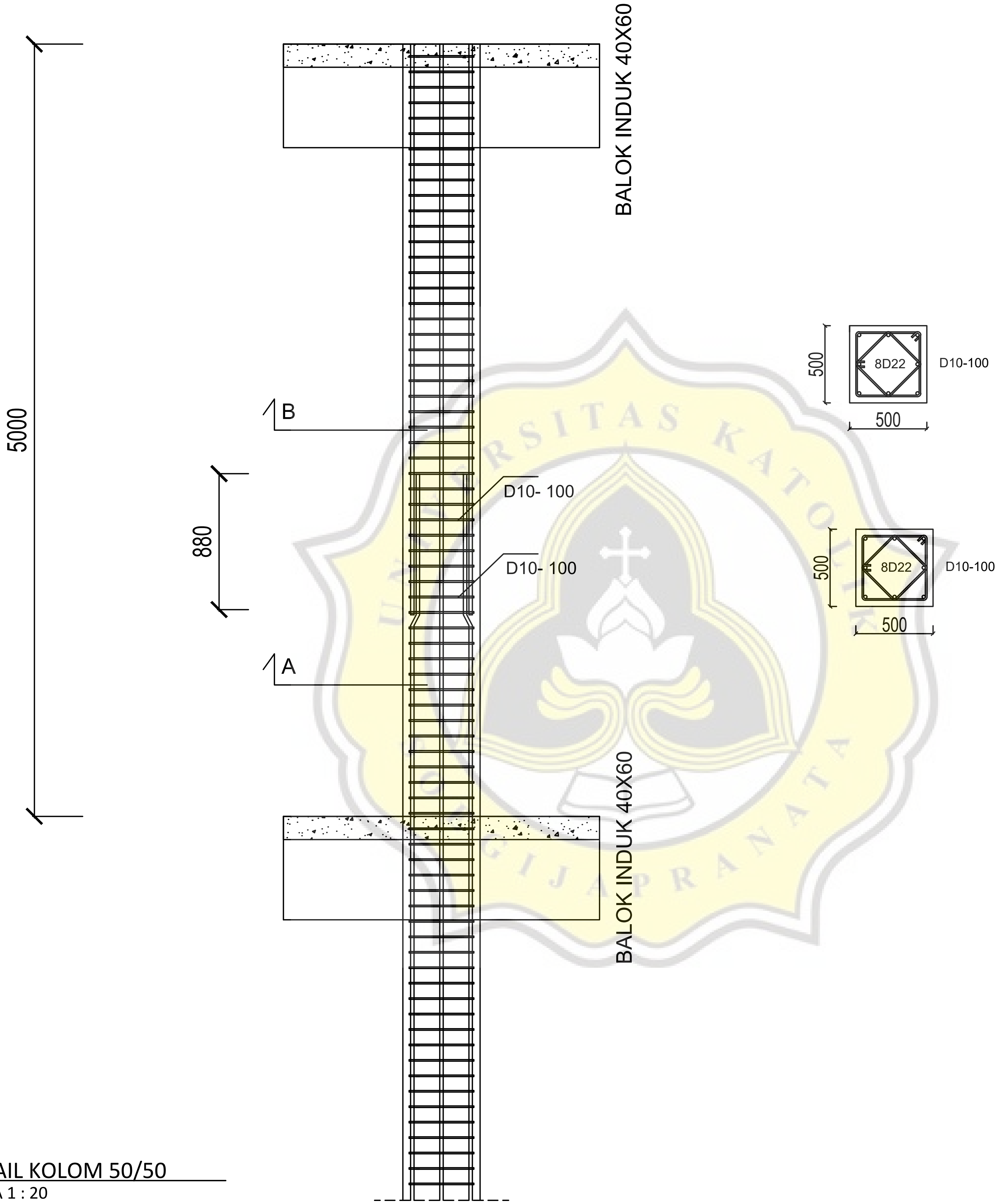

DETAIL KOLOM 50/50
SKALA 1 : 20

UNIKA SOEGIJAPRANATA
Jl. Pawiyatan Luhur IV/1 Bendan Dhuwur
Telp. 024-8441555 , Semarang 50234

JUDUL PEKERJAAN	
PROYEK PEMBANGUNAN HOTEL IBIS Jalan Raya Yogyakarta-Purworejo Temon, Kulon Progo, DIY	
JUDUL GAMBAR	SKALA
DETAIL KOLOM 50/50	1:20
DIGAMBAR OLEH :	
TAVIO FORTINO T	17.B1.0047
FRIEDRICH ADESCANIUS S	17.B1.0122
DIPERIKSA OLEH :	TANDA TANGAN
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Daniel Hartanto, ST.,MT.	
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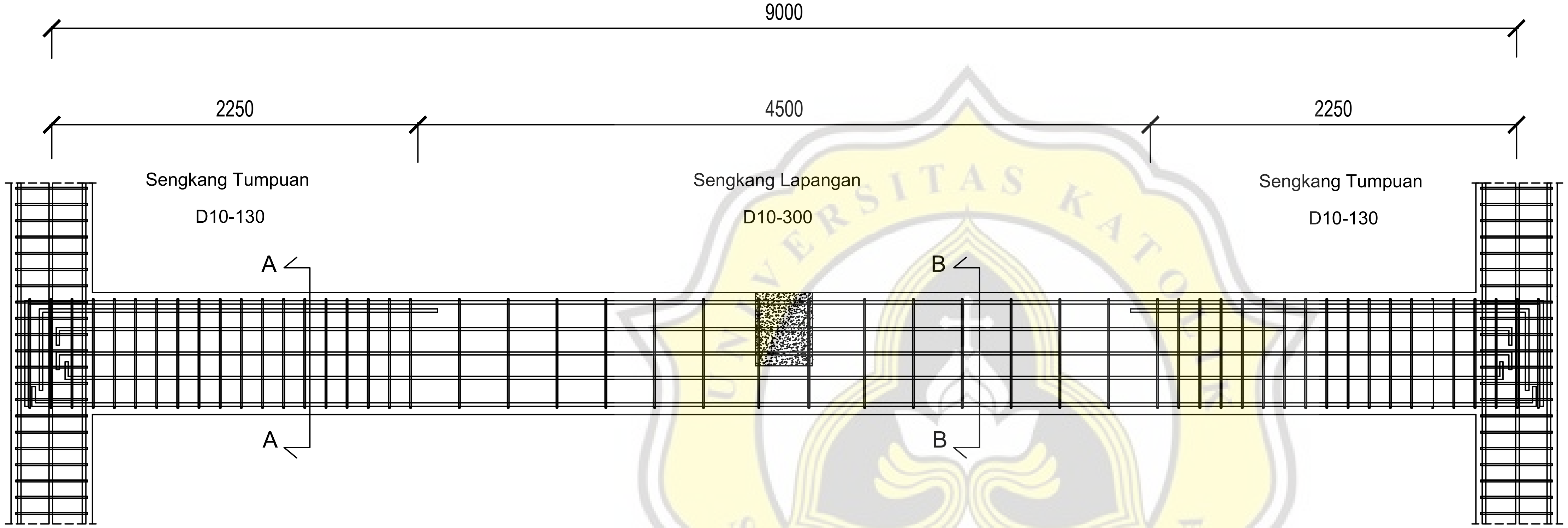
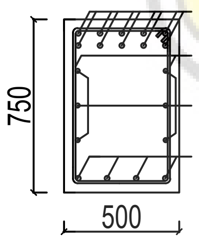
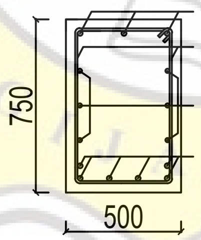




POT A-A
BALOK TUMPUAN



POT B-B
BALOK LAPANGAN

DETAIL BALOK INDUK 50/75
SKALA 1 : 20

UNIKA SOEGIJAPRANATA
Jl. Pawiyatan Luhur IV/1 Bendan Dhuwur
Telp. 024-8441555 , Semarang 50234

JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS
Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
DETAIL BALOK INDUK 50/75	1:20

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
FRIEDRICH ADESCANIUS S	17.B1.0122

DIPERIKSA OLEH :	TANDA TANGAN
Ir. David Widianto, M.T	
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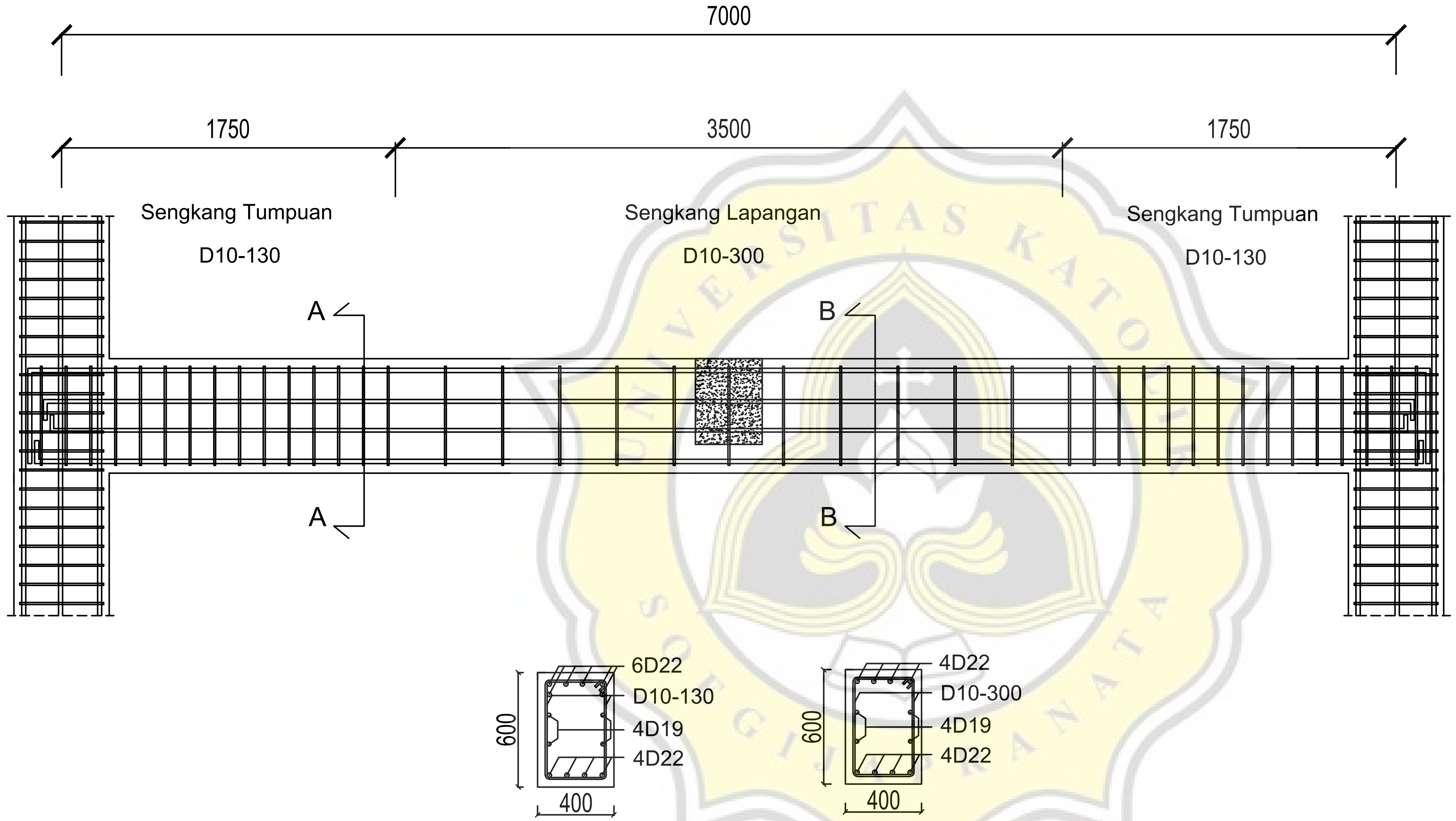
L- 33



POT A-A
BALOK TUMPUAN

POT B-B
BALOK LAPANGAN

DETAIL BALOK INDUK 40/60

SKALA 1 : 20

UNIKA SOEGIJAPRANATA

Jl. Pawiyatan Luhur IV/1 Bendan Dhuwur

Telp. 024-8441555 , Semarang 50234

JUDUL PEKERJAAN

PROYEK
PEMBANGUNAN HOTEL IBIS

Jalan Raya Yogyakarta-Purworejo
Temon, Kulon Progo, DIY

JUDUL GAMBAR	SKALA
DETAIL BALOK INDUK 40/60	1:20

DIGAMBAR OLEH :

TAVIO FORTINO T	17.B1.0047
FRIEDRICH ADESCANIUS S	17.B1.0122

DIPERIKSA OLEH :	TANDA TANGAN
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L- 34

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Mar 15, 2022
29739 words / 164362 characters

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