LAMPIRAN 1
DATA TANAH

Penyelidikan Tanah
Lokasi Pembangunan Gedung Bertingkat
di Rumah Sakit Telogorejo Semarang

1. Pendahuluan

Dalam rangka pengembangan Gedung Rumah Sakit Telogorejo Semarang maka perlu diketahui kemampuan dukung tanah dasar fondasinya, agar mampu mendukung beban yang ada di atasnya. Gedung bertingkat direncanakan dengan 11 lantai. Fondasi merupakan struktur bagian bawah bangunan yang berfungsi meneruskan beban bangunan ke tanah pendukungnya. Jenis dan dimensi fondasi yang dipakai sebagai pendukung bangunan harus sedemikian hingga fondasi aman terhadap keruntuhan kuat dukung dan penurunan yang terjadi masih dalam batas-batas toleransi yang aman bagi bangunan. Selain itu fondasi juga harus mampu menahan baik beban statis maupun dinamis.

Data mengenai kondisi dan sifat-sifat teknis tanah dasar merupakan salah satu faktor untuk menentukan jenis, bentuk dan kedalaman fondasi. Oleh karena itu, untuk mengetahui kemampuan dukung tanah dasar fondasi ini perlu dilakukan suatu investigasi/ penyelidikan tanah di lokasi tersebut. Hasil penyelidikan tanah ini diharapkan dapat menyajikan kuat dukung fondasi yang diperlukan untuk pelaksanaan rencana pembangunan Gedung Bertingkat di Rumah Sakit Telogorejo Semarang.

2. Maksud dan Tujuan

Maksud dilakukan penyelidikan tanah di lokasi rencana pembangunan Gedung Bertingkat di Rumah Sakit Telogorejo Semarang adalah untuk mengetahui kondisi tanah di lokasi tersebut, sehingga dapat diketahui kemampuan kuat dukung tanah dan fondasi yang akan dipakai dalam pelaksanaan pembangunan. Tujuannya adalah agar pemilihan tipe fondasi tepat sesuai dengan beban bangunan yang direncanakan serta kondisi tanah dasar fondasi di lokasi.

3. Lokasi

Lokasi pekerjaan berada di dalam lingkungan Rumah Sakit Telogorejo Semarang dengan batas sekeliling adalah bangunan yang sudah ada dan saat ini masih beroperasi. Bangunan sekeliling gedung yang akan dibangun adalah bagian dari rumah sakit dan sebagian rumah penduduk.

Sketsa lokasi titik - titik uji dapat dilihat pada Lampiran no. 1 dengan jumlah sesuai kesepakatan, untuk titik uji bor mesin sebanyak 2 buah (BH1 dan BH2) dan uji sondir berat sebanyak 6 buah (SB1 sd SB6).

4. Lingkup Pekerjaan

Lingkup pekerjaan penyelidikan tanah ini meliputi pengamatan di lapangan serta mengumpulkan data sekunder jikalau ada, melakukan penyelidikan tanah di lokasi serta dilakukan pengambilan sampel, selanjutnya dari sampel yang diperoleh diuji di laboratorium. Dari data lapangan dan laboratorium ini dilakukan evaluasi data primer dan sekunder yang diperoleh untuk disajikan dalam suatu laporan yang memuat hasil penyelidikan. Adapun rincian dari lingkup pekerjaan ini dapat dijelaskan sebagai berikut ini.

a. Pekerjaan di Lapangan

Pekerjaan lapangan terdiri pengamatan lapangan serta pelaksanaan uji bor mesin dan penetrasi statis (sondir). Pengamatan lapangan bertujuan untuk mengetahui kondisi lapangan serta informasi dari penduduk sekitar terutama berkaitan dengan kedalaman tanah keras di lokasi tersebut. Uji penetrasi statis dilakukan dengan alat CPT (*Cone Penetration Test* – Sondir – ASTM D 3441-86) atau sondir berat dilakukan di lokasi 6 titik uji (SB 1 s/d SB 6) yang telah disepakati sampai kedalaman mencapai tanah keras (nilai konus >700 kg/cm^2) atau lekatan yang besar pada tanah kohesif sehingga alat sudah tidak mampu atau kedalaman maksimum 40 meter.

Uji bor mesin beserta uji penetrasi dinamis (Standard Penetration Test – SPT) sepanjang pengeboran dengan interval kedalaman 1.5m dilakukan di 2 titik. Bor mesin dilakukan sampai dengan kedalaman yang telah disepakati, yaitu total kedalaman 80m dan diharapkan mencapai/ menemui lapisan tanah keras dengan nilai N SPT ≥ 60. Selain itu sampel *disturbed* untuk mengetahui sifat fisis tanah di lokasi tersebut juga dilakukan.

b. Pekerjaan di Laboratorium

Pekerjaan di laboratorium meliputi pengujian-pengujian untuk mendapatkan karakteristik fisis maupun mekanis dari sampel tanah yang diperoleh dari lokasi. Macam pengujian dan standar uji yang digunakan adalah sebagai berikut ini.

(1) Karakteristik fisis

Macam pengujian	Standar uji
Uji kadar air	ASTM D 2216 – 90
Uji gravitas khusus (*specific gravity*)	ASTM D 854 – 92

Analisis gradasi butiran tanah

Saringan	ASTM D 421 – 85
Hidrometer	ASTM D 422 – 63

(2) Karakteristik mekanis

Macam pengujian	Standar uji
Uji tekan bebas (unconfined compressive)	ASTM D 2166
Uji pemadatan (compaction)	ASTM D 698

5. Hasil Penyelidikan Tanah

Dari data primer yang diperoleh dari uji lapangan perlu dilakukan evaluasi dan kajian lebih lanjut untuk menentukan langkah-langkah di dalam menetapkan parameter-parameter yang digunakan di dalam perancangan fondasi pembangunan Gedung Bertingkat di Rumah Sakit Telogorejo Semarang. Hasil penyelidikan tanah berupa hasil uji lapangan dan laboratorium dapat dilihat pada Lampiran di bagian akhir laporan ini.

a. Kondisi Lapisan Tanah

Berdasarkan hasil pengamatan di lapangan kondisi lokasi merupakan daerah bekas bangunan lama yang dirobohkan. Secara topografis lokasi pekerjaan relatif datar dan dari pengamatan lapangan diperoleh bahwa lokasi tanah untuk bangunan ini dapat dikatakan hampir rata. Berdasarkan data hasil uji lapangan terdiri dari CPT (*Cone Penetration Test* atau lebih dikenal dengan uji sondir) sebanyak 6 lokasi yaitu titik SB-1 sampai dengan SB-6 dan titik bor, yaitu BH-1 dan BH-2 mempunyai elevasi seperti ditunjukkan dalam Tabel 5.1. Elevasi ini diukur terhadap lantai bangunan sebelah timur dari lokasi dengan elevasi titik ikat +100.00 m.

Tabel 5.1 Elevasi titik lokasi uji

Titik lokasi uji	Elevasi (m)
SB-1	+99.80
SB-2	+99.82
SB-3	+99.83
SB-4	+99.84
SB-5	+99.86
SB-6	+99.90
BH-1	+99.80
BH-2	+99.82

Dari hasil uji bor dan sondir diperoleh bahwa lapisan tanah didominasi lempung relatif lunak di bagian atas dan lapisan lempung kaku ditemukan berkisar mulai kedalaman 20m. Dari kedalaman 2.5 m hingga 6m merupakan tanah dengan nilai sondir q_c secara umum relatif meningkat, yaitu berkisar 75 kg/cm^2, kemudian menurun. Mulai kedalaman berkisar 19m nilai sondir q_c secara umum meningkat lagi hingga akhir sondir yaitu depth 30m berkisar 100 kg/cm^2.

Secara umum tanah didominasi lapisan lempung dan tersisipi lapisan pasir. Terlihat dari muka tanah hingga 20m depth mempunyai nilai N SPT 3 hingga 9 dan dari depth 40 hingga akhir pemboran 50m di titik BH-1 nilai N SPT relatif stabil berkisar 20. Teramati juga adanya lapisan pasir yang relatif padat setebal 5m dari depth 28.5m dengan N SPT 33 hingga 49.

Secara umum profil tanah dan perlapisannya relatif seragam untuk seluruh daerah penyelidikan yaitu dominasi tanah lempung, meskipun adanya lensa sisipan lapisan pasir padat pada titik BH-1 dan belum ditemukan di titik pengeboran satunya, yaitu BH-2 karena akhir pemboran hanya sampai kedalaman 30m dari muka tanah.

Hubungan nilai N SPT dengan konsistensi tanah lempung menurut Terzaghi dan Peck (1948) ditunjukkan dalam Tabel 5.2. Berdasarkan Tabel 5.2 diketahui bahwa lapisan lempung kaku dengan nilai N SPT relatif baik mulai di kedalaman 20m

dengan nilai N SPT berkisar 9 sd 14. Lapisan sisipan pasir halus dan pasir kelanauan terdapat di kedalaman 6m dan 28.5m hingga 33.5m pada titik BH-1. Pada titik BH-2 sisipan lapisan pasir terdapat di kedalaman 5m setebal 3m dan di kedalaman 13m setebal 2.5m. Lapisan batuan dengan nilai N SPT> 55 tidak dijumpai hingga akhir pengeboran, yaitu pada kedalaman 50m.

Tampak kondisi lapisan tanah relatif seragam dan kecenderungan semakin dalam nilai N SPT relatif stabil dengan rerata 19 mulai kedalaman 40m dari muka tanah dengan dominasi tanah lempung dan terdapat sisipan lapisan pasiran.

Tabel 5.2 Hubungan nilai N SPT dengan konsistensi tanah lempung (Terzaghi & Peck, 1948)

Konsistensi	Nilai N SPT
Sangat lunak	0 - 2
Lunak	2 - 4
Sedang	4 - 8
Kaku	8 - 15
Sangat kaku	15 - 30
Keras	≥ 30

b. Parameter Teknis Tanah

Dari hasil uji laboratorium, sampel tanah asli yang diambil bersamaan uji boring merupakan tanah lempung memberikan informasi bahwa lapisan tanah pada kedalaman tersebut mempunyai sifat teknis sebagai berikut ini. Berdasarkan uji di lokasi BH-1, lapisan tanah dari kedalaman 13m hingga 30m mempunyai kadar air berkisar 38% -56%, specific gravity sebesar 2,7 dan plastisitas tinggi.

Tanah sampel pada lapisan tersebut secara umum mempunyai butiran halus lebih dominan. Dengan demikian tanah di lapisan tersebut termasuk dalam kelompok CH, sandy fat clay (Das, 1994). Berdasarkan uji tekan bebas tanah pada kedalaman tersebut mempunyai kohesi c= 0.13 – 0.67 kg/cm^2.

Berdasarkan uji pemadatan (Proctor) diperoleh bahwa tanah di lokasi ini mempunyai nilai MDD sebesar 1,53 gr/cm^3 dan OMC sebesar 23 %. Hasil uji laboratorium secara lengkap ditampilkan dalam Lampiran.

c. Muka Air Tanah

Pada saat dilakukan uji lapangan (tanggal 18 sd 21 November 2010) dilakukan pengamatan letak ketinggian muka air tanah. Muka air tanah dijumpai di lokasi ini relatif dangkal yaitu pada kedalaman 1.10m.

d. Kuat Dukung Tanah dan Fondasi

Uji bor mesin dan sondir telah dilakukan di lokasi penyelidikan. Denah lokasi penyelidikan tanah seperti terlihat dalam Lampiran. Kuat dukung tanah yang diijinkan (q_a) dapat ditentukan berdasarkan hasil uji sondir (CPT) dan juga berdasar uji SPT.

Berdasarkan data borlog dan nilai N SPT, kuat dukung ijin (q_a dalam kN/m^2) tanah dasar untuk fondasi menerus menurut Mayerhof (1974) dengan lebar fondasi B> 1.2m adalah

$$q_a = 8N\left(\frac{B+0.3}{B}\right)^2 \quad \text{.....(5.1)}$$

dengan N adalah nilai N SPT rerata di bawah dasar fondasi dan B adalah lebar fondasi (m).

Berdasarkan data sondir, kuat dukung ijin (qa dalam kg/cm^2) tanah dasar untuk fondasi memanjang menurut Mayerhof pada tanah pasiran dengan lebar fondasi B> 1.2m adalah

$$q_a = \frac{q_c}{50}\left(1+\frac{0.3}{B}\right)^2 \quad \text{.....(5.2)}$$

dengan q_c adalah nilai tahanan konus rerata di bawah dasar fondasi.

Analisis kuat dukung tiang digunakan metode Belanda (Dutch method) yang didasarkan pada data sondir. Untuk menentukan kapasitas dukung tiang digunakan hubungan

$$Q_{ult} = A_p . q_c + k . q_f \quad \text{.....(5.3)}$$

dengan

q_c : nilai konus (kg/cm^2),

q_f : nilai total lekatan (kg/cm),

k : keliling tiang (cm),

A_p : luas tampang tiang (cm^2).

Besarnya q_c ditentukan dengan cara sebagai berikut ini.

$$q_c = \frac{R_{p1} + R_{p2}}{2} \quad \text{.....(5.4)}$$

dengan

R_{p1} : rerata perlawanan ujung konis berjarak 8 x diameter tiang dari ujung tiang yang direncanakan di sebelah atasnya,

R_{p2} : rerata perlawanan ujung konis berjarak 4 x diameter tiang dari ujung tiang yang direncanakan di sebelah bawahnya.

Untuk mendapatkan kapasitas dukung ijin, diperlukan angka aman (SF), sehingga diperoleh besarnya

$$Q_{ijin} = (A_p . q_c)/SF_1 + (k . q_f)/SF_2 \quad \text{.....(5.5)}$$

Analisis kuat dukung tiang juga dapat didasarkan pada nilai N SPT dari hasil uji bor mesin dengan uji SPT. Untuk menentukan kuat dukung ijin tiang (Qa), banyak cara analisisnya antara lain dengan metode Mayerhoff, Briaud et al (1985) dan Reese & O'neill (1989). Kuat dukung fondasi tiang ultimit netto dapat dihitung

$$Q_L = Q_b + Q_s - W_p \quad \text{.....(5.6)}$$

dimana Q_p = kuat dukung ujung tiang

Q_s = kuat dukung gesek/ lekatan tiang

W_p = berat sendiri tiang

Sehingga kapasitas dukung tiang yang diijinkan

$$Q_a = \frac{Q_u}{SF}$$ dimana SF = angka aman .....(5.7)

Briaud et al. (1985): memberikan rumus

$$Q_b = q_c' \cdot A_b$$ .....(5.8)

dengan

$q_c' = 19{,}7 \cdot \sigma_r (N_{60})^{0.8}$

$\sigma_r = 100\ kPa$

$$Q_s = f_s \cdot A_s$$ .....(5.9)

dengan

$f_s = 0{,}224\ \sigma_r (N_{60})^{0.29}$

Salah satu metode yang relatif konservatif (metode Reese & O'neill (1989)) digunakan hubungan empirik sebagai berikut ini.

$Q_b = q_e'.A_b$ dengan $q_e' = 0{,}6.\sigma_r.N_{60} < 4500$ kPa dengan N_{60} adalah nilai rerata N_{60} dari 2d di bawah ujung tiang. $Q_s = f_s'.A_s$ dengan $f_s' = \sum kd.\tan\delta.q$.

Dari berbagai metode tersebut, maka dalam perancangan fondasi dangkal (slab foundation), untuk kuat dukung ijin tanah untuk berbagai kedalaman dapat ditentukan seperti dalam Tabel 5.3.

Tabel 5.3 Kuat dukung ijin tiang tanah untuk berbagai kedalaman

Depth (m)	Kuat dukung ijin tanah q_a (kg/cm^2) berdasar CPT	Kuat dukung ijin tanah q_a (kg/cm^2) berdasar N SPT
1.5	0.5	0.4
2	0.8	0.6
3	1.0	0.8
6	0.8	0.9

Tabel 5.4 Resume kuat dukung ijin tiang dalam perancangan

Diameter tiang (cm)	Qa (ton) L= 25m	Qa (ton) L= 35m	Qa (ton) L= 36m	Qa (ton) L= 40m
50	62	-	120	130
35	42	-	75	82
30	36	58	60	67

Pada kedalaman 1.50 hingga 2.0m dari muka tanah, kuat dukung ijin tanah berkisar 0.5 kg/cm^2 (5 T/m^2). Kuat dukung tanah dasar fondasi relatif baik berkisar 0.9 kg/cm^2 (9 T/m^2) pada kedalaman 3.0m dan mulai kedalaman 7m kuat dukung menurun lagi berdasarkan hasil uji sondir.

Untuk bangunan utama apabila dipakai fondasi tiang maka ujung tiang dapat diletakkan pada lapisan tanah dengan nilai N SPT yang sudah relatif stabil yaitu mulai di kedalaman berkisar 30m dari muka tanah. Kuat dukung fondasi tiang tunggal beradasarkan hasil uji sondir untuk diameter tiang d= 50cm dan panjang tiang yang tertanam L= 36m diperoleh q_c= 110 kg/cm^2 dan q_f= 950 kg/cm. Dengan angka aman SF= 3 diperoleh kuat dukung ijin tiang Qa= 120.7 ton. Kuat dukung ijin tiang berdasar hasil uji SPT dengan variasi diameter dan panjang tiang yang tertanam (embeded length) ditunjukkan seperti dalam Tabel 5.4. Hitungan secara lengkap dapat dilihat dalam Lampiran.

6. Pembahasan

Dari hasil uji penetrasi (sondir – CPT) dan uji SPT pada bor mesin, maka dapat diambil besarnya kuat dukung tanah di lokasi tersebut. Untuk perancangan fondasi yang akan dibangun di lokasi ini, maka untuk bangunan pagar keliling dapat digunakan tipe fondasi menerus (*continous footing*) dengan kedalaman dasar fondasi 2.0 m dari muka tanah asli dengan kuat dukung ijin (σ_{ijin}) tanah sebesar 0.6 kg/cm^2 (6 Ton/m^2).

Untuk bangunan utama yaitu gedung bertingkat adalah penggunaan fondasi tiang dan diikat pile cap. Ujung tiang dapat diletakkan pada kedalaman berkisar 30m, tergantung dari panjang tiang tertanam (embeded length) yang diinginkan. Kuat dukung ijin tiang tunggal terhadap axial load dapat diambil **120 ton** (tiang diameter, 0.50m), **75 Ton** (tiang diameter 0.35m), dan **60 Ton** (tiang diameter 0.30m) untuk panjang tiang tertanam **L= 36m**. Untuk kuat dukung tiang dengan berbagai variasi diameter dan panjang tiang tertanam dapat dilihat dalam Tabel 5.4.

Dengan demikian design capacity yang ada yaitu tiang dengan daya dukung 120 ton (diameter, d= 0.5m dan panjang tiang tertanam L= 36m), 65 ton (d= 0.35m & L= 36m) dan 57,5 ton (d= 0.30m & L= 35m) dapat digunakan dengan ketentuan bahwa panjang tiang yang tertanam sesuai dengan uraian di atas dan disesuaikan dengan kondisi letak sistem fondasi dan pilecap dari muka tanah.

Seperti dalam uraian sebelumnya diketahui bahwa terdapat lapisan tanah pasiran yang relatif padat di kedalaman sekitar 29m dari muka tanah. Untuk itu perlu diperhatikan pada waktu pelaksanaan pemancangan agar terjamin bahwa tiang tidak mengalami kesulitan pemancangan dan tidak terjepit/ bahkan patah. Selain itu juga perlu teknologi pemancangan yang bisa meredam getaran karena di sekeliling lokasi terdapat banyak bangunan termasuk bangunan sederhana (pemukiman). Juga perlu perhatian khusus terkait kemungkinan terjadinya heaving selama proses pemancangan. Untuk itu perlu metode dan teknik pemancangan yang baik serta

teknik isolasi daerah apabila ada bangunan ringan yang terletak terlalu dekat dengan lokasi pekerjaan.

7. Kesimpulan dan Rekomendasi

Dari hasil uji di lapangan dan di laboratorium, dapat diberikan suatu kesimpulan dan rekomendasi yang dapat digunakan sebagai pertimbangan di dalam pengambilan keputusan sehubungan kondisi tanah di lokasi sebagai berikut ini.

1. Berdasarkan hasil pengamatan di lapangan kondisi lokasi merupakan daerah bekas bangunan dan secara topografis lokasi pekerjaan relatif datar.
2. Secara umum tanah didominasi lempung lunak di bagian atas dan lapisan lempung kaku ditemukan mulai kedalaman sekitar 20m. Nilai N SPT relatif stabil dengan rerata 19 mulai kedalaman 40m dari muka tanah. Lapisan batuan dengan nilai N SPT> 55 tidak dijumpai hingga akhir pengeboran, yaitu pada kedalaman 50m.
3. Lapisan lempung sebagai sampel termasuk dalam kelompok CH, sandy fat clay (ASTM), mempunyai nilai kohesi c= 0.13 kg/cm^2 pada lempung lunak dan mencapai c= 0.69 kg/cm^2 pada lapisan lempung kaku.
4. Berdasarkan uji pemadatan (Proctor) diperoleh bahwa tanah di lokasi ini mempunyai nilai MDD sebesar 1,53 gr/cm^3 dan OMC sebesar 23 %.
5. Untuk bangunan utama yaitu gedung gedung bertingkat adalah penggunaan fondasi tiang dan diikat pile cap. Ujung tiang dapat diletakkan pada kedalaman berkisar 30m, tergantung dari panjang tiang tertanam (embeded length) yang diinginkan. Kuat dukung ijin tiang tunggal terhadap axial load dapat diambil 120 ton (tiang diameter 0.50m), 75 Ton (tiang diameter 0.35m), dan 60 Ton (tiang diameter 0.30m) untuk panjang tiang tertanam L= 36m. Untuk diametr dan panjang tiang tertanam lainnya dapat dilihat dalam Tabel 5.4. Dengan demikian design capacity yang ada dapat digunakan

dengan ketentuan bahwa panjang tiang yang tertanam sesuai dan disesuaikan dengan kondisi letak sistem fondasi dan pilecap dari muka tanah.

6. Untuk bangunan pagar keliling dapat digunakan tipe fondasi menerus (*continous footing*) dengan kedalaman dasar fondasi 2.0 m dari muka tanah asli dengan kuat dukung ijin (σ_{ijin}) tanah sebesar 0.6 kg/cm^2 (6 Ton/m^2).
7. Perlu dijamin bahwa tiang tidak mengalami kesulitan pemancangan dan tidak terjepit/ bahkan patah karena adanya lapisan tanah pasiran padat di kedalaman 29m dengan tebal 5m. Selain itu juga perlu teknologi pemancangan yang bisa meredam getaran karena di sekeliling lokasi terdapat banyak bangunan termasuk bangunan sederhana (pemukiman). Terkait kemungkinan terjadinya heaving, maka perlu metode dan teknik pemancangan yang baik serta teknik isolasi daerah apabila ada bangunan ringan yang terletak terlalu dekat dengan lokasi pekerjaan.

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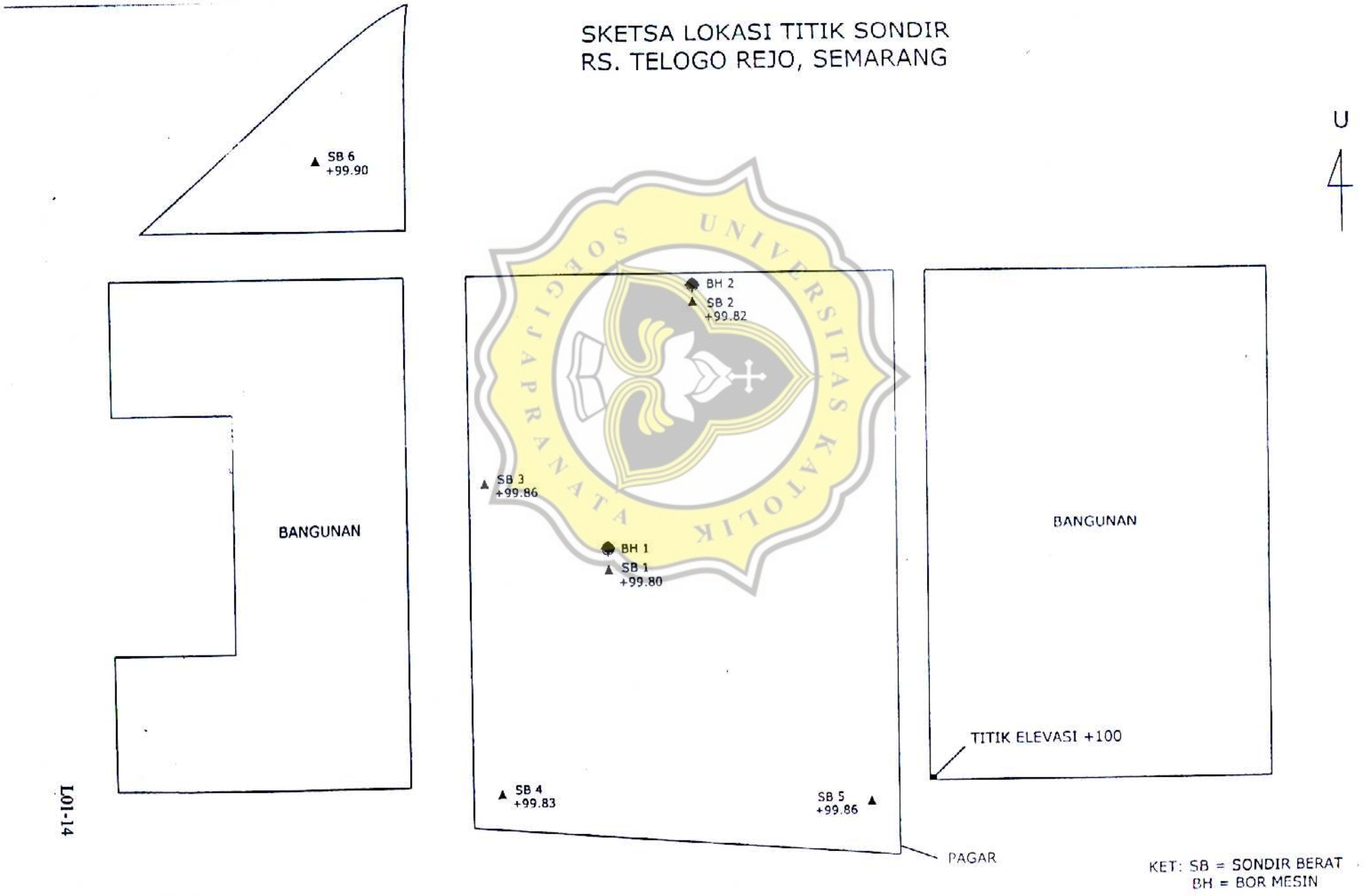
SKETSA LOKASI TITIK SONDIR
RS. TELOGO REJO, SEMARANG



KET: SB = SONDIR BERAT
BH = BOR MESIN

L01-14

GEOLOGICAL DRILL LOG

BH 1

PROJECT	RS. TELOGOREJO	Depth	50.00 m
LOCATION	RS. TELOGOREJO, SEMARANG	Point Coordinate	
Average Core Recovery (%)	Date started: 18 November 2010 / Date finished: 20 November 2010	Drilled By	Mucharob
Ground Elevation		Hole Inclination	Vertical
Logged By	Anung Prayoko, ST		

Depth (m)	Rock / Soil Type	Thickness (m)	Rock / Soil Description
0.00 – 0.50	PASIR lempung	0.50	Coklat, tanah urug
0.50 – 4.00	LANAU	3.50	Hijau, plastisitas rendah-sedang
4.00 – 6.70	PASIR halus	2.70	Hijau, ada cangkang koral putih, keras
6.70 – 9.70	LANAU	3.00	Hijau, plastisitas rendah-sedang
9.70 – 13.70	LEMPUNG	4.00	Hijau, plastisitas sedang
13.70 – 17.70	LEMPUNG	4.00	Abu-abu gelap, plastisitas sedang
17.70 – 21.00	LEMPUNG	3.00	Abu-abu kehijauan, plastisitas sedang

Groundwater Elevation (m): 1.10

Standard Penetration Test

Depth (m)	N value (blows / ft)
1.50 – 1.95	2
3.00 – 3.45	3
4.50 – 4.95	5
6.00 – 6.45	6
7.50 – 7.95	8
9.00 – 9.45	4
10.50 – 10.95	6
12.00 – 12.45	6
13.50 – 13.95	8
15.00 – 15.45	6
16.50 – 16.95	7
18.00 – 18.45	8
19.50 – 19.95	9

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LABORATORIUM MEKANIKA TANAH TELP/FAKS

WQA

GEOLOGICAL DRILL LOG

BH 1

PROJECT	RS. TELOGOREJO		Depth:	50.00 m	Ground Elevation:
LOCATION	RS. TELOGOREJO, SEMARANG		Point Coordinate:		Hole Inclination: Vertical
Average Core Recovery (%)	Date started: 18 November 2010	Date finished: 20 November 2010	Drilled By:	Mukharibi	Logged By: Anung Prasko, ST

Depth (m)	Soil Sample	Rock / Soil Type	Thickness (m)	Rock / Soil Description	Core Recovery (%)	Groundwater Elevation (m)	Standard Penetration Test: Depth (m)	N value (Blows / ft)
21.00		LEMPUNG	1.00	Abu-abu kehijauan plastisitas sedang			21.45	9
22.00							22.50	
23.00		LEMPUNG	3.50	Hitam, plastisitas tinggi			22.95	12
24.00							24.00	
25.00							24.45	14
25.50		LEMPUNG	1.50	Coklat, plastisitas tinggi			25.50	
26.00							25.95	16
27.00		LEMPUNG	1.50	Abu-abu kecoklatan plastisitas tinggi			27.00	
28.00							27.45	16
28.50							28.50	
29.00							28.95	23
30.00		PASIR halus	2.60	Abu-abu gelap, butiran seragam			30.00	
31.00							30.45	44
31.30		LEMPUNG	0.70	Abu-abu, plastisitas tinggi			31.50	
32.00		PASIR halus	1.00	Abu-abu, butiran seragam			31.95	17
33.00		BATU PASIR	0.70	coklat, berukuran pasir halus			33.00	
34.00							33.45	49
35.00							34.50	
36.00							34.95	15
37.00		LEMPUNG	8.30	Abu-abu gelap, plastisitas tinggi			36.00	17
38.00							36.45	
39.00							37.80	17
40.00							37.85	
41.00							39.00	18
42.00							39.45	
							40.50	18
							40.95	

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LABORATORIUM MEKANIKA TANAH - GEOTEKNIK

WQA

GEOLOGICAL DRILL LOG

BH 1

PROJECT	RS. TELOGOREJO	Depth	50.00 m	Ground Elevation	
LOCATION	RS. TELOGOREJO, SEMARANG	Point Coordinate		Hole Inclinatio	Vertical
Average Core Recovery (%)	Date started : 16 November 2010 / Date finished : 20 November 2010	Drilled By	Mukharob	Logged By	Anung Priyoko, ST

Depth (m)	Soil Sample	Rock / Soil Type	Thickness (m)	Column Section	Rock / Soil Description	Core Recovery (%)	Groundwater Elevation (m)	Standard Penetration Test: Depth (m)	N value (blows / ft)
42.00 – 45.00		LEMPUNG	3.00		Abu-abu gelap, plastisitas tinggi			42.00	20
								42.45	
								43.50	20
								43.95	
								45.00	20
45.00 – 48.00		LEMPUNG	3.00		Abu-abu kecoklatan plastisitas tinggi			45.45	
								46.50	18
								46.95	
48.00 – 50.00		LEMPUNG	2.00		Abu-abu gelap plastisitas tinggi			48.00	20
								48.45	
								49.50	20
								49.95	

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WQA

GEOLOGICAL DRILL LOG

BH-2

PROJECT				Depth	30.00 m	Ground Elevation	
LOCATION	RUMAH SAKIT TELOGO REJO SEMARANG			Point Coordinate		Hole Inclination	Vertical
Average Core Recovery (%)		Date started : 21 November 2010	Date finished : 21 November 2010	Drilled By	Mulhamot	Logged By	Anung

Depth (m)	Soil Sample	Rock / Soil Type	Thickness (m)	Column Section	Rock / Soil Description	Core Recovery (%)	Groundwater Elevation (m)	Standard Penetration Test (N value (blows / ft))
2.00		Lanau	2.5		Hijau, lunak, plastisitas sedang			4
3.00		Lempung	1.3		Coklat, plastisitas sedang			8
4.30		Pasir halus	1.2		Hijau, ada cangkang koral putih			12
7.00		Pasir halus tanahan	3.5		Hijau, banyak cangkang koral putih			8
8.00		Pasir halus	0.5		Hijau, butiran seragam			11
11.80		Lanau	3.8		Hijau, plastisitas sedang lunak			14
13.50		Pasir halus	2.7		Hijau, butiran seragam			13
16.00		Lempung	5.5		Hijau, plastisitas tinggi			22
17.00		Lempung	1.0		Hijau, plastisitas tinggi			26
22.00		Lempung	5.0		Abu-abu gelap, plastisitas tinggi			18
27.00								16
								18
								17
								18
								16
								17

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WQA

GEOLOGICAL DRILL LOG

BH-2

PROJECT		Depth	30.00 m	Ground Elevation	
LOCATION	RUMAH SAKIT TELOGO REJO SEMARANG	Point Coordinate		Hole Inclinatio	Vertical
Average Core Recovery (%)	Date started 21 November 2010	Date finished 21 November 2010	Drilled By	Mukhamad	Logged By	Anung

Date	Depth (m)	Soil Sample	Rock / Soil Type	Thickness (m)	Column Section	Rock / Soil Description	Rock: Weathering / Compactness / Hardness	Soil: Consistency / Relative density	Core Recovery (%)	Groundwater Elevation (m)	Standard Penetration Test: Depth (m) / N value (blows / ft)
	28.00		Lempung	5.0		Abu-abu coklat, plastisitas tinggi					27.45 — 17
	28.84										28.84 — 18
	30.00		END OF HOLE								30.00 — 18
	31.00										30.46

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LABORATORIUM MEKANIKA TANAH - GEOTEKNIK

WQA

WATER CONTENT DETERMINATION

Project : RS. Telogo Rejo
Location : Semarang
Boring no. : BH 1

Depth : 5.50 - 6.00 m
Date : 25 November 2010
Made by : Ris

1	Can no.		1	2
2	Mass of can	M_1 gram	22.1	20.6
3	Mass of wet soil + can	M_2 gram	144.56	155.59
4	Mass of dry soil + can	M_3 gram	116.03	122.88
5	Mass of moisture	(M_2-M_3) gram	28.53	32.71
6	Mass of dry soil	(M_3-M_1) gram	93.93	102.28
7	Water content, w	$[(M_2-M_3)/(M_3-M_1)]\times100\%$	30.37	31.98
8	Average water content, w		31.18	

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SPECIFIC GRAVITY

Project : RS. Telogo Rejo
Location : Semarang
Boring no : BH 1

Depth : 5.50 - 6.00 m
Date : 29 Nov 2010
Made by : Ris

1	Piknometer no.		1	2
2	Mass of piknometer	M_1 gram	**27.82**	**21.85**
3	Mass of dry soil + piknometer	M_2 gram	**47.84**	**41.86**
4	Mass of dry soil + water + piknometer	M_3 gram	**90.18**	**84.07**
5	Mass of water + piknometer	M_4 gram	**77.48**	**71.39**
6	Temperature t°C		28.00	
7	$A = M_2 - M_1$		20.02	20.01
8	$B = M_3 - M_4$		12.70	12.68
9	$C = A - B$		7.32	7.33
10	Specific Gravity, $G_1 = A/C$		2.73	2.73
11	Average specific gravity, G_1		2.73	
12	G_{water} at t°C		0.9962	
13	G for 27,5 °C = G = (G_{water} at t°C)/(G_{water} at 27.5°C)		2.73	

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LABORATORIUM MEKANIKA TANAH - GEOTEKNIK

WQA

ATTERBERG LIMITS

Project	: RS. Telogo Rejo	Depth	: 5.50 - 6.00 m
Location	: Semarang	Date	: 29 Nov 2010
Point no	: BH 1	Made by	: Pn

Soil sample (~~disturbed~~ / undisturbed)
Description of soil :
Specific Gravity, *Gs* : 2.73

Liquid Limit Determination

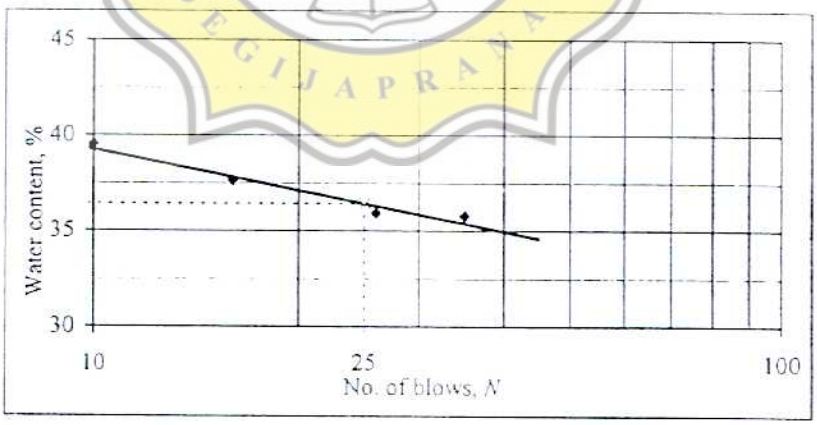
Can no		1		2		3		4	
No. of blows, *N*		10		16		26		35	
Mass of can	(gr)	14.55	14.70	14.33	14.03	16.45	15.80	14.83	14.18
Mass of wet soil + can	(gr)	46.18	42.55	32.85	37.43	34.08	42.18	46.69	35.75
Mass of dry soil + can	(gr)	37.25	34.64	27.80	31.02	29.45	35.17	38.29	30.07
Mass of dry soil	(gr)	22.70	19.94	13.47	16.99	13.00	19.37	23.46	15.89
Mass of moisture	(gr)	8.93	7.91	5.05	6.41	4.63	7.01	8.40	5.68
Water content, *w*	(%)	39.34	39.67	37.49	37.73	35.62	36.19	35.81	35.75
		39.50		37.61		35.90		35.78	

Plastic Limit Determination

1	2
15.87	14.64
34.45	33.18
30.54	29.20
14.67	14.56
3.91	3.98
26.65	27.34
26.99	

Shrinkage Limit Determination

Mass of shrinkage dish	W_1 (gr)	
Mass of shrinkage dish + wet soil	W_2 (gr)	
Mass of shrinkage dish + dry soil	W_3 (gr)	
Mass of dry soil	$W_o = W_3 - W_1$ (gr)	20.58
Mass of soil cake dish	W_4 (gr)	29.20
Mass of soil cake dish + Hg	W_5 (gr)	214.66
Mass of Hg	$W_6 = W_5 - W_4$ (gr)	185.46
Volume of dry soil	$V_o = W_o/13.6$ (cm^3)	13.64
Shrinkage limit	$SL = (V_o.W_o - 1/G) \times 100\%$	29.63



Liquid Limit,	*LL*	=	36.43 %
Plastic Limit,	*PL*	=	26.99 %
Plasticity Index,	*PI*	=	9.44 %
Natural Water Content	w_N	=	31.18 %
Liquidity Index,	*LI*	=	0.44

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LABORATORIUM MEKANIKA TANAH - GEOTEKNIK

WQA

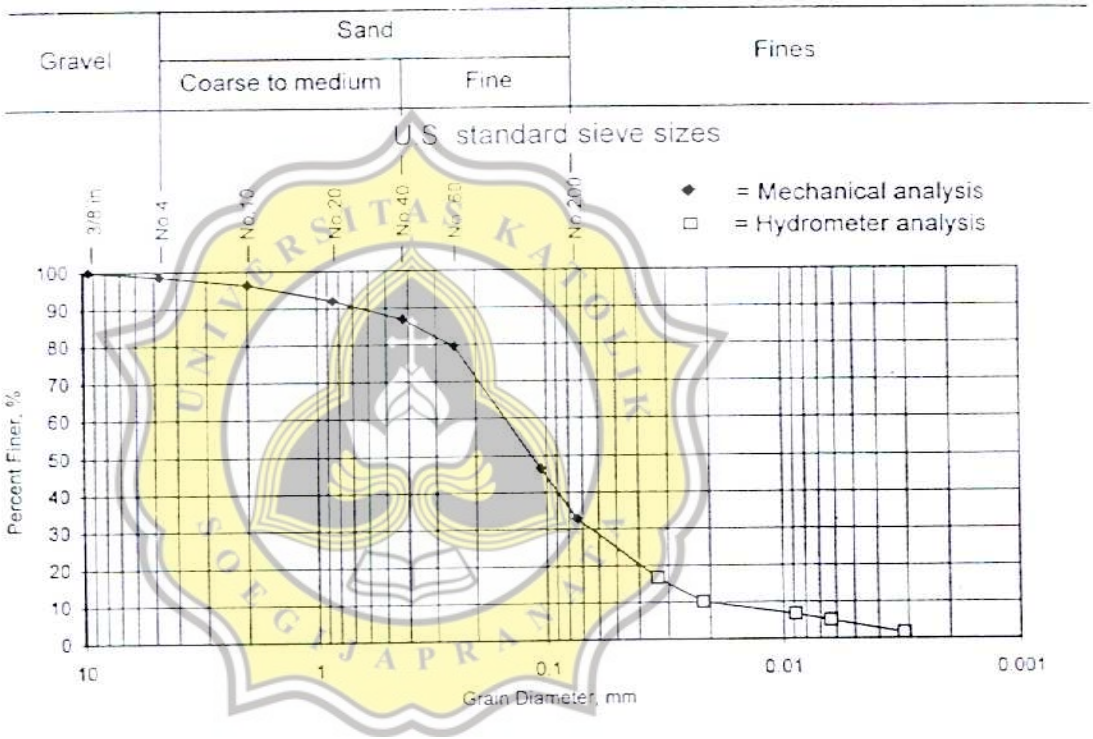
GRAIN SIZE ANALYSIS

Project : RS. Telogo Rejo
Location : Semarang
No. : BH 1

Depth : 5.50 - 6.00 m
Date : 29 November 2010
Made by : Ris

Specific Gravity 2.73

Description of soil _____



Finer # 200 = 32.77 %

Gravel = 1.38 %
Sand = 65.85 %
Silt/Clay = 32.77 %

D_{10}	D_{30}	D_{60}	$C_u = D_{60}/D_{10}$	$C_c = (D_{30})^2/(D_{10} \times D_{60})$
-	-	-	-	-

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LABORATORIUM MEKANIKA TANAH - GEOTEKNIK

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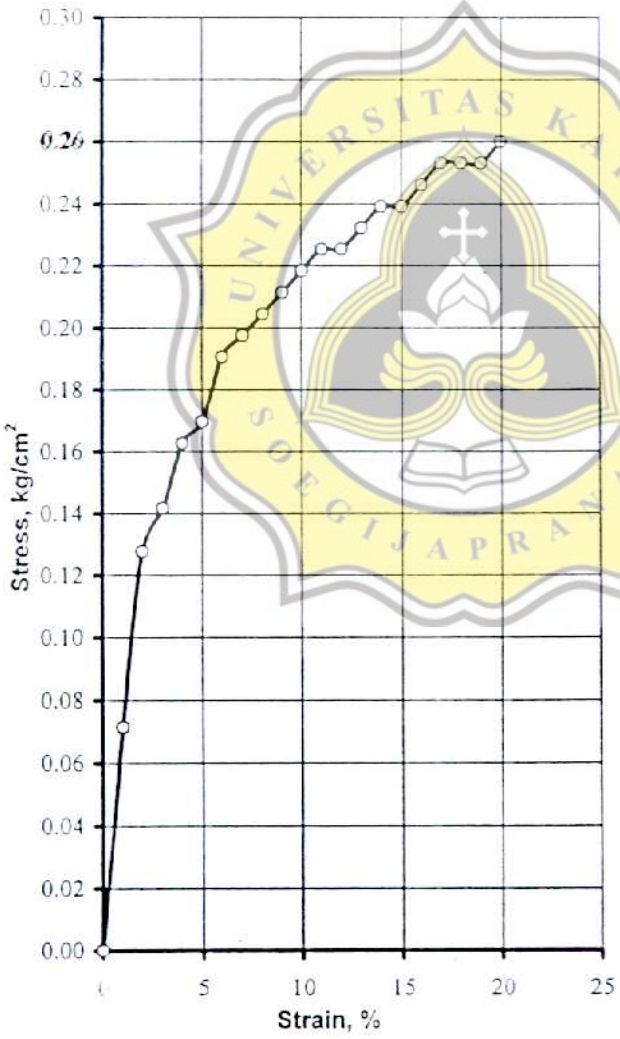
UNCONFINED COMPRESSION TEST

Project	: RS. Telogo Rejo	Depth	: 13.00 - 13.50 m
Location	: Semarang	Date	: 24 Nov 2010
Boring No.	: BH 1	Tested by	: Ris

Diameter of Sample	=	6.6	cm
Area	=	34.23	cm^2
Height of Sample	=	14.00	cm
Soil description	=		

Water Content	51.47 %
Mass of Sample	775.00 gr
Density	1.62 gr/cm^3

Specific Gravity, G_s	2.71
Void ratio, e	1.54
Degree of Saturation, S_o	90.70 %



Compression strength :

q_u = 0.26 kg/cm^2

Soil shear strength :

c_u = 0.13 kg/cm^2

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LABORATORIUM MEKANIKA TANAH - GEOTEKNIK

WQA

COMPACTION

Project	: RS. Telogo Rejo	Depth	: -
Location	: Semarang	Date	: 10 November 2010
Test Point no.	: T3	Made by	: Smd

Blows/Layer	: 25	Volume	:	947.9	cm^3
No. of Layers	: 3	Mold dimensions	: Diam.	10.2	cm
Mass of Hammer	: 2.5 kg	Ht	:	11.6	cm

Specific Gravity : 2.69

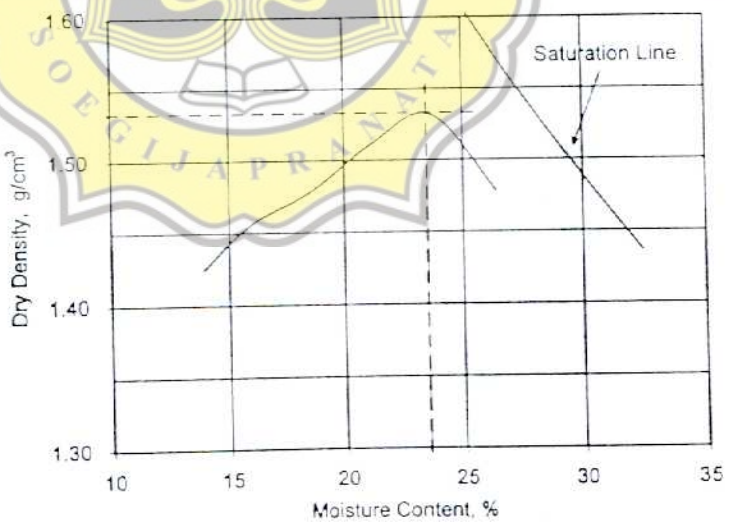
Description of Soil : -

Water Content Determination

Sample no.	1		2		3		4		5		6	
Moisture can no.												
Mass of can	21.80	20.06	21.68	21.40	21.97	20.81	20.96	20.57	22.07	21.27	20.70	21.85
Mass of can + wet soil	88.47	82.74	81.83	84.95	98.91	94.73	90.88	86.10	94.69	93.50	98.15	93.74
Mass of can + dry soil	80.30	75.12	73.59	76.21	86.82	83.10	78.68	74.60	80.89	79.55	82.03	78.63
Mass of water	8.17	7.62	8.24	8.74	12.09	11.63	12.20	11.50	13.80	13.95	16.12	15.11
Mass of dry soil	58.50	55.06	51.91	54.81	64.85	62.29	57.72	54.03	58.82	58.28	61.33	56.78
Water content, w %	13.97	13.84	15.87	15.95	18.64	18.67	21.14	21.28	23.46	23.94	26.28	26.61
Average water content %	13.90		15.91		18.66		21.21		23.70		26.45	

Density Determination

Water content, w %	13.90	15.91	18.66	21.21	23.70	26.45
Mass of soil + Mold	5984	6045	6110	6183	6242	6217
Mass of mold	4446	4446	4446	4446	4446	4446
Mass of soil in mold	1538	1599	1664	1737	1796	1771
Wet density γ_b, g/cm^3	1.62	1.69	1.76	1.83	1.89	1.87
Dry density γ_d, g/cm^3	1.42	1.46	1.48	1.51	1.53	1.48



Maximum Dry Density, MDD	=	1.53	g/cm^3
Optimum Moisture Content, OMC	=	23.50	%

RS Telogorejo Semarang
Koreksi N spt untuk setiap lapisan tanah
Borehole BH-1

mat 1,4
diambil zc= 15d

SF 3
diameter 0,5
panjang tiang 36

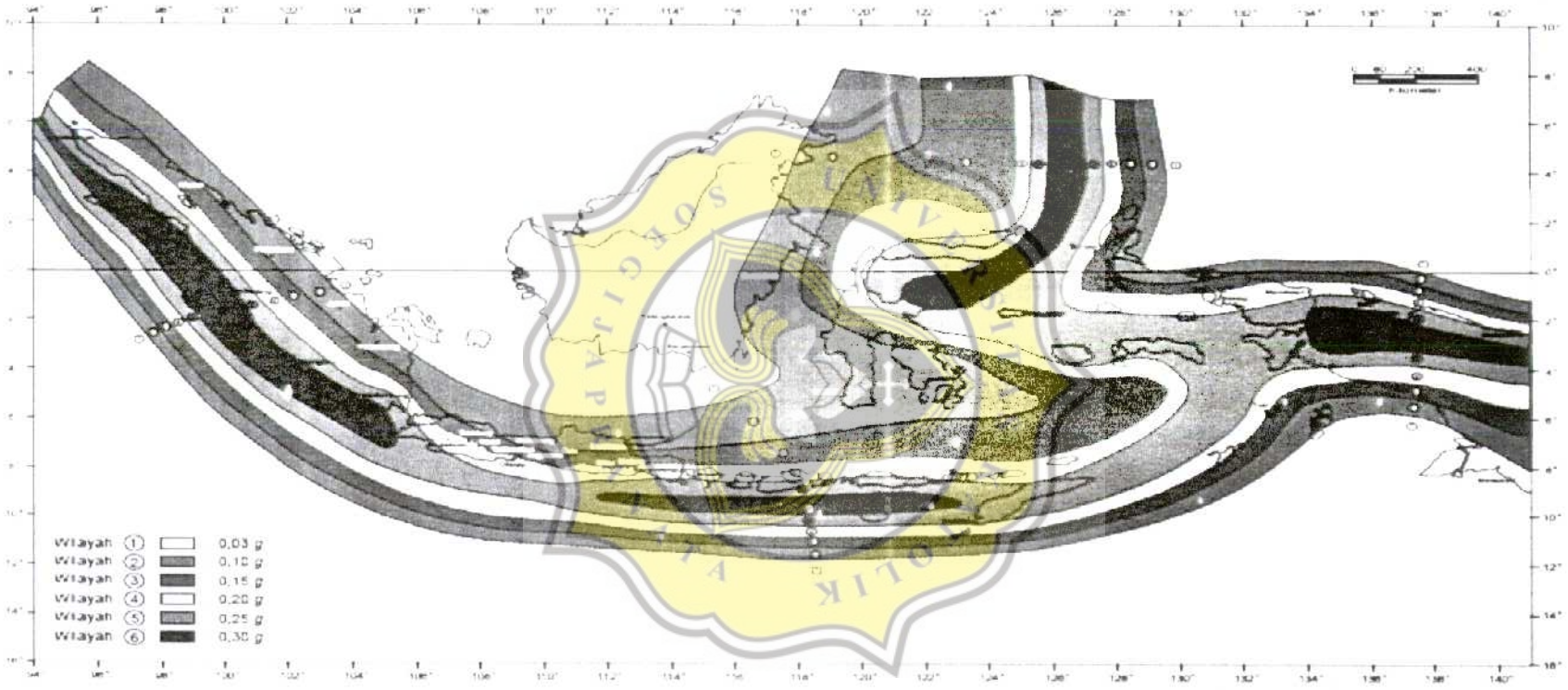
2
Wtiang/m
25

3
4
40

1	2	3	4	5	6	7	8	9	10	11	12	13	12
depth	N SPT	po'	CN	N60'	phi	delta	q	kd*tan(7)*(8)	cu	alpha *cu	As	(9)*(12) + (11)*(12)	Qs Briaud
0													
1,75													
[illegible]	3	26	1,5873	4,7619		0	26	0	20	15	2,356194	35,34292	72,58123
[illegible]	5	38	1,44928	7,24638		0	38	0	30	22,5	2,356194	53,01438	84,17061
[illegible]	6	50	1,33333	8		0	50	0	40	30	2,356194	70,68583	88,74073
[illegible]	6	62	1,23457	7,40741		0	62	0	40	30	2,356194	70,68583	88,74073
[illegible]	4	74	1,14943	4,5977		0	74	0	25	18,75	2,356194	44,17865	78,89628
[illegible]	6	86	1,07527	6,45161		0	86	0	40	30	2,356194	70,68583	88,74073
[illegible]	6	98	1,0101	6,06061		0	98	0	40	30	2,356194	70,68583	88,74073
[illegible]	8	110	0,95238	7,61905		0	110	0	50	37,5	2,356194	88,35729	96,46178
[illegible]	6	122	0,9009	5,40541		0	122	0	40	30	2,356194	70,68583	88,74073
[illegible]	7	134	0,8547	5,98291		0	122	0	45	33,75	2,356194	79,52156	92,79778
[illegible]	9	146	0,81301	7,31707		0	122	0	60	45	2,356194	106,0288	99,81355
[illegible]	9	158	0,77519	6,97674		0	122	0	60	45	2,356194	106,0288	99,81355
[illegible]	9	170	0,74074	6,66667		0	122	0	60	45	2,356194	106,0288	99,81355
[illegible]	12	182	0,70922	8,51064		0	122	0	75	56,25	2,356194	132,5359	108,498
[illegible]	14	194	0,68027	9,52381		0	122	0	90	67,5	2,356194	159,0431	113,4583
[illegible]	16	206	0,65359	10,4575		0	122	0	100	75	2,356194	176,7146	117,9381
[illegible]	16	218	0,62893	10,0629		0	122	0	100	75	2,356194	176,7146	117,9381
28,75	33	230	0,60606	20	36	27	122	62,1621048			2,356194	146,466	145,4883
[illegible]	48	242	0,5848	28,0702	39	29,25	242	135,526512			2,356194	319,3269	162,1881
[illegible]	17	254	0,56497	9,60452	31	23,25	254	109,127012			2,356194	257,1245	120,0299
[illegible]	49	266	0,54645	26,776	39	29,25	266	148,967158			2,356194	350,9956	163,1609
[illegible]	15	278	0,5291	7,93651		0	278	0	95	71,25	2,356194	167,8789	115,7512
[illegible]	17	290	0,51282	8,71795		0	290	0	105	78,75	2,356194	185,5503	120,0299
[illegible]	17	302	0,49751	8,45771		0	302	0	105	78,75	2,356194	185,5503	120,0299
[illegible]	19	314	0,48309	9,17874		0	314	0	120	90	2,356194	212,0575	123,9646
[illegible]	19	326	0,46948	8,92019		0	122	0	120	90	2,356194	212,0575	123,9646
[illegible]	20	338	0,45662	9,13242		0	122	0	130	97,5	2,356194	229,729	125,8224
[illegible]	20	350	0,44444	8,88889		0	122	0	130	97,5	2,356194	229,729	125,8224
[illegible]	20	362	0,4329	8,65801		0	122	0	130	97,5	2,356194	229,729	125,8224
[illegible]	19	374	0,42194	8,01688		0	122	0	120	90	2,356194	212,0575	123,9646
[illegible]	20	386	0,41152	8,23045		0	122	0	130	97,5	2,356194	229,729	125,8224
[illegible]	20	398	0,40161	8,03213		0	122	0	130	97,5	2,356194	229,729	125,8224
	354	388	487										

L01-26

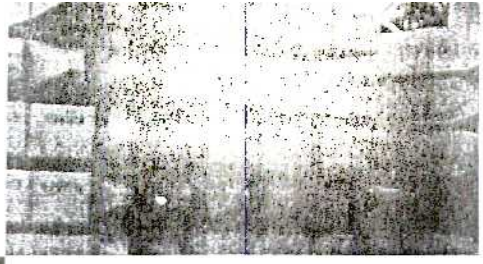
LAMPIRAN 2
GAMBAR WILAYAH GEMPA DI INDONESIA



Gambar 2.1. Wilayah Gempa Indonesia dengan percepatan puncak batuan dasar dengan perioda ulang 500 tahun

LAMPIRAN 3
BROSUR TIANG PANCANG

PC SQUARE PILES



Description

Type of piles : Prestressed concrete square piles

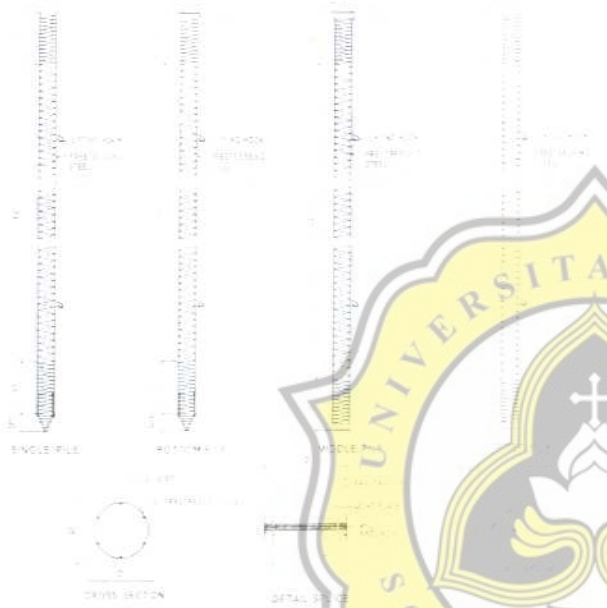
System of Joints : Welded / Steel Joint Plate

Type of shoe : Pencil

Method of driving : Dynamic Pile Driving (Diesel or Hydraulic Hammer)
Static Pile Driving (Hydraulic Static Pile Driver/Jacking Pile)

WIKA BETON
Innovation and Trust

Shape and Dimension



Pile Dimension	Type of Diesel Hammer*) Single Pile	Jointed Pile
25 x 25	K 13	K 13 / K 25
30 x 30	K 13	K 25 / K 35
35 x 35	K 25	K 35
40 x 40	K 25 / K 35	K 35 / K 45
45 x 45	K 35 / K 45	K 45 / KB 45
50 x 50	K 45 / KB 45	K 45/ KB 45 / KB 60

*) Refer to Kobe Diesel Pile Hammer Manual.
**) For other hammer, energy/power should be adjusted to kobe hammer.

Specification

Dimension D (cm)	Concrete Area (cm²)	Unit Weight (kg/m)	Class	Bending Moment Crack (ton.m)	Bending Moment Ultimate (ton.m)	Allowable Axial Load (Ton)	Length of Pile (L) (m)
25 X 25	625	156	A	2.24	3,46	81.40	6 - 12
			B	2.50	4,33	79.62	6 - 14
			C	2.76	5,19	77.92	6 - 16
30 X 30	900	225	A	3.62	5,19	118.59	6 - 12
			B	3.95	6,23	116.76	6 - 14
			C	4.33	7,47	114.66	6 - 16
			D	4.88	9,34	111.60	6 - 18
35 X 35	1225	306	A	5.22	6,57	163.98	6 - 12
			B	5.91	8,72	160.68	6 - 14
			C	6.58	10,90	157.45	6 - 16
			D	7.24	13,08	154.32	6 - 18
40 X 40	1600	400	A	7.84	9,96	213.96	6 - 14
			B	8.64	12,45	210.60	6 - 16
			C	9.43	14,95	207.32	6 - 18
			D	11.65	22,42	198.01	6 - 20
45 X 45	2025	506	A	11.11	14,01	270.98	6 - 14
			B	12.02	16,81	267.61	6 - 16
			C	12.90	19,62	264.30	6 - 18
			D	14.63	25,22	257.88	6 - 20
50 X 50	2500	625	A	15.07	18,68	335.12	6 - 14
			B	16.08	21,79	331.72	6 - 16
			C	17.08	24,91	328.38	6 - 18
			D	18.06	28,02	325.09	6 - 20

LO3-2

LAMPIRAN 4
BROSUR LIFT

▲ HYUNDAI ELEVATOR CO., LTD.

San 136-1, Ami-ri, Bubal-eup, Icheon-si, Gyeonggi-do 467-734, Korea
Tel : 82-2-3670-0661/0665 Fax : 82-2-3672-8763-4
www.hyundaielevator.co.kr

9F East Bldg, Hyundai Group Bldg, 1-7 Yeonji-dong, Jongno-gu, Seoul 110-754, Korea
Tel : 82-2-3670-0661/0665 Fax : 82-2-3672-8763-4

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Tel 277-1422-4770

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Fax 249-183-230-384

Tel 963-114-419189
Fax 963-114-420-8666

Tel 66-2348-8000
Fax 66-2249-8483

Tel 216-70-853-231
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Tel 90-216-488-8000
Fax 90-216-488-8191

Tel 993-12-46-0333
Fax 993-12-46-0330

Tel 971-2-671-1778
Fax 971-2-443-8822

Tel 971-4-294-4475
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Tel 1-562-404-1909
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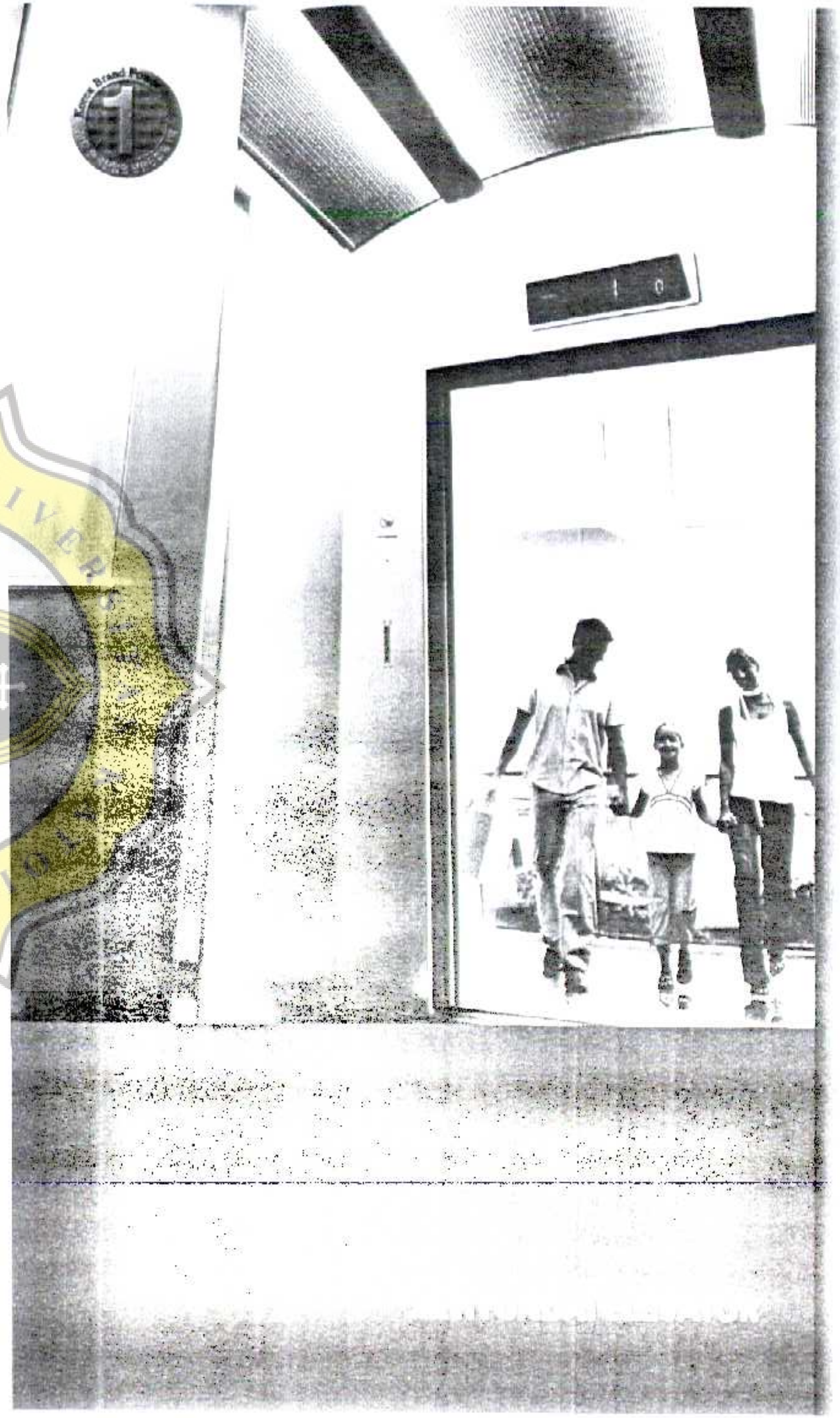
Tel 58-212-232-8283
Fax 58-212-232-7178

VIETNAM
Tel 84-4-3572-4588
Fax 84-4-3577-4088
Tel 84-4-3943-4945
Fax 84-8-3232-1496

PASSENGER ELEVATORS We reserve the right to change designs and specifications for the product development without prior notice.

CATALOG CODE : C-PEL E0409-201.1203Rev.4

L04-1



Trusted quality

We export products to 50 countries like Japan, Europe, East / West Asia, the Middle East and are recognized for excellence in quality.

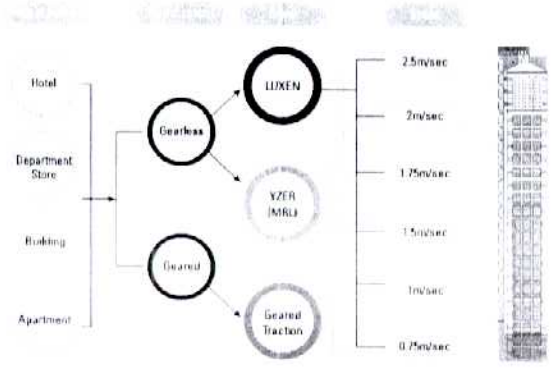
Refined design

Refined design to give consideration to health and the environment adds new value to the elevator.

[Selection of passenger elevator system]

The selection of elevators should be made in consideration of the building type/scale, tenant characteristics, elevator usage and the anticipated passenger carrying capacity at the building's traffic peak time.

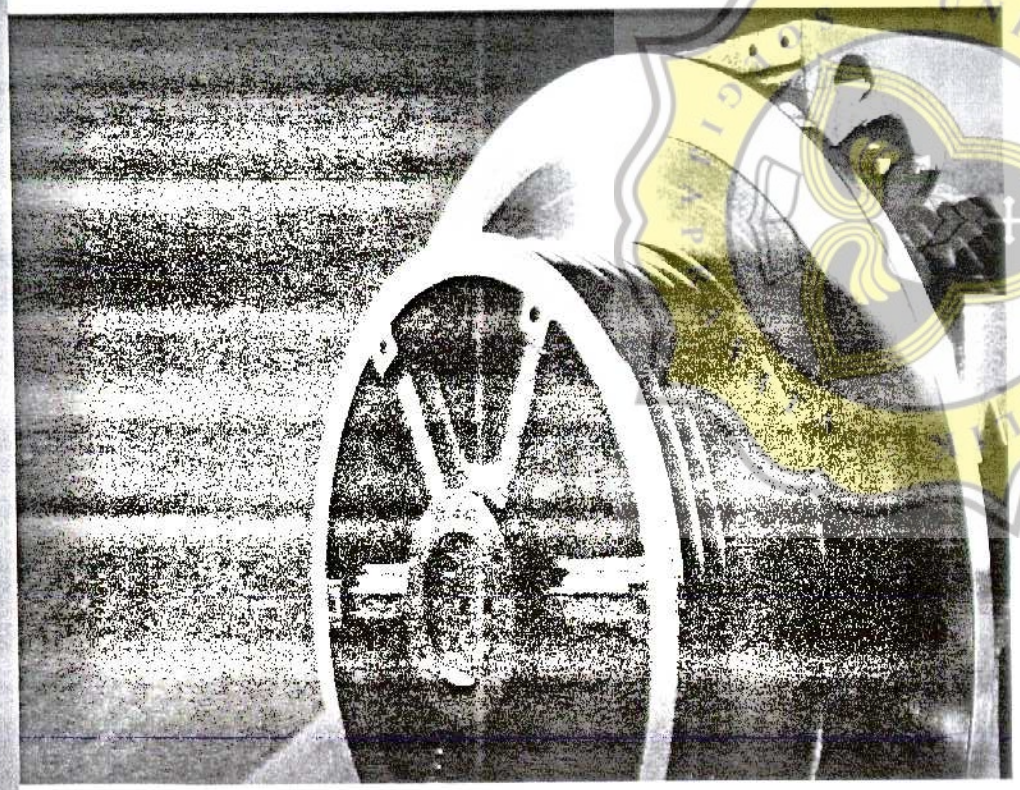
Hyundai elevators are available from geared traction elevator to gearless traction elevators, covering the full range of vertical transportation requirements.



Contents

Gearless Traction Machine

With the use of gearless traction machine, smoother ride, improved energy-saving, and environment-friendly features are enhanced.



+Improved energy savings

Gearless traction machine with permanent magnet synchronous motor provides up to 25% energy savings compared with geared traction machine with induction motors.

+Comfortable riding

Noise and vibration level have been decreased dramatically and car ride is improved thanks to the use of gearless traction machine with permanent magnet synchronous motor without toothing gear and rope swing.

+Environment-friendly components

It is environmentally friendly because gear oil is not required.

+Reduced installation space

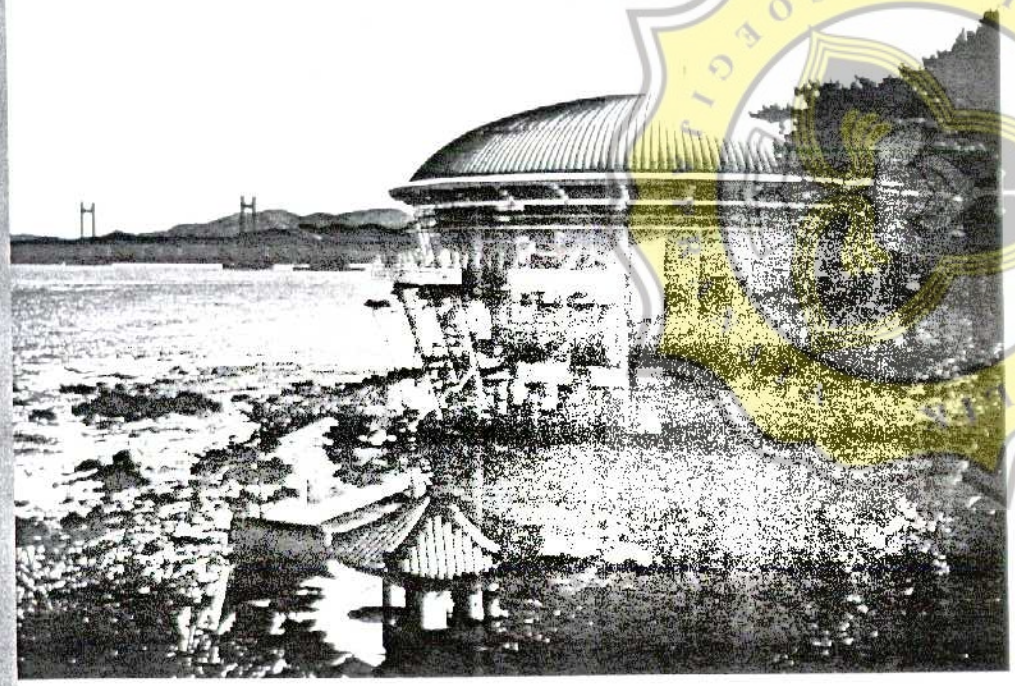
It can save the building space as it needs smaller machine room space than the conventional.

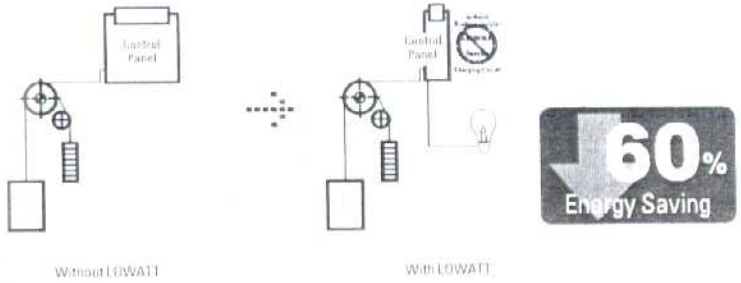
+Easy installation and maintenance

The installation and maintenance is less complicated as the implementation is the same 1:1 roping for induction motor.

LOWATT (Energy Regenerative Elevator Inverter)

LOWATT, next generation elevator inverter system, minimizes energy consumption by regenerating wasted kinetic energy with newly designed power circuit. It is applicable for low-medium speed gearless elevator LUXEN, machine roomless elevator YZER, and geared elevator.





Without LOWATT

With LOWATT

+ Up to 60% energy savings

The energy generated by the motion of the car is recycled back to the inverter, resulting a 60% total energy consumption.

+ Reduced heat emission

The heat emission of the motor has been drastically reduced as the energy generated from operating the elevator is recycled.

+ Easy maintenance

The inverter doesn't have condensers, reactors, resistant parts so it is easy to maintain and repair.

1 (Energy Regenerative Elevator Inverter) LOWATT is ethereal
2 In Dec., 2007 the Ministry of Science and Technology certified the NET (New Excellent Technology) for the capacitor-less inverter control for driving elevator

LOWATT

NET
NEW EXCELLENT TECHNOLOGY

HELIAS (Destination Selecting System)

The purpose of registration is to automatically select the best service of the elevator car within the system and the passenger does not need to click the car operating button in car.
HELIAS (Destination Selecting System) manages elevator more effectively.

+ Shorter waiting time

It saves calling time and riding time as it selects the proper elevator for effective service.

+ Improving efficiency in energy usage

By grouping passengers having the same target floor to the same elevator, it will save energy and increase system efficiency.

+ Security and Convenience

Use of Building Access Cards to work with the elevator call button and the user ID in the Building Access Cards will automatically register a call to provide convenience to residents, as well as preventing any non-authorized outsider gain access to the building.

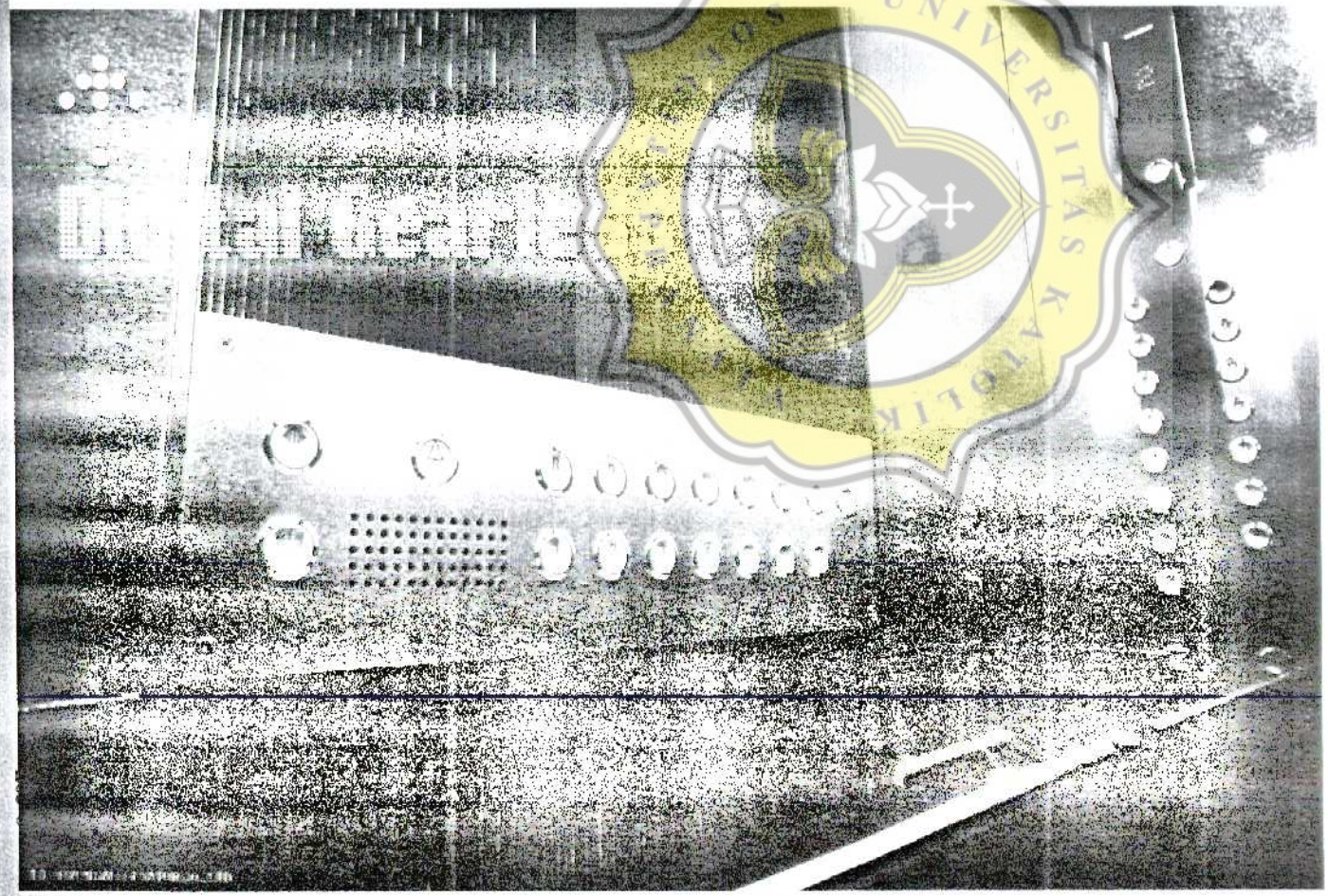
+ A variety of contents in real time

This system can be applied to existing systems and this feature will provide a touch screen and LCD display inside the car, so passengers can get internet-based information such as car operation, weather, stock price, index trends, and real-time headline news.

2 | E

LUXEN (Medium speed gearless traction elevators)

A high-tech gearless traction machine which was used mainly in high-speed elevator is used for this product.



Excellent car ride

The LUXEN, using the gearless machine, provides a smooth and noiseless ride.

Increased energy efficiency

Gearless traction machine with permanent magnet synchronous motor application and energy recycling Inverters(LOWATT) will increase energy efficiency.

Spacious car interior

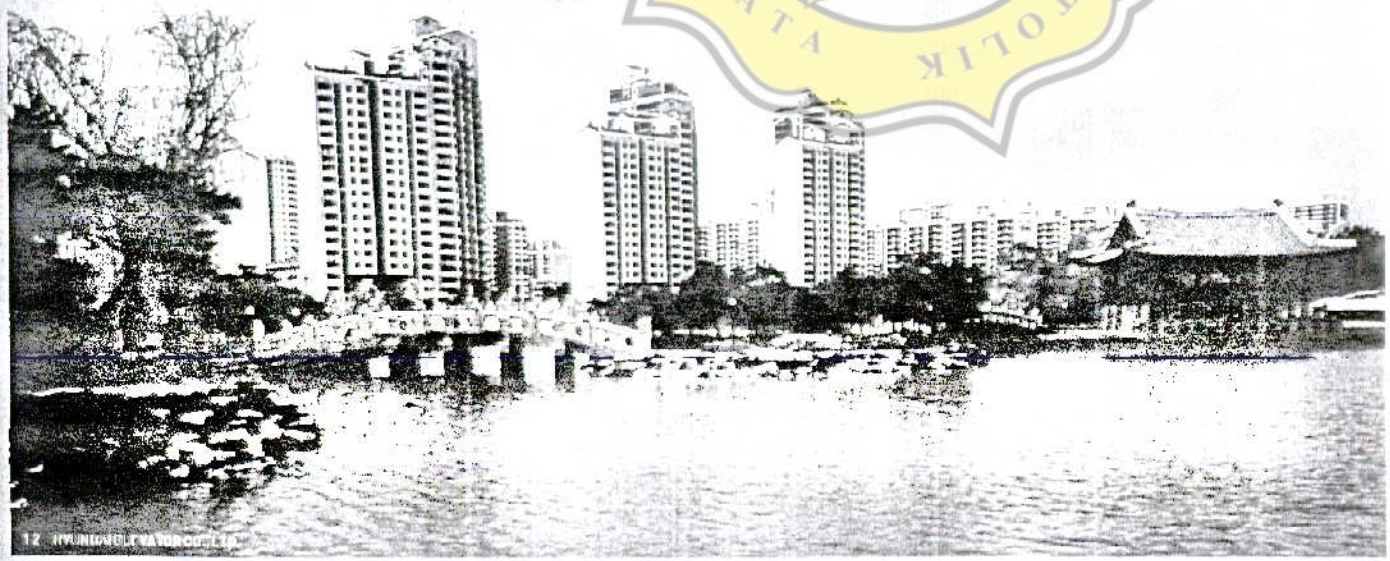
The car is more spacious and more comfortable compared with existing product design which has low ceiling height.

Eco-friendly product

This is an environment-friendly products. It does not need to replace the gear oil regularly.

YZER (Machine-room-less elevators)

An innovative elevator which does not require a separate machine room



High space efficiency

The thinner control panel and compact gearless traction machine eliminate the need for a separate machine room because the system is so compact it can be located at any floor or on hoistway wall.

More flexible architectural design

The building roof line can be enhanced due to the elimination of the conventional penthouse type machine room. It enables a free layout of hoistway position as the machine room is not necessary.

Reduction of building cost

Expenses for the construction of machine room as well as the completion time of building work can be reduced as the machine room is not necessary.

Compact gearless traction machine

By using gearless traction machine with permanent magnet synchronous motor, it provides smoother ride, improved energy-saving, and environment friendly features.

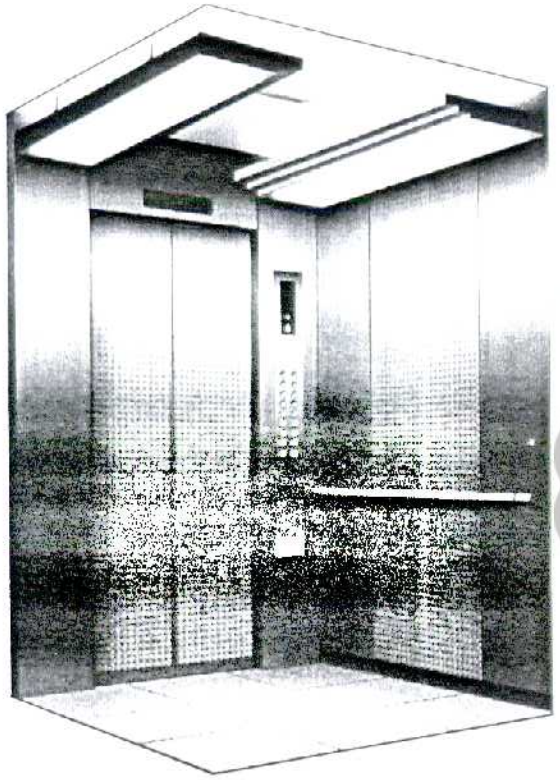
Geared Traction Elevators

The hightest efficiency is achieved through the optimal combination of voltage and frequency, the latest and most advanced VVVF technology of electric power supply to the induction motor

Extremely smooth riding comfort & accurate landing
Using computer control for acceleration and deceleration the riding comfort is improved

Enhanced safety
The self-checking system as part of the software/hardware design built in the elevator and drive contol system greatly improve safety of the elevator operation

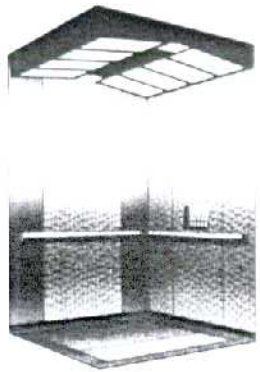
Compact design
Minimized control panel enables to reduce installation costs



| FRONT VIEW |

| REAR VIEW |

| FRONT VIEW |



| REAR VIEW |

SB-25

| CAGE DESIGN |

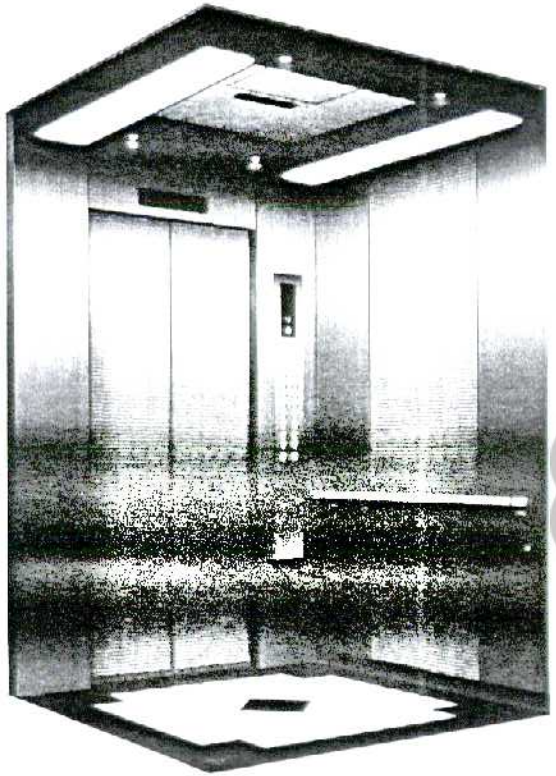
Ceiling	CD59A: Painted Steel (P021), Skylite 10T, Indirect Lighting
Wall	Hairline Finished Stainless Steel, Hairline Etched Stainless Steel (SE1172)
Car Doors	Hairline Etched Stainless Steel (SE1172)
Operating Panel	OPP-N241B / OPP-N241W (Hairline Finished Stainless Steel)
Indicator	PI-D110
Handrail	Stainless Steel 1 Pipe / Polished (1B)
Flooring	Sense Tile (TN2402C)

Notes: 1. Finished product may vary slightly from these points.
2. The price will vary depending on the customer's specification.
3. The pit may vary depending on the capacity.

| CAGE DESIGN |

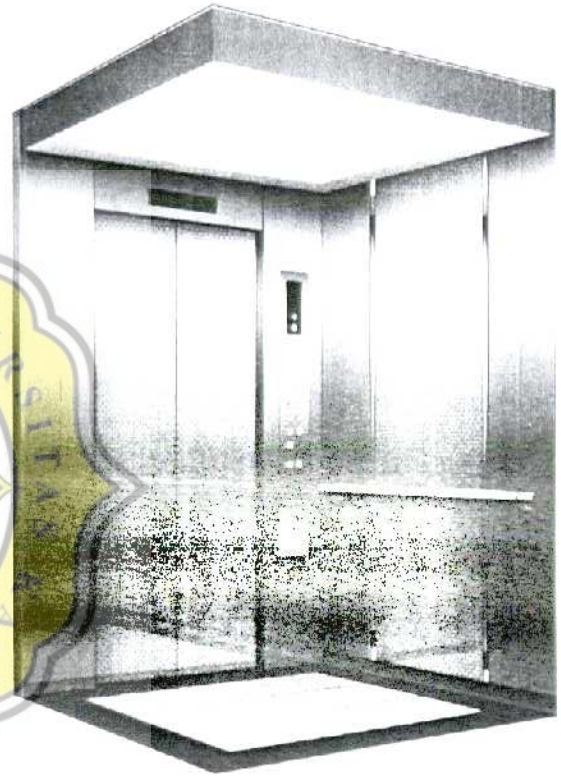
Ceiling	CD451B: Acryl Acryl Lens, Painted Steel (P022)
Wall	Hairline Etched Stainless Steel (SE1169)
Car Doors	Hairline Etched Stainless Steel (SE1169)
Operating Panel	OPP-N240B
Indicator	PI-D600
Handrail	Stainless Steel 1 Pipe (1A)
Flooring	Polyvinyl Tile (TN2401C, TN2406C)

1. Finished product may vary slightly from these points.
2. The price will vary depending on the customer's specification.
3. The pit may vary depending on the capacity.

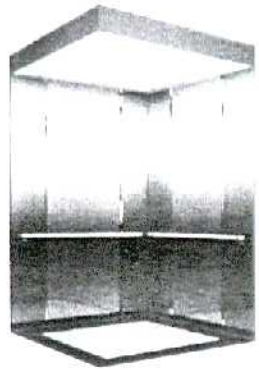


| FRONT VIEW |

| REAR VIEW |



| FRONT VIEW |



| REAR VIEW |

| CAGE DESIGN |

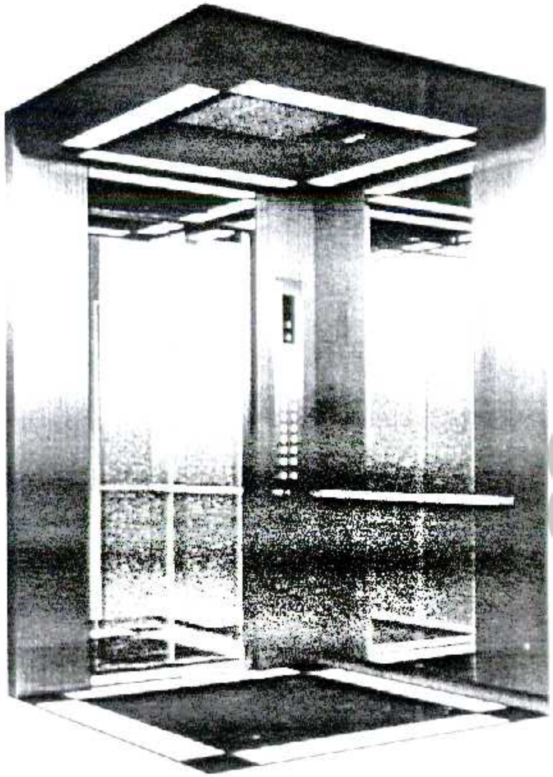
Ceiling	CD253A, Painted Steel (P021, P022), Skylite 10T, LED Down Light
Wall	Hairline Etched Stainless Steel (SE1168), Hairline Finished Stainless Steel
Car Doors	Hairline Etched Stainless Steel (SE1168)
Operating Panel	OPP-N240B / OPP-N240W (Hairline Finished Stainless Steel)
Indicator	PID110
Handrail	Stainless Steel 1 Pipe + Coated Chrome Bracket (1B)
Flooring	Polyvinyl Tile (DTE2241, DTE2246)

Notes : 1. Finished product may vary slightly from these prints.
2. The price will vary depending on the customer's specification.
3. The split may vary depending on the capacity.

| CAGE DESIGN |

Ceiling	CD291C, Acryl Painted Steel (P021)
Wall	Mirror Trimmed Stainless Steel, Hairline Etched Stainless Steel (SE1673)
Car Doors	Hairline Etched Stainless Steel (SE1673)
Operating Panel	OPP-N241B
Indicator	PID110
Handrail	Stainless Steel 1 Pipe + Coated Chrome Bracket (1B)
Flooring	Polyvinyl Tile (TN2422C, TN2801C)

1. Finished product may vary slightly from these prints.
2. The price will vary depending on the customer's specification.
3. The split may vary depending on the capacity.



| FRONT VIEW |

| REAR VIEW |

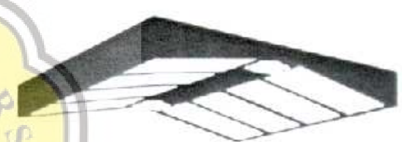
| CAGE DESIGN |

Ceiling	CD251A, Painted Steel(P022), Acryl, Convective Air Sterilization System
Wall	Hairline Finished Stainless Steel, Mirror Etched Stainless Steel(SE1184)
Car Doors	Mirror Etched Stainless Steel(EE008)
Operating Panel	OPP N241B(Mirror Finished Stainless Steel)
Indicator	PI D110(Dot Type)
Handrail	Stainless Steel 1 Pipe + Aluminum diecasting(1A)
Flooring	Marble

Note: 1. Finished product may vary slightly from these prints.
2. The price will vary depending on the customer's specification.
3. The split may vary depending on the capacity.

CD251A
(P022 / Acryl / Convective Air Sterilization System)

CD253A
(P021, P022 / Skylite 10T / LED Down Light)



CD451B
(P022)

CD516B
(Indirect Lighting / Convective Air Sterilization System)

CD519D
(Indirect Lighting / Aluminum Silver / Convective Air Sterilization System)

CD597A
(P007, Colorless White / Skylite 10T / Indirect Lighting)

CD299B
(P021 / LED Lighting(Daylight) / LED Down Light / Skylight / Anion Air Cleaner)

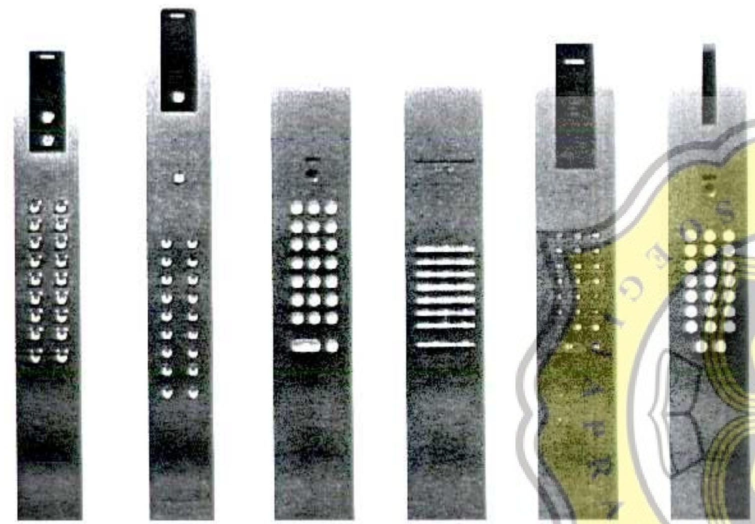
CD569A
(Aluminum / Acryl / Sheet / LED Lighting(Daylight) / Anion Air Cleaner)

Sectional View

Sectional View

Note: 1. Finished product may vary slightly from these prints.
2. The color of painted steel sheet can be changed according to the car wall color.
3. If car wall is stainless steel, P011 is recommended. The other materials need to be specified separately.

Car Operating Panels



OPP-N240B | OPP-D241B | OPP-N260A | OPP-N270A | OPP-N280A | OPP-N290A

Position Indicators

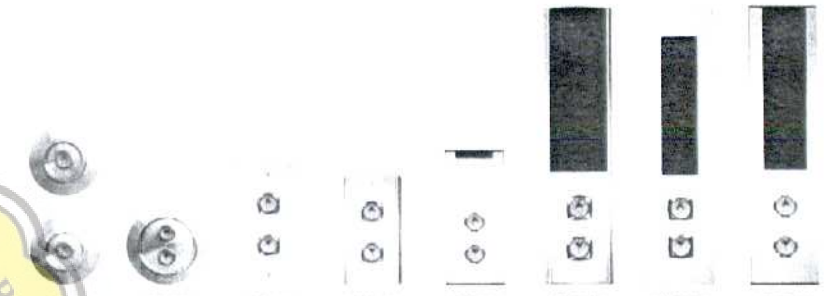
PI-D110 (Dot Matrix Type) | PI-D400 (Dot Matrix Type) | PI-D600 (Dot Matrix Type) | PI-S100 (Dot Matrix Type)

Handrail

FL (Stainless Hairline Flat Bar) | 1C (1 Pipe Stainless Hairline, Chrome Bracket) | IDV (Antiviral 1 Pipe, Ivory)

1R (1 Pipe Stainless Polished) | 2R (2 Pipe Stainless Polished) | IDW (Antiviral 1 Pipe, Wood Sheet)

Note: 1. ... means optional feature 2. Finished product may vary slightly from these prints 3. If one of the above handrails is applied for the disabled elevators, 1I and 2I are not available.

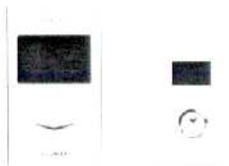


HPB-344 | HPB-342 | HPB-240 | HPB-640 (Boxless Type) | HPB-841 (Boxless Type) | HIP-D640 (Boxless Type) | HIP-D240 | HIP-D841 (Boxless Type)

1. Finished product may vary slightly from these prints.
2. Boxless Type : 90type button cannot be applied.
3. If card key system is applied, please select the box type hall buttons and key system cannot be applied on boxless hall button.

40 Type | 41 Type | 60 Type | 70 Type | 80 Type | 90 Type (Touchless Button)

90 Type is optional



HBI-12T (Box Type) | HBI-64A (Boxless Type)

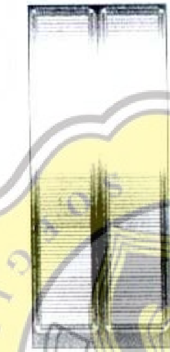
To minimize waiting time at a special floor, a special car calling button can be installed in an office (e.g. Secretary for a CEO office) or in a penthouse (e.g. Penthouse for Executives or Government Officials or Special Guests) or in a high-rise apartment.

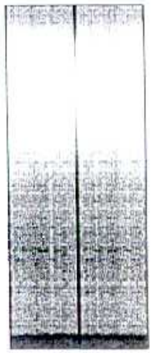
Entrance (Etching)

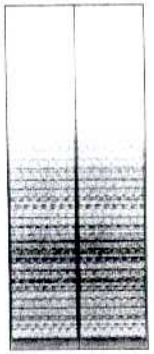

EE001
(SE695)


EE002
(SE692)


EE003
(SE691)


EE005
(SE614)


EE006
(SE743)


EE007
(SE1188)


EE008
(SE1171)


EE009
(SE1172)

Note: 1. It's different from actual size.
2. Emboss pattern Intaglio Pattern
3. If the above etching patterns are applied for fire protection doors, the left door is 20mm bigger than the right one. Consult Hyundai.
4. Etching patterns shown above are available for car doors and entrance doors.
5. For entrance opening, EE002, EE003, EE008 are not applied.


SE403


SE409

SE424


SE439

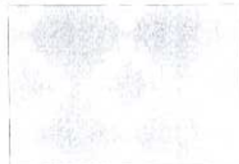
SE785


SE859


SE928


SE1168


SE1169


SE1172


SE1184


SE1589


SE1590

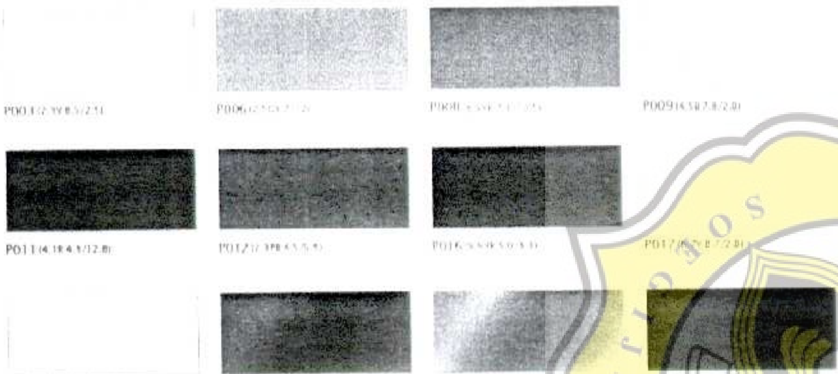
SE1591 [illegible]

SE1673

1. It's different from actual size.
2. Emboss pattern Intaglio Pattern

3 A

Paint Color



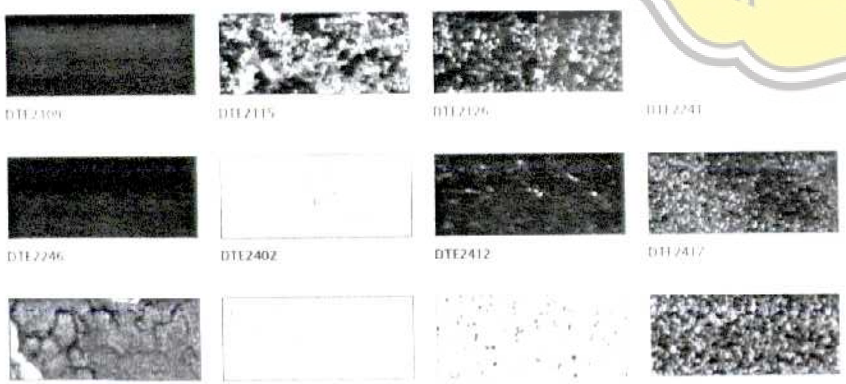
P003 · P006 · P008 · P009 (4.5B 7.8/2.8)

P011 (4.1R 4.1/12.8) · P012 · P016 · P017

P019 (5.1Y 7.8/1.1) · P020 (Metallic Gold) · P021 (Metallic Silver) · P022

Note: Finished product may vary slightly from these prints

Polyvinyl Tile

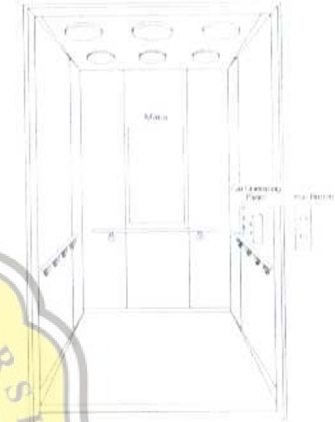


DTE2309 · DTE2115 · DTE2126 · DTE2241

DTE2246 · DTE2402 · DTE2412 · DTE2417

TN2230C · TN2233C · TN2601C · TN2604C

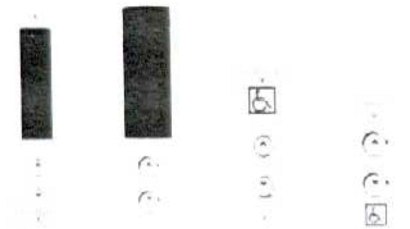
Note: Finished product may vary slightly from these prints



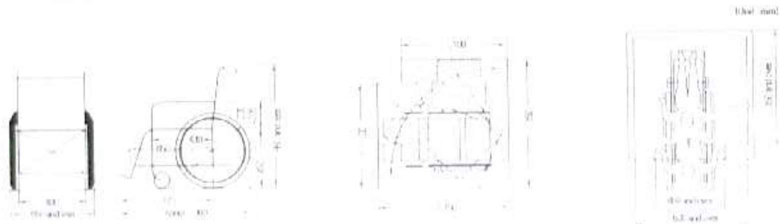
OPP-N240W

Note: Finished product may vary slightly from these prints

40 TYPE · 41 TYPE



HIP-D240 (Box Type) · HIP-D641 (Boxless Type) · HPB-240 (Box Type) · HPB-641 (Boxless Type)



Rear/Side View · Required Space (if rotated 90-degrees) · Car and Door Size

Standard & Optional Features

○ Standard ★ Optional

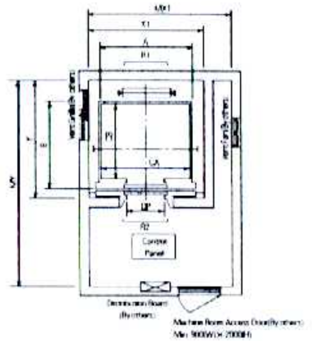
Items	Descriptions	Marks
1) Selective collective	The first call determines the direction of the elevator. All calls opposing the respective direction are serviced after carrying out by the calls of the respective direction.	○
2) Duplex selective collective	2 units of elevator provide the effective service for the common hall calls.	★
3) Automatic bypass	When a car is 80% loaded, it will automatically bypass all hall calls as the bypass load weighing device is activated.	○
4) Arrival Voice	It provides an audible indication in the car that an elevator is about to arrive.	○
5) Signal fixtures	Dot matrix type(moving direction) Hall lantern	○ ★
6) Single-side safety edge of door	Contact with a passenger or inanimate object causes the doors to stop and reopen automatically. The elevator doesn't start if the door is not completely closed.	○
7) Ventilation fan	Car ventilation is smooth with ventilation fan built in the ceiling.	○
8) Emergency car lighting	In case of a power failure, it automatically turns on the emergency light in the car.	○
9) Automatic interruption of light and ventilation fan	The lights and ventilation fan are automatically turned off to save energy if there is no call registered for a period of time. If there is a call registered again, it works again.	○
10) Car door interlock switch	When the door is opened, the switch installed at the door operator is activated and keeps the car from moving. During the operation of car, it locks the door completely so as not to open the door from out side.	○
11) Overload features	To protect the overload of an elevator, this device sounds a buzzer and the elevator remains stopped at that floor when the number of passengers exceeds the rated capacity. When the excess number of passengers get out of the car, the buzzer stops and the elevator door closes.	○

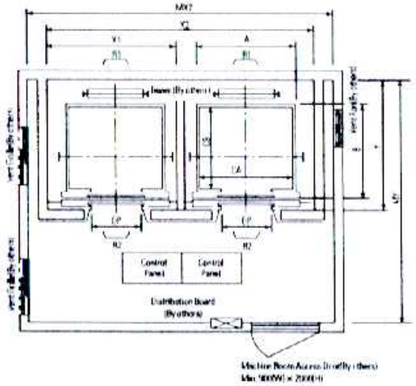
Items	Descriptions	Marks
12) Safety drive	During the operation if the car stops between floors, and safety device doesn't work the car automatically moves to the nearest floor with the low speed. Then, it opens the door to allow the passengers to exit off.	○
13) Multi-beam door protection	Multi beam from the top to the bottom of the door senses any obstruction caught in the door. It makes the door reopen and stay open until the obstruction is removed.	★
14) Fire emergency service	When a fire breaks out, all cars activated by the switch or fire detector are immediately called to a specified rescue floor for the passenger's safety.	★
15) Anti-nuisance	Evaluates the number of people on the car and compares that value to the number of the car calls registered. If the number of car calls exceeds the number of people in the car by the load sensor, the car call exceeding the number of passengers will be cancelled after service nearest call only.	★
16) Voice synthesizer	A voice synthesizer with microprocessor makes announcements to inform passengers of various conditions, including landing floor and operation direction, etc.	○
17) Fireman's emergency service	When the fireman's switch located at the main floor lobby and operating panel on the car is activated during a fire or other emergency, a designated car can be called back to a specified floor for fire fighting service.	★
18) HELMON (Hyundai Elevator Computer Monitoring) System	This system has various functions, like elevator monitoring and control by a personal computer and modem.	★
19) Attendant service	It is activated when the attendant turns on the ATT switch in the car operating panel to "ON" position.	★
20) Earthquake operation	When the seismic sensor detects and earthquake that exceeds a predetermined level all cars promptly proceed to land at the nearest floor and park with the doors open to allow passengers to exit out safely.	★
21) Parking	With the use of the parking switch on the hall button, the car can be parked at a specified floor, during nights and holidays.	★

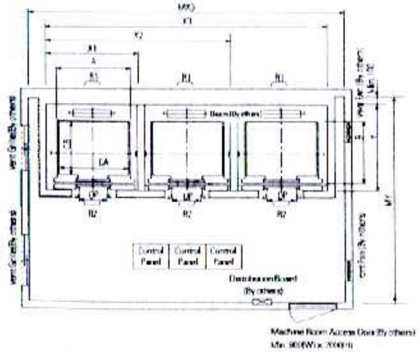
Note : Consult Hyundai if you need the specific features except the above items.

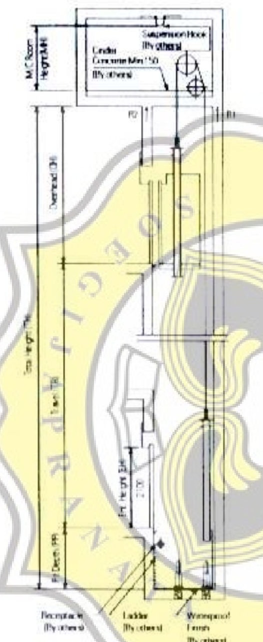
Layout Plan - LUXEN(Gearless Elevators) 1~2.5m/sec

Plan of Hoistway & Machine Room









(Unit : mm)

Speed (m/sec)	Capacity		Clear Opening	Car		Hoistway				M/C Room				M/C Room Reaction (kg)		Pit Reaction (kg)	
				Internal	External	1Car	2Cars	3Cars	Depth	1Car	2Cars	3Cars	Depth				
	Persons	kg	OP	CA × CB	A × B	X1	X2	X3	Y	MX1	MX2	MX3	MY	R1	R2	R3	R4
	6	450	800	1400 × 850	1460 × 1005	1800	3700	5600	1430	2000	4000	6000	3200	3600	2000	5400	4500
	8	550	800	1400 × 1030	1460 × 1185	1800	3700	5600	1610	2000	4000	6000	3400	4050	2250	6000	4900
1	9	600	800	1400 × 1150	1460 × 1285	1800	3700	5600	1710	2000	4000	6000	3500	4100	2450	[illegible]	5100
	10	700	800	1400 × 1250	1460 × 1405	1800	3700	5600	1830	2000	4000	6000	3600	4700	2700	2800	5400
1.5	11	750	800	1400 × 1350	1460 × 1505	1800	3700	5600	1930	2000	4000	6000	3700	4550	2800	7100	5600
	13	900	900	1600 × 1350	1660 × 1505	2050	4200	6350	1980	2300	4400	6800	3750	5100	3750	8100	6300
1.75	15	1000	900	1600 × 1500	1660 × 1655	2050	4200	6350	2130	2300	4400	6800	3850	5450	4300	8600	6600
2	17	1150	1000	1800 × 1500	1900 × 1870	2350	4800	7250	2180	2600	4900	7500	3900	6400	5100	11000	8700
			1100	2000 × 1350	2100 × 1520	2550	5200	7850	2030	2800	5250	8300	3800				
2.5	20	1350	1000	1800 × 1700	1900 × 1870	2350	4800	7250	2380	2600	4900	7500	4200	7800	6000	12200	9500
			1100	2000 × 1500	2100 × 1670	2550	5200	7850	2180	2800	5250	8300	4000				
	24	1600	1100	2000 × 1750	2100 × 1920	2550	5200	7850	2430	2900	5400	8300	4300	8500	6800	13600	10400
				2150 × 1600	2250 × 1770	2700	5500	8300	2280	3000	5650	8700	4200				

1. Above hoistway dimensions are based on 15-storied buildings. For application to over 16-storied buildings the hoistway dimensions shall be at least 5% larger considering the sloping of the hoistways.
2. Above dimensions are based on center opening doors. For applicable dimensions with side opening doors, consult Hyundai.
3. When non-standard capacities and dimensions are required to meet the local code, consult Hyundai.
4. The capacity in persons is calculated at 65kg/person (EN81 : 75kg/person).
5. Above dimensions are applied in case the door is standard. In case fire protection door that the clear opening is over 1000mm is applied, hoistway size for 1 car should be applied above X1 dimension plus 100mm.
6. In case of 2m/sec and 2.5m/sec, hoistway size is above plus 100mm, the machine room size is above plus 100mm.

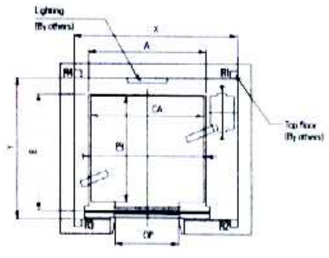
(Unit : mm)

Speed (m/sec)	Overhead (OH)	Pit (PP)	M/C Room Height (MH)
1	4600	1500	2200
1.5	4800	1800	2400
1.75	5000	2100	2400
2	5000	2100	2600
2.5	5500	2400	2600

1. Machine room temperature should be maintained below 40°C with ventilating fan and/or air conditioner (if necessary) and humidity below 90%.
2. The minimum hoistway dimensions are shown on the above table. Therefore some allowances should be made considering the sloping of the hoistways.
3. The minimum machine room height should be 2800mm in case of the traction machine with double isolation pad.
4. For gearless (1:1 roping) elevators, the minimum machine room height should be 2400mm.

Layout Plan - YZER(Machine-Room-Less Elevators) 1~2.5m/sec

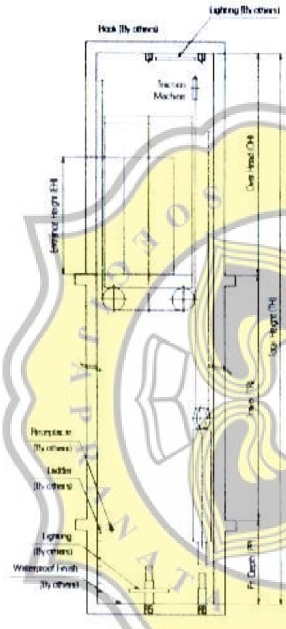
Plan of Hoistway (8~36 Persons)



Floor without control panel

Floor with control panel

Notes 1. The lighting of hoistway should be installed less than 500mm from above the ceiling of hoistway and within 500mm above the bottom of the pit (By others)
2. Machine room temperature should be maintained below 40°C with ventilating fan and/or air conditioner (if necessary) and humidity below 90%.



(Unit: mm)

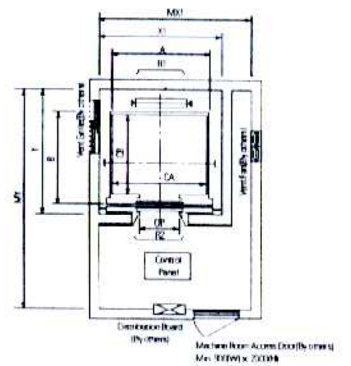
Speed (m/sec)	Capacity Persons	Capacity kg	Clear Opening DP	Car CA × CB	Car A × B	Hoistway X	Hoistway Y	Motor (kW)	M/C Room Reaction (kg) R1	R2	R3	R4	Pit Reaction (kg) R5	R6
1 1.5 1.75	8	550	800	1300×1150	1540×1255	2050	1700	5.4 5.1 5.9	4400	2100	1500	720	7000	1400
1 1.5 1.75	9	600	800	[illegible]	[illegible]	[illegible]	[illegible]	5.6 6.5	5100	2400	1200	760	7500	1600
1 1.5 1.75	10	700	800	1400×1300	1540×1455	2150	1800	4.5 6.1 7.5	4500	2300	1110	750	7800	1600
1 1.5 1.75	11	750	800	1300×1400	1540×1555	2050	1850	4.7 6.9 8.1	4800	2300	1250	[illegible]	8100	1700
1 1.5 1.75	13	900 930 (HC)	900	1500×1400 1700×1350	1540×1555 1640×1505	2200 2300	1950	5.7 8.4 10	5100	2500	1800	750	9200	1900
2 2.5					1600×1570 1700×1520	2400 2500	2100 2050	11.5 14.5	5500	3100	1800	100	11200	2300
1 1.5 1.75	15	[illegible]	900	1600×[illegible]	1600×1555	2900	1900 (2100)	[illegible]	5600	2100	1900	800	9800	2000
2 2.5					1700×[illegible]	[illegible]	2150 [illegible]	[illegible]	5700	3900	[illegible]	100	11600	2500
1 1.5 1.75	17	1150	1000	1600×1500	1800×1520	[illegible]	[illegible]	10.7	6300	4000	2100	500	12500	2500
2 2.5						2250	2250	12 17	6600	4200	2100	500	14200	2710
1 1.5 1.75	20	1350	1000	1800×1600	1900×1770	2550	2400	8.5 11.5 12.5	7100	4300	2500	1160	13500	3000
2 2.5						2600		16.6 20.7	8200	4600	2600	1200	16500	2500
1 1.5 1.75	24	1600	1100	2000×1650	2100×1[illegible]	2850	2250	9.5 14.8 17.3	7500	3600	2600	1210	15200	3200
2 2.5						[illegible]		[illegible]	8500	4200	2700	[illegible]	[illegible]	3300
1 1.5 1.75	[illegible]	1750	1200	1600×[illegible]	[illegible]	[illegible]	[illegible]	11 [illegible]	8000	[illegible]	2800	1900	18[illegible]	2900
1 1.5 1.75	30	2000	1200	2100×1950	2100×2107	3000	2550	17.3 18.4 21.5	9100	4700	2800	1260	19600	3200
1 1.5 1.75	36	2500	1200	2200×2200	2300×2407	3300	3050	15.6 23 26.9	10300	5200	3000	1600	22400	3300

Persons	Speed (m/sec)	Overhead (OH)	Pit (PP)	Control Panel (CPX*)
8~12	0.75 1	2800	1500	550
	1.5	2900	1600	550
	1.75	3000	2100	550
13~17	[illegible]	2900	[illegible]	550
	2.5	3600	2400	550
21~24	0.75 1	3200	1500	550
	1.5	4300	1600	650
	1.75	4500	2100	650
	2	4800	2200	650
	2.5	5100	2400	650
27~30	0.75 1	4400	1750	550
	1.5	4500	1900	650
	1.75	4600	2100	650
36	0.75 1	5000	1750	650
	1.5	5100	1900	650
	1.75	5200	2100	650

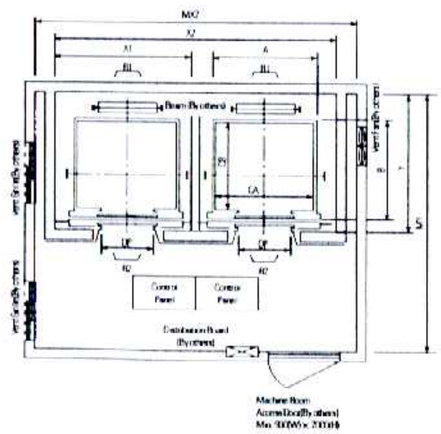
Notes 1. Above dimensions are applied for car height of 2500mm (car internal height ≤ 2800mm). For other application dimensions consult Hyundai.
2. For car internal height (under 17 persons) of 2500mm, dimension of overhead is CH plus 200mm.
3. The minimum hoistway dimensions are shown on the above table. Therefore, some allowances should be made considering the sloping of the hoistways.
4. When face to face arrangement is required, partitioning work for hoistway is required. (FNB1)
5. If the hoistway is glass, consult Hyundai as it needs to finish laminated glass. (FNB1)
6. When non-standard capacities and dimensions are required to meet the local code, please consult Hyundai Elevator.

Notes 1. When non-standard capacities and dimensions (including fire protection doors) are required to meet the local code, please consult Hyundai.
2. The minimum hoistway dimensions are shown on the above table. Therefore, some allowances should be made considering the sloping of the hoistways.
3. If the height of floor is over 11m, please consult Hyundai as to the needs for emergency exit.
4. Above dimensions are applied in case the door is standard. In case fire protection door that the clear opening is over 1100mm is applied, hoistway size for [illegible] applied above X dimension plus 100mm.
5. In case the emergency stop switch is applied to the counter weight, consult Hyundai.
6. When face to face arrangement is required, partitioning work for hoistway is required. (FNB1)

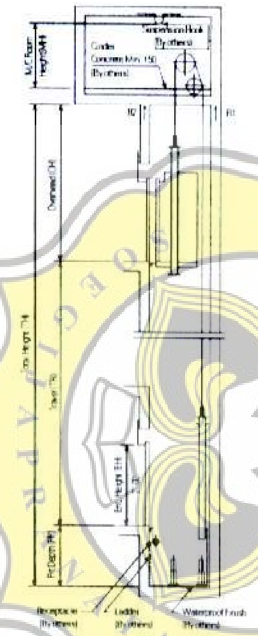
Plan of Hoistway & Machine Room

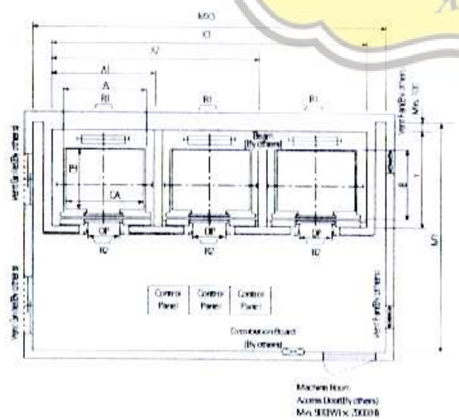


Note : Machine room temperature should be maintained below 40°C with ventilating fan and/or air conditioner(if necessary) and humidity below 90%.



Section of Hoistway





Standard Dimensions & Reactions

(Unit : mm)

Speed (m/sec)	Capacity		Clear Opening	Car		Hoistway				M/C Room				M/C Room Reaction (kg)		Pit Reaction (kg)	
				Internal	External	1Car	2Cars	3Cars	Depth	1Car	2Cars	3Cars	Depth				
	Persons	kg	OP	CA × CB	A × B	X1	X2	X3	Y	MX1	MX2	MX3	MY	R1	R2	R3	R4
	6	450	800	1400 × 850	1460 × 1005	1800	3750	5600	1520	2000	4000	6050	3200	3800	2000	5300	4200
	8	550	800	1400 × 1030	1460 × 1185	1800	3700	5600	1670	2000	4000	6000	3400	4050	2250	5400	4700
	9	600	800	1400 × 1130	1460 × 1285	1800	3700	5600	1770	2000	4000	6000	3500	4100	2450	6100	3900
1	10	700	800	1400 × 1250	1460 × 1405	1800	3700	5600	1890	2000	4000	6000	3600	4200	2200	5600	5200
	11	750	800	1400 × 1350	1460 × 1505	1800	3700	5600	1930	2000	4000	6000	3700	4550	2800	6700	5400
	13	900	900	1600 × 1350	1660 × 1505	2050	4200	6350	1980	2300	4400	7800	3750	5100	3750	7900	6100
1.5	15	1000	900	1600 × 1500	1660 × 1655	2050	4200	6350	2130	2300	4400	6800	5850	5450	4300	8400	6400
	17	1150	1000	1800 × 1500	1900 × 1670	2350	4800	7250	2180	2600	4900	7500	5900	6600	5100	10800	8500
			1100	2000 × 1350	2100 × 1520	2550	5200	7850	2030	2800	5250	8000	5800				
1.75	20	1350	1000	1800 × 1700	1900 × 1870	2350	4800	7250	2380	2600	4900	7500	4200	7800	4050	11800	9100
			1100	2000 × 1500	2150 × 1620	2550	5200	7850	2140	2800	5250	8000	6000				
	24	1600	1100	2000 × 1750	2100 × 1920	2550	5200	7850	2380	2800	5250	8000	6300	8500	5600	13100	9900
				2150 × 1600	2250 × 1770	2750	5600	8450	2230	3000	5650	8700	6200				

Note : 1. Above hoistway dimensions are based on 15-storied buildings. For application to over 16-storied buildings, the hoistway dimensions shall be at least 5% larger considering the sloping of the hoistways.
2. Above dimensions are based on center opening doors. For applicable dimensions with side opening doors, consult Hyundai.
3. When non-standard capacities and dimensions are required to meet the local code, consult Hyundai.
4. The capacity in persons is calculated at 65kg/person. (EN81 : 75kg/person)
5. Above dimensions are applied in case the door is standard. In case fire protection door that the clear opening is over 1000mm is applied, hoistway size for 1 car should be applied above X1 dimension plus 100mm.

(Unit : mm)

Speed (m/sec)	Overhead (OH)	Pit (PP)	M/C Room Height (MH)
1	4600	1500	2200
1.5	4800	1800	2400
1.75	5000	2100	2400

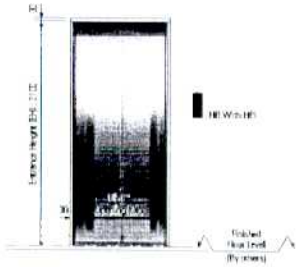
Note : 1. The minimum hoistway dimensions are shown on the above table. Therefore, some allowances should be made considering the sloping of the hoistways.
2. Machine room temperature should be maintained below 40°C with ventilating fan and/or air conditioner (if necessary) and humidity below 90%.
3. The minimum machine room height should be 2800mm in case of the traction machine with double isolation pad.

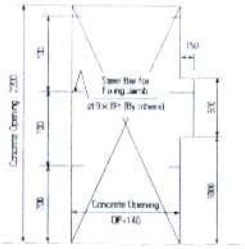
Typical Entrance Layouts

Typical Entrance Layouts – Only for Floor with Control Panel of the Machine-Room-Less Elevators

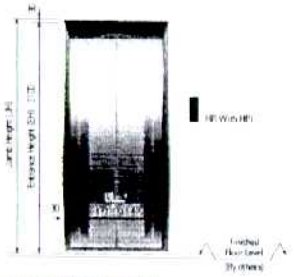
Entrance

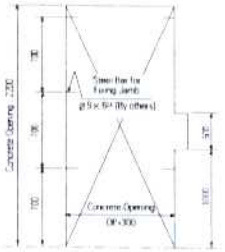
Structural Opening of Entrance



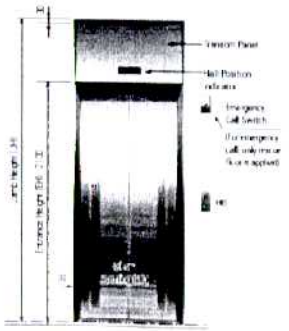


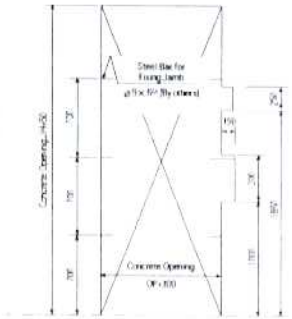
JP050 Type (Standard)





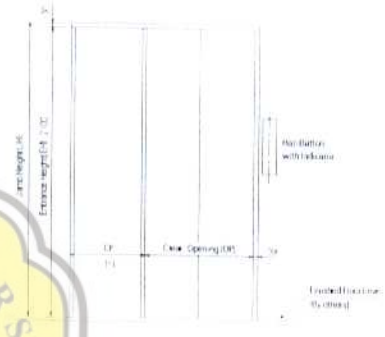
JP100 Type (Optional)



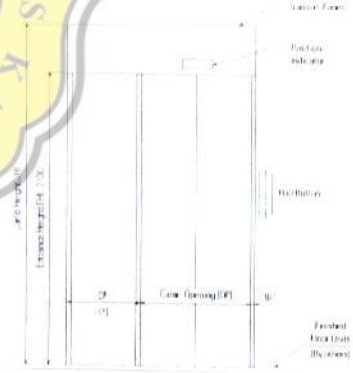


JP200 Type (Optional)

In case of Boxless Type Buttons and Fire man's Switch

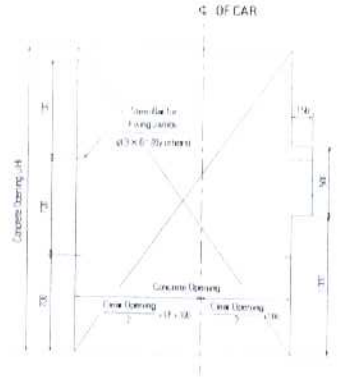


CP110 Type (Standard)

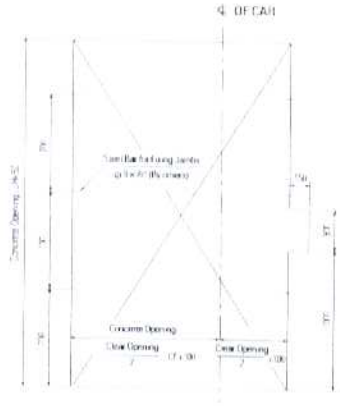


CP210 Type (Optional)

Persons	Speed (m/sec)	Width of Control Panel (CP) (*)
8-17	Under 1.75	530
	1	530
20-24	1.5	630
	1.75	630



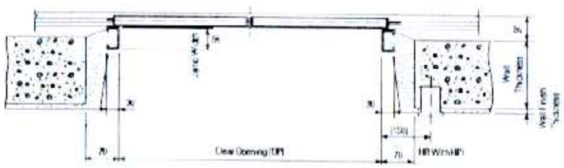
CP110 Type (Standard)



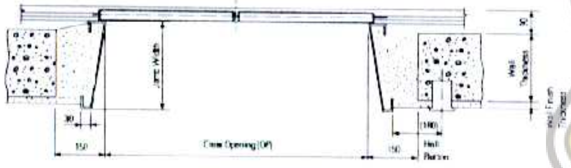
CP210 Type (Optional)

Typical Entrance Layouts – 2-Panel Center-Opening Doors (CO)

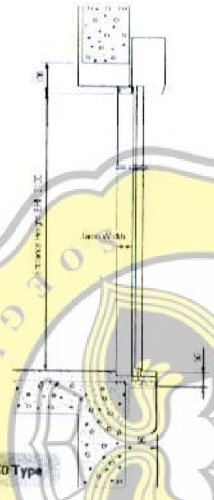
Plan of Entrance



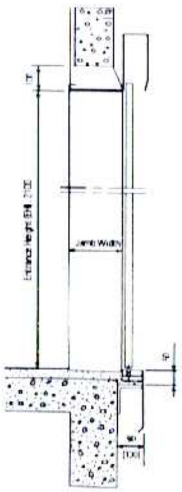
JP050 Type



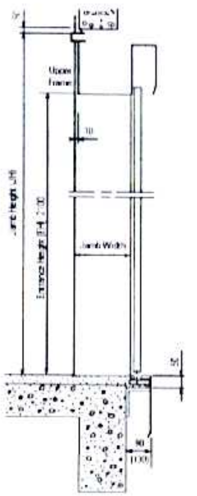
JP100, JP200 Type



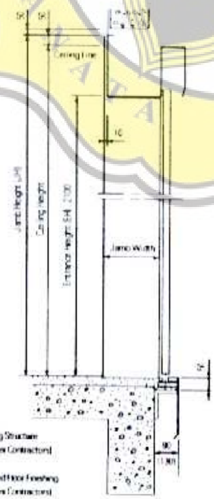
JP050 Type



JP100 Type



JP200 Type (with upper frame)



Building Structure (By Other Contractors)

Wall and Floor Finishing (By Other Contractors)

JP200 Type (without upper frame)

Note: The dimension in [ ] is applied for 2m/sec and over

Works To Be Done By Other Contractors

The following works are not included in the elevator contract, and shall be done by other contractors in accordance with the Hyundai Elevator's drawings and the applicable codes and regulations.
The reference rules shown are from Code ANSI.

Hoistway

1. Clear, plumb hoistway with fire resistant hatch walls as required by the applicable code. (Rule 100.1a)
2. 75° bevel guards on all projections, recesses, or setbacks over 50mm except on side used for loading or unloading. (Rule 100.5)
3. Venting of the hoistway as required by the applicable code or responsible authority. (Rule 100.4)
4. Supports for rail brackets at each floor roof and machine room. (Rule 200.9)
   Maximum allowable vertical spacing of rail supports without backing. (Rule 200.4 and 301.1) Divider beams 100mm between hoistway at each floor and roof, for guide rail bracket supports. (Rule 200.4, 200.9 and 301.1)
5. Recessed supports and patching as required to accommodate hall button boxes, signal fixtures, etc.
6. All barricades either outside elevator hoistways or between hoistways as required.
7. Dry pit reinforced to sustain normal vertical forces from rails and buffers. (Rule 106.1b and 109) Consult Hyundai Elevator Company for rail forces and buffer impacts. Where there is space below the pit floor that can be occupied, consult Hyundai Elevator Company for special requirements. (Rule 300.4) Cylinder hole, casings under the pit as required, and backfilling around the cylinder casings when direct plunger type is to be installed.
8. Where access to the pit is by means of the lowest hoistway entrance, vertical iron ladder extending 1060mm minimum above sill of access door. (Rule 106.1d)
9. Entrance walls and finished floor are not to be constructed until after door frames and sills are in place. Door frames are to be anchored to walls and properly grouted in place to maintain legal fire rating.
10. For application as indoor or outdoor observation elevator, a glass enclosure of at least 3.6m in height at the bottom landing is recommended for safety. For use as an outdoor observation elevator, a full-height glass enclosure is required.

Machine Room

11. Enclosed and protected machine room. (Rule 101.1)
12. Access to the machine room and machinery space as required by the applicable code or responsible authority. (Rule 101.3)
13. Reinforced concrete machine room floor slab or grating, as specified, which must not be placed over the hoistway until elevator machinery is set in position. (Rule 100.1 for Traction Elevator)
    Clear access above ceiling or trench in floor for oil line and wiring duct from machine room, if machine room is remote from elevator hoistway. (For Hydraulic Elevator) Cutout through machine room wall, for oil line and wiring duct as required by Hyundai Elevator's shop drawings. (For Hydraulic Elevator)
14. Hoisting beams, trap doors, and other means of access to machine room for maintenance and equipment removal purposes. (Rule 101.3d)
15. Cable guards in the machine room or secondary level. (Rule 104.1)
16. Supports for machine and sheave beams and reactions including wall pockets and patching after beams are set in place. (Rule 105.1 to 105.[illegible])

Electrical

Hoistway

1. Light outlet for each elevator in center of hoistway for machine room as indicated by Hyundai Elevator Company.
2. Convenience outlet and light fixture in pit with switch located adjacent to the access door. (Rule 106.1e)
3. Wiring and piping work of emergency bell, interphone etc. Outside the hoistway and the machine room.

Machine Room

4. Lighting, convenience outlets, ventilation, heating of machine room, and machinery space. (Rule 101.5)
5. Temperature should be maintained below 40° by a ventilating fan and/or air conditioner, if necessary, and humidity below 90%.
6. A fused disconnect switch or circuit breaker for each elevator and light switch located per the applicable code and where practicable located adjacent to the door of the machine room. (Rule 210.5 and 306.7)
7. Feeder and branch wiring to the controller including mainline switch and convenience outlets.
8. Suitable power feeder and branch wiring circuits as required for elevators with power operated doors, including disconnect switch or circuit breaker.

Emergency Operations

9. Elevator fireman's and other emergency services wiring and interconnections to automatic sprinkler systems or heat and smoke sensing devices furnished by others and installed to terminal points on the elevator controllers.
10. When emergency power operation of elevators is required, the electrical contractor should coordinate with Hyundai Elevator Company or local distributor for operation requirements.
11. Elevator fireman's and other emergency service requirements may differ from each country. Consult Hyundai Elevator Company or local distributor for other local requirements.
12. When provisions for earthquake protections are required, consult Hyundai Elevator Company for special requirements.

Heat Emission

Q [Kcal/H] = W × V × F × N

W: Capacity [kg] V: Speed [m/sec]

F: Factor [1/40: VVVF] N: Number of cars

Electric Power Requirements (By others)

VVVF (2:1 ROPING)

Persons (kg)	Speed (m/sec)	Motor (kW)	MCCB (A)		Power (KVA)		Cable (mm²)		Earth (mm²)	
			1Car	2Cars	1Car	2Cars	1Car	2Cars	1Car	2Cars
6/450	1	5.5 (2.8)	20 (20)	30 (20)	4 (3)	7 (5)	4 (4)	6 (4)	6 (6)	6 (6)
	1.5	7.5 (4.2)	20 (20)	30 (40)	6 (4)	10 (8)	4 (4)	6 (10)	6 (6)	6 (6)
	1.75	7.5 (4.9)	20 (20)	40 (40)	7 (5)	12 (9)	4 (4)	10 (16)	6 (6)	6 (6)
8/550	1	5.5 (3.4)	20 (20)	30 (20)	5 (4)	9 (6)	4 (4)	6 (4)	6 (6)	6 (6)
	1.5	7.5 (5.1)	20 (20)	30 (40)	7 (5)	13 (10)	4 (4)	6 (10)	6 (6)	6 (6)
	1.75	11 (5.9)	20 (20)	50 (40)	8 (6)	15 (11)	6 (4)	16 (10)	6 (6)	6 (6)
9/600	1	5.5 (3.7)	20 (20)	30 (30)	5 (4)	9 (7)	4 (4)	6 (6)	6 (6)	6 (6)
	1.5	11 (5.4)	30 (20)	50 (40)	8 (6)	14 (11)	6 (4)	16 (10)	6 (6)	6 (10)
	1.75	11 (6.5)	30 (20)	50 (40)	9 (7)	16 (12)	6 (6)	16 (10)	6 (6)	6 (10)
10/700	1	7.5 (4.2)	20 (20)	40 (30)	6 (5)	11 (8)	4 (4)	10 (6)	6 (6)	6 (6)
	1.5	11 (6.5)	30 (20)	50 (40)	9 (7)	16 (12)	6 (6)	16 (10)	6 (6)	6 (6)
	1.75	11 (7.6)	30 (20)	60 (40)	11 (9)	19 (14)	6 (6)	16 (10)	6 (6)	10 (6)
11/750	1	7.5 (4.6)	20 (20)	40 (30)	6 (5)	12 (9)	4 (4)	10 (6)	6 (6)	6 (6)
	1.5	11 (6.9)	30 (20)	50 (40)	10 (7)	17 (12)	6 (4)	16 (10)	6 (6)	6 (10)
	1.75	11 (8.1)	30 (30)	60 (50)	11 (9)	20 (15)	10 (6)	16 (16)	6 (6)	10 (10)
13/900	2	(9.2)	(30)	(50)	(10)	(18)	(6)	(16)	(6)	(10)
	1	11 (5.6)	30 (20)	50 (30)	8 (6)	14 (11)	6 (4)	10 (6)	6 (6)	6 (6)
	1.5	15 (8.3)	40 (30)	60 (50)	12 (9)	21 (16)	10 (6)	16 (16)	6 (6)	10 (10)
	1.75	15 (9.7)	40 (30)	75 (50)	14 (10)	24 (18)	10 (6)	25 (16)	6 (6)	10 (10)
	2	(11.1)	(30)	(60)	(12)	(21)	(6)	(16)	(6)	(10)
	2.5	(13.8)	(50)	(100)	(15)	(26)	(10)	(25)	(6)	(16)
15/1000	1	11 (6.2)	30 (20)	50 (60)	9 (7)	15 (12)	6 (4)	16 (10)	6 (6)	6 (10)
	1.5	15 (9.2)	40 (30)	75 (50)	13 (10)	23 (18)	10 (6)	25 (16)	6 (6)	10 (10)
	1.75	15 (10.8)	40 (30)	75 (60)	15 (11)	27 (20)	10 (6)	25 (16)	6 (6)	10 (10)
	2	(12.3)	(40)	(75)	(13)	(23)	(10)	(25)	(6)	(16)
	2.5	(15.4)	(50)	(100)	(17)	(31)	(10)	(25)	(6)	(16)
17/1150	1	11 (7.1)	30 (20)	50 (60)	10 (8)	18 (13)	6 (4)	16 (10)	6 (6)	6 (10)
	1.5	15 (10.6)	40 (30)	75 (60)	15 (11)	27 (20)	10 (6)	25 (16)	6 (6)	10 (10)
	1.75	18.5 (12.4)	50 (30)	100 (60)	17 (13)	31 (23)	16 (6)	35 (16)	6 (6)	10 (16)
	2	(14.1)	(60)	(75)	(15)	(27)	(10)	(25)	(6)	(16)
	2.5	(17.7)	(60)	(100)	(20)	(35)	(10)	(25)	(6)	(16)
20/1350	1	15 (8.3)	30 (20)	60 (40)	12 (9)	21 (16)	10 (6)	16 (10)	6 (6)	6 (6)
	1.5	18.5 (12.5)	50 (40)	100 (75)	17 (13)	31 (24)	16 (10)	25 (25)	6 (6)	10 (10)
	1.75	22 (14.5)	50 (40)	100 (75)	20 (15)	37 (28)	16 (10)	35 (25)	6 (6)	10 (10)
	2	(16.6)	(60)	(100)	(17)	(31)	(10)	(25)	(6)	(10)
	2.5	(20.7)	(75)	(125)	(23)	(43)	(16)	(35)	(10)	(25)
24/1600	1	15 (9.9)	40 (30)	75 (50)	14 (10)	25 (19)	10 (6)	25 (16)	6 (6)	10 (6)
	1.5	22 (14.8)	50 (50)	100 (75)	21 (16)	37 (28)	16 (10)	35 (25)	6 (6)	10 (10)
	1.75	22 (17.2)	60 (50)	125 (100)	24 (18)	43 (33)	16 (16)	35 (25)	10 (6)	16 (10)
	2	(19.7)	(60)	(100)	(21)	(37)	(16)	(25)	(6)	(10)
	2.5	(24.5)	(75)	(150)	(27)	(49)	(16)	(50)	(10)	(35)

Note : 1. Above power feeder sizes are for the length of electric wire up to 50m from elevator machine room to power.
For the length being 50m or more, the following formula should be applied.
2. Above cable sizes are for copper wires inside electromagnetic tubings.
Cable sizes may v[illegible]

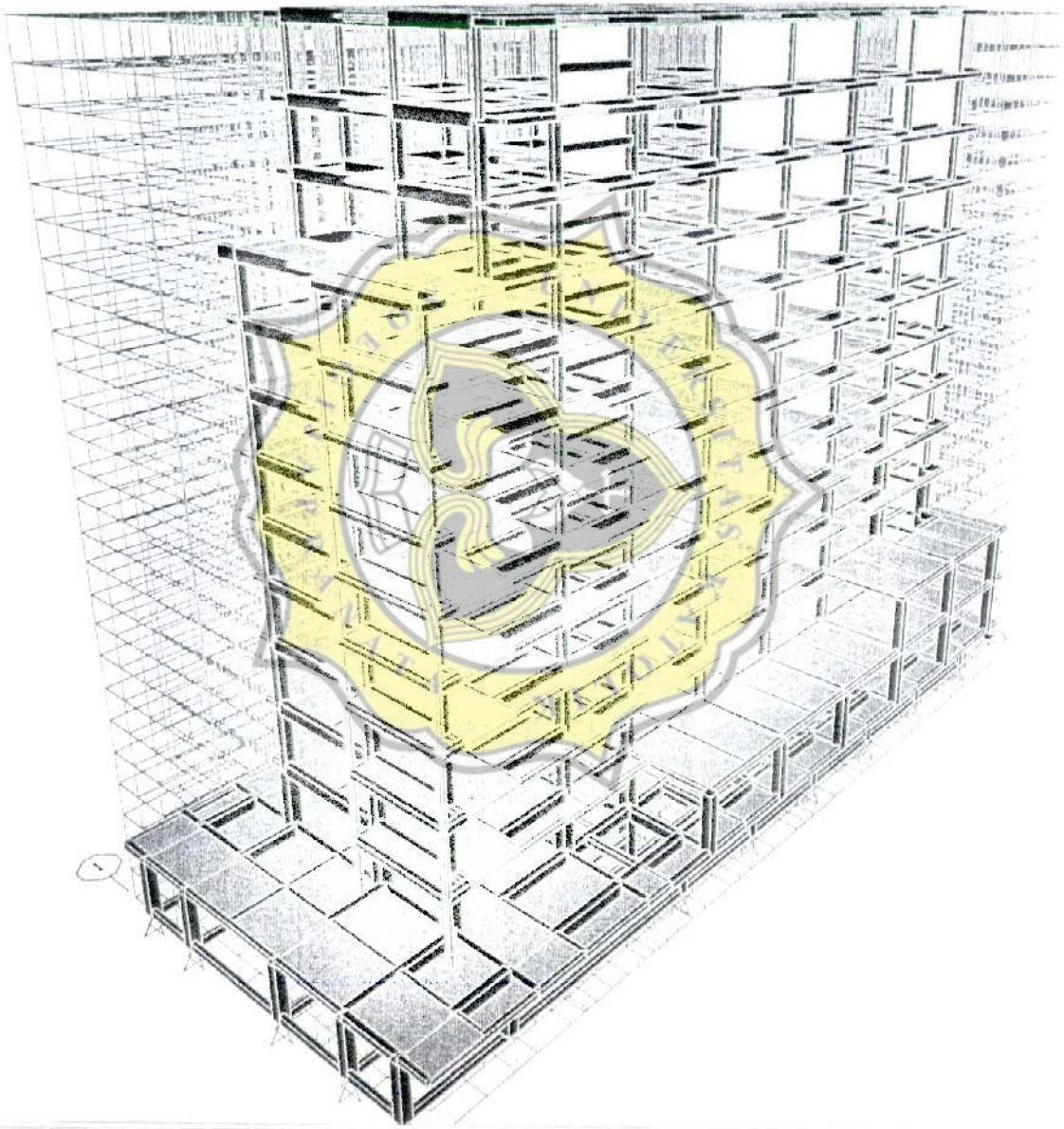
3. For power requirement of 3 cars or more, consult Hyundai.
4. Machine room temperature should be maintained below 40°C with ventilating fan and air conditioner, and humidity below 90%.
5. Data shown in ( ) is applied to the Machine Room Less elevators and gearless traction machines.

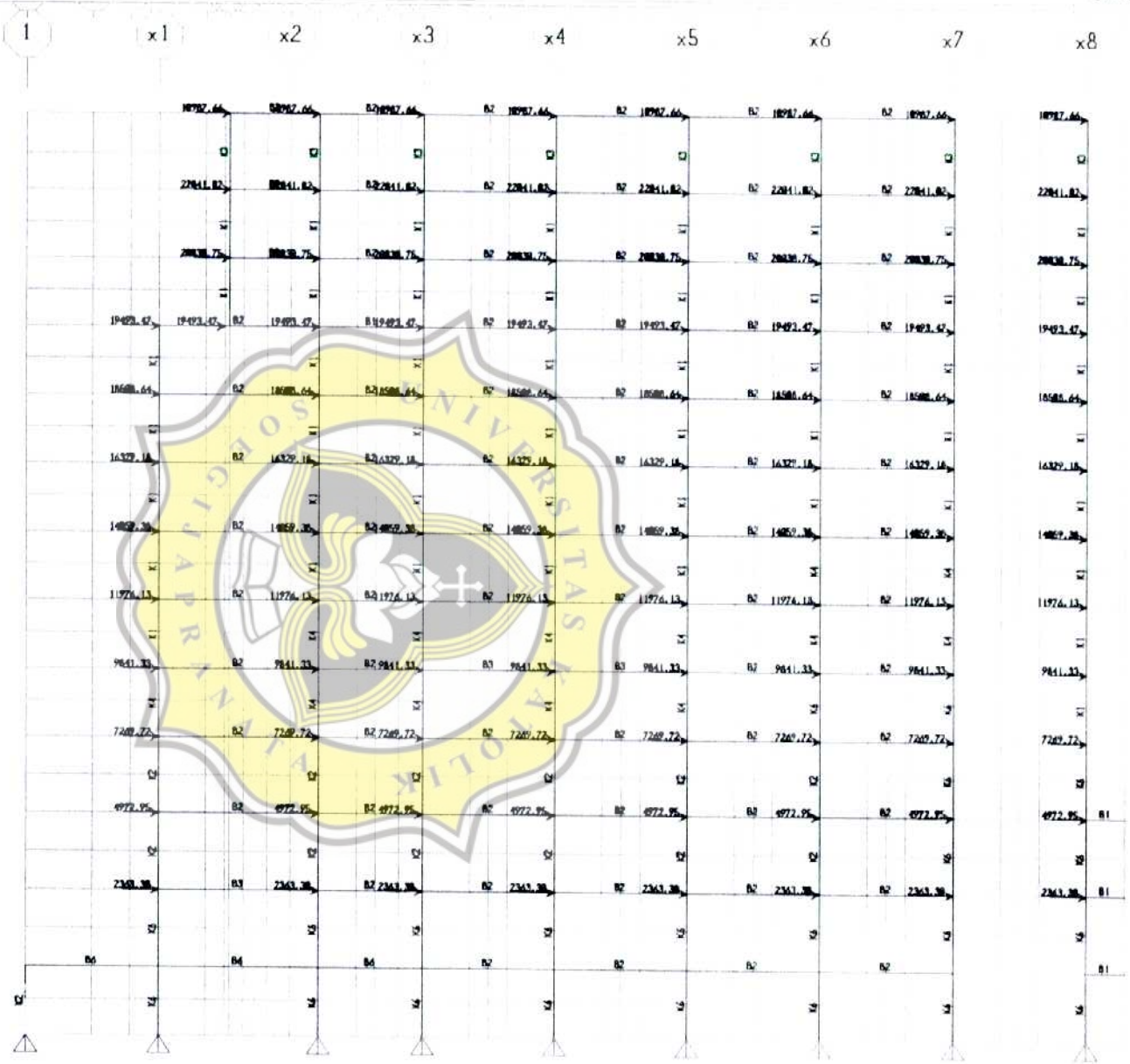
Persons (kg)	Speed (m/sec)	Motor (kW)	MCCB (A)		Power (KVA)		Cable (mm²)		Earth (mm²)	
			1Car	2Cars	1Car	2Cars	1Car	2Cars	1Car	2Cars
6/450	1	5.5 (2.8)	30 (20)	50 (40)	4.3 (3.3)	8 (6)	4 (4)	10 (6)	4 (4)	6 (6)
	1.5	7.5 (4.2)	30 (30)	60 (60)	6.4 (4.9)	12 (9)	6 (6)	16 (16)	4 (4)	10 (10)
	1.75	7.5 (4.9)	40 (30)	75 (60)	7.5 (5.7)	14 (10)	6 (6)	16 (16)	6 (6)	10 (10)
8/550	1	5.5 (3.4)	30 (20)	50 (40)	5.3 (4.1)	9 (7)	4 (4)	10 (6)	4 (4)	6 (6)
	1.5	7.5 (5.1)	40 (30)	75 (60)	7.9 (6)	14 (11)	6 (6)	25 (16)	6 (6)	10 (10)
	1.75	11 (5.9)	40 (30)	75 (60)	9.2 (7)	17 (13)	10 (6)	25 (16)	6 (6)	10 (10)
9/600	1	5.5 (3.7)	30 (20)	60 (40)	5.7 (4.4)	10 (8)	4 (4)	16 (10)	6 (6)	10 (6)
	1.5	11 (5.4)	40 (30)	75 (60)	8.6 (6.5)	15 (12)	10 (6)	25 (16)	6 (6)	10 (10)
	1.75	11 (6.5)	40 (30)	100 (60)	10 (7.6)	18 (14)	10 (6)	25 (16)	6 (6)	16 (10)
10/700	1	7.5 (4.2)	30 (20)	60 (40)	6.7 (5.1)	12 (9)	6 (4)	16 (10)	6 (6)	10 (6)
	1.5	11 (6.5)	40 (30)	100 (60)	10 (7.6)	18 (14)	10 (6)	25 (16)	6 (6)	16 (10)
	1.75	11 (7.6)	50 (40)	100 (75)	11.7 (8.8)	21 (16)	16 (6)	35 (25)	6 (6)	16 (10)
11/750	1	7.5 (5.4)	30 (30)	60 (50)	7.2 (5.4)	13 (10)	6 (6)	16 (10)	6 (6)	10 (6)
	1.5	11 (6.9)	50 (40)	100 (75)	10.7 (8.1)	19 (15)	10 (6)	35 (16)	6 (6)	16 (10)
	1.75	11 (8.1)	50 (60)	100 (75)	12.5 (9.5)	22 (17)	16 (10)	35 (25)	6 (6)	16 (10)
13/900	2	(9.2)	(60)	(100)	(10.8)	(19)	(10)	(25)	(6)	(16)
	1	11 (5.6)	40 (30)	75 (50)	8.6 (6.5)	15 (12)	10 (6)	25 (16)	6 (6)	10 (6)
	1.5	15 (8.3)	50 (50)	100 (75)	12.9 (9.7)	23 (18)	16 (10)	35 (25)	6 (6)	16 (10)
	1.75	15 (9.7)	60 (50)	125 (100)	15 (11.3)	27 (20)	16 (10)	50 (35)	10 (6)	25 (16)
	2	(11.1)	(60)	(100)	(13)	(23)	(16)	(35)	(6)	(16)
	2.5	(13.8)	(60)	(100)	(16.2)	(29)	(10)	(25)	(6)	(16)
15/1000	1	11 (6.2)	40 (30)	75 (60)	9.4 (7.2)	17 (13)	10 (6)	25 (16)	6 (6)	10 (10)
	1.5	15 (9.2)	60 (50)	125 (100)	14.3 (10.8)	26 (19)	16 (10)	35 (35)	10 (6)	25 (16)
	1.75	15 (10.8)	75 (50)	125 (100)	16.7 (12.6)	30 (23)	16 (16)	50 (35)	10 (6)	25 (16)
	2	(12.3)	(60)	(125)	(14.4)	(26)	(16)	(35)	(10)	(25)
	2.5	(15.4)	(100)	(150)	(18)	(32)	(16)	(35)	(6)	(16)
17/1150	1	11 (7.1)	50 (40)	100 (75)	11 (8.3)	20 (15)	10 (6)	35 (25)	6 (6)	16 (10)
	1.5	15 (10.6)	75 (60)	125 (100)	16.5 (12.4)	30 (22)	16 (10)	50 (25)	10 (6)	25 (16)
	1.75	18.5 (12.4)	75 (60)	150 (125)	19.3 (14.5)	35 (26)	25 (16)	70 (35)	10 (10)	25 (25)
	2	(14.1)	(70)	(150)	(16.5)	(30)	(25)	(50)	(10)	(25)
	2.5	(17.7)	(80)	(125)	(20.7)	(37)	(25)	(70)	(6)	(10)
20/1350	1	15 (8.3)	50 (50)	100 (75)	12.9 (9.7)	23 (18)	16 (10)	35 (25)	6 (6)	16 (10)
	1.5	18.5 (12.5)	75 (60)	150 (125)	19.3 (14.6)	35 (26)	25 (16)	70 (35)	10 (10)	25 (25)
	1.75	22 (14.5)	100 (60)	200 (125)	22.6 (17)	41 (31)	35 (16)	95 (35)	16 (10)	35 (25)
	2	(16.6)	(70)	(150)	(19.4)	(35)	(25)	(50)	(10)	(25)
	2.5	(20.7)	(80)	(100)	(24.2)	(44)	(25)	(95)	(6)	(16)
24/1600	1	15 (9.9)	60 (50)	125 (100)	15.3 (11.5)	28 (21)	16 (10)	50 (35)	10 (6)	25 (16)
	1.5	22 (14.8)	100 (70)	200 (125)	22.9 (17.3)	43 (33)	35 (16)	95 (35)	16 (10)	25 (25)
	1.75	22 (17.2)	100 (80)	200 (150)	26.8 (20.1)	48 (36)	35 (25)	95 (70)	16 (16)	35 (25)
	2	(19.7)	(80)	(175)	(23)	(43)	(35)	(95)	(16)	(35)
	2.5	(24.6)	(80)	(175)	(29.7)	(52)	(35)	(95)	(16)	(35)

Note : 1. Above power feeder sizes are for the length of electric wire up to 50m from elevator machine room to power.
For the length being 50m or more, the following formula should be applied.
2. Above cable sizes are for copper wires inside electromagnetic tubings.
Cable sizes may v[illegible]

3. For power requirement of 3 cars or more, consult Hyundai.
4. Machine room temperature should be maintained below 40°C with ventilating fan and air conditioner, and humidity below 90%.
5. Data shown in ( ) is applied to the Machine Room Less elevators and gearless traction machines.

LAMPIRAN 5
LAMPIRAN SAP





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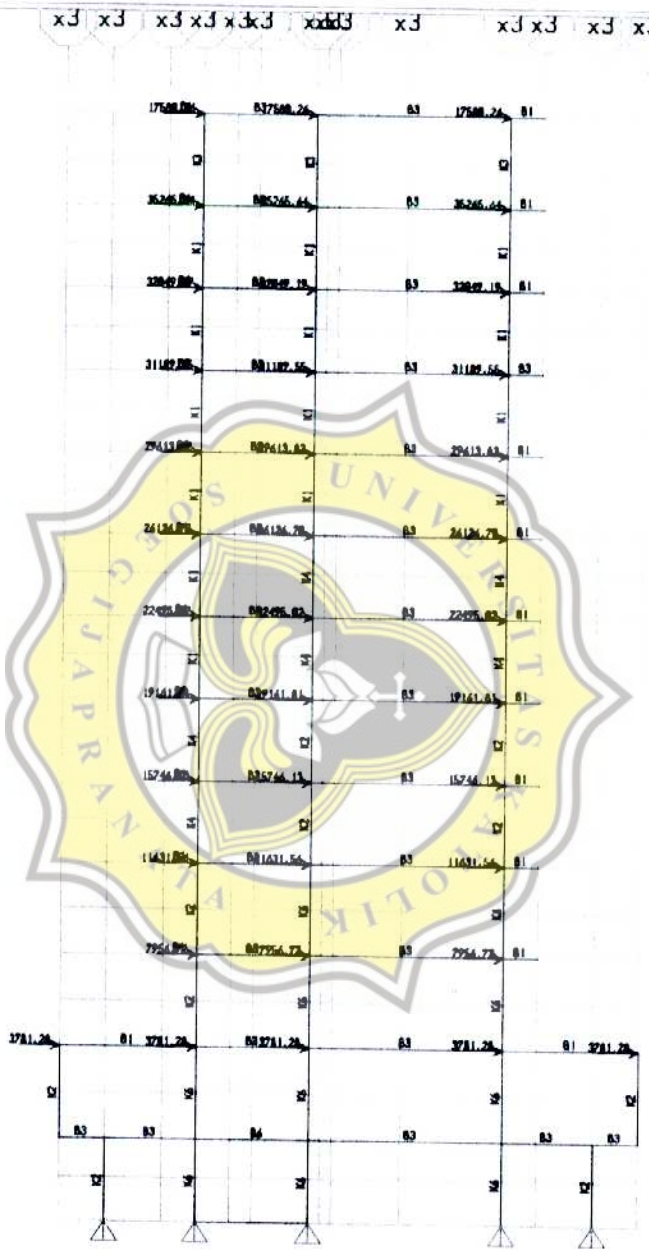

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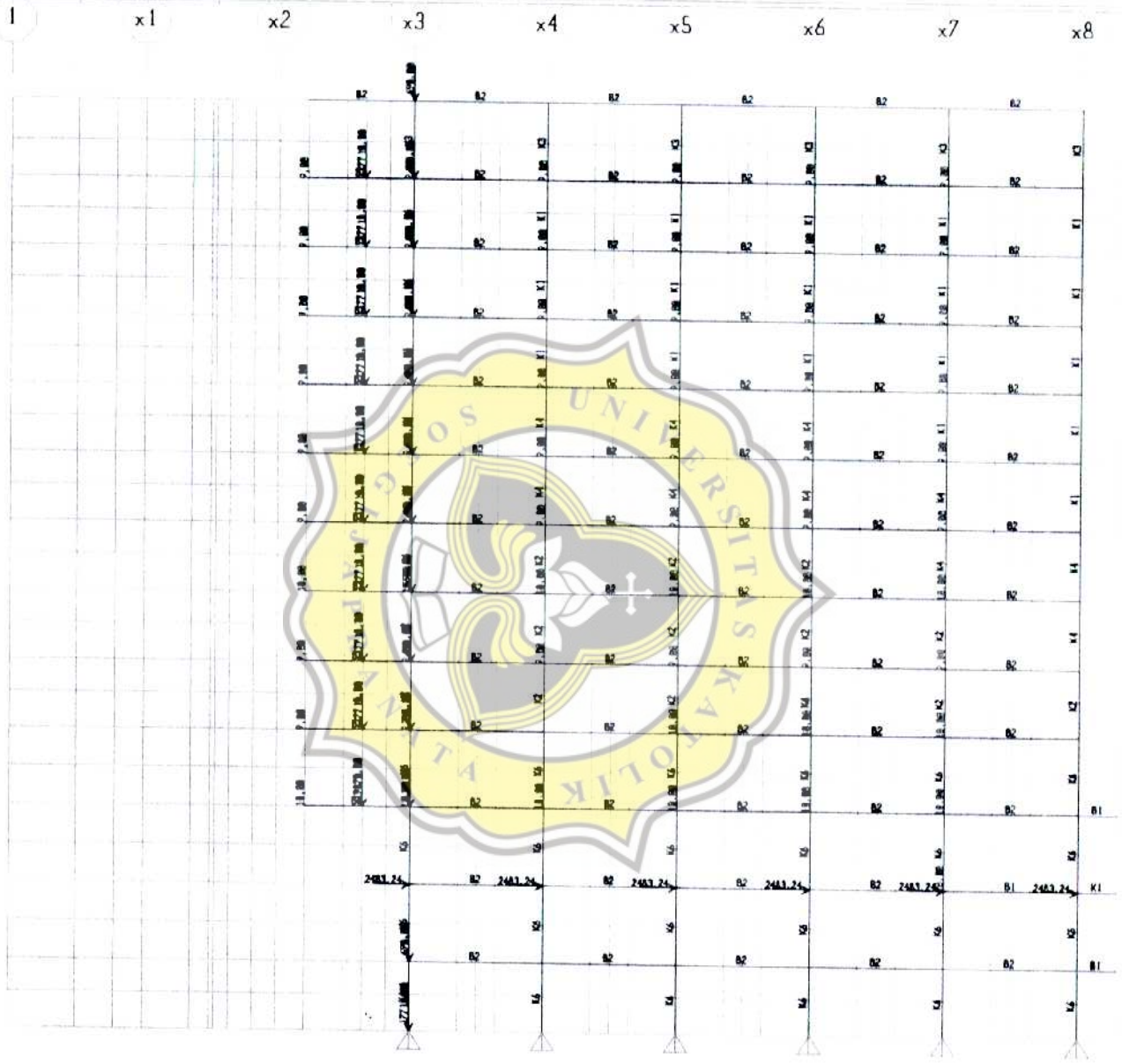

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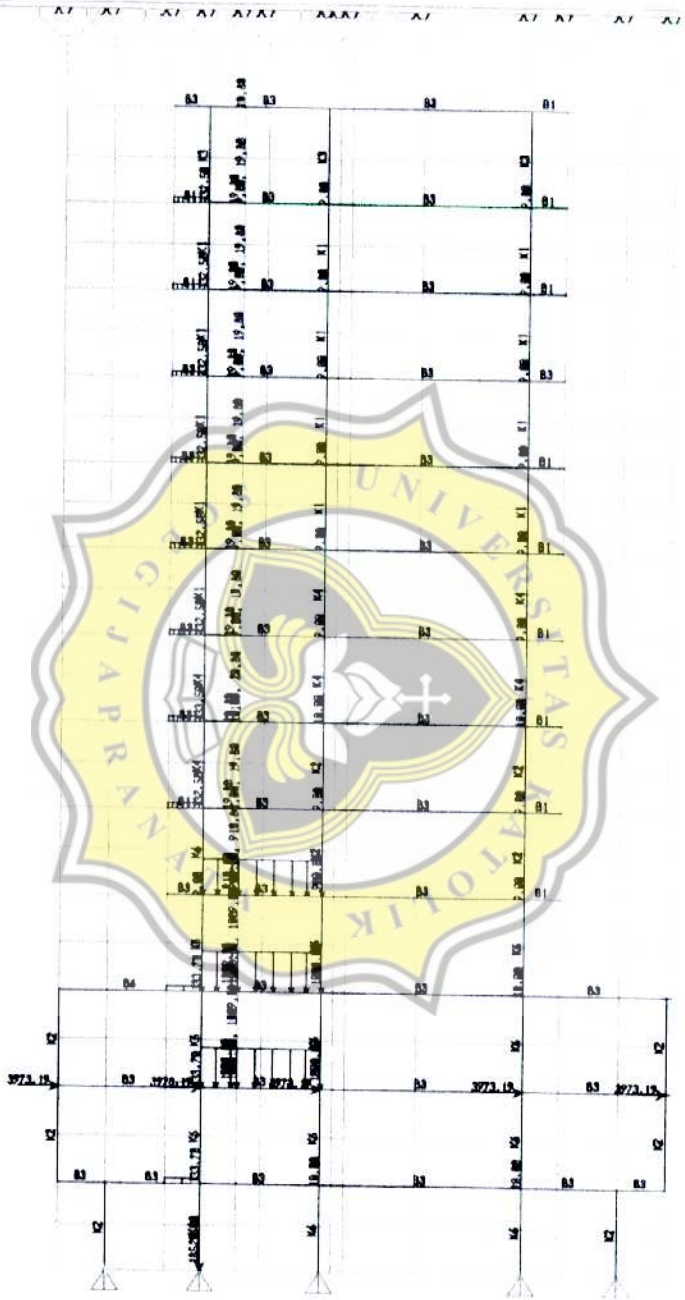

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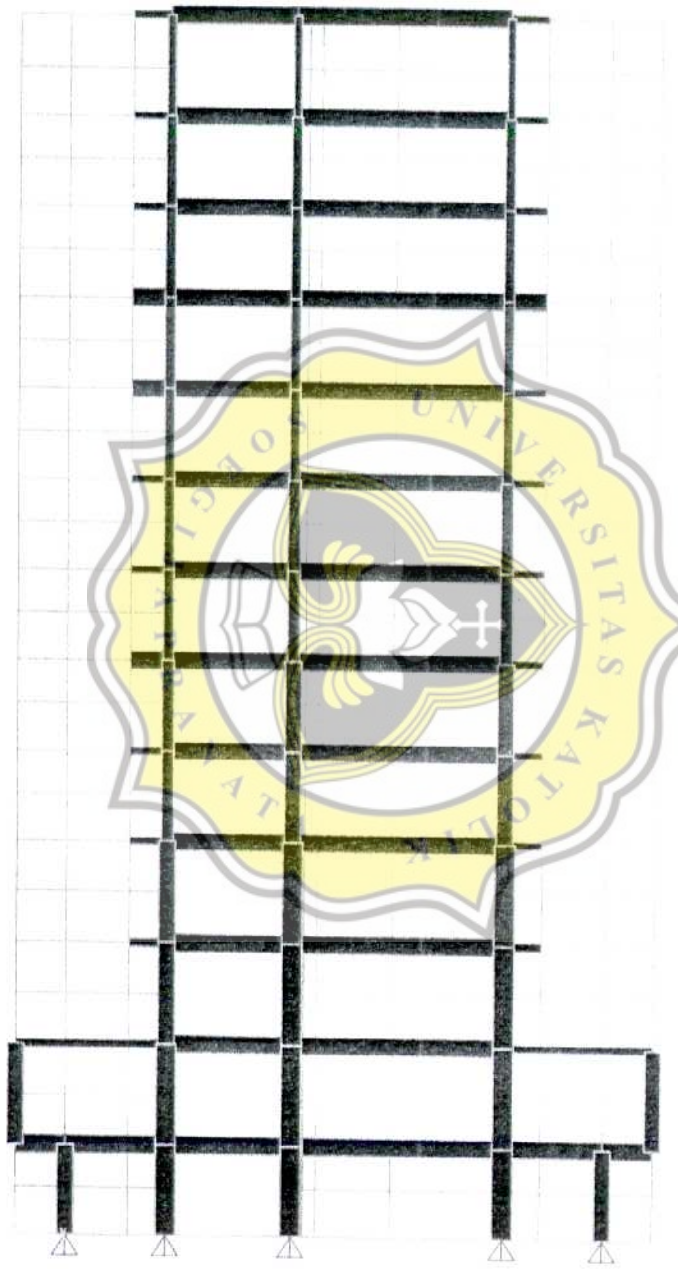
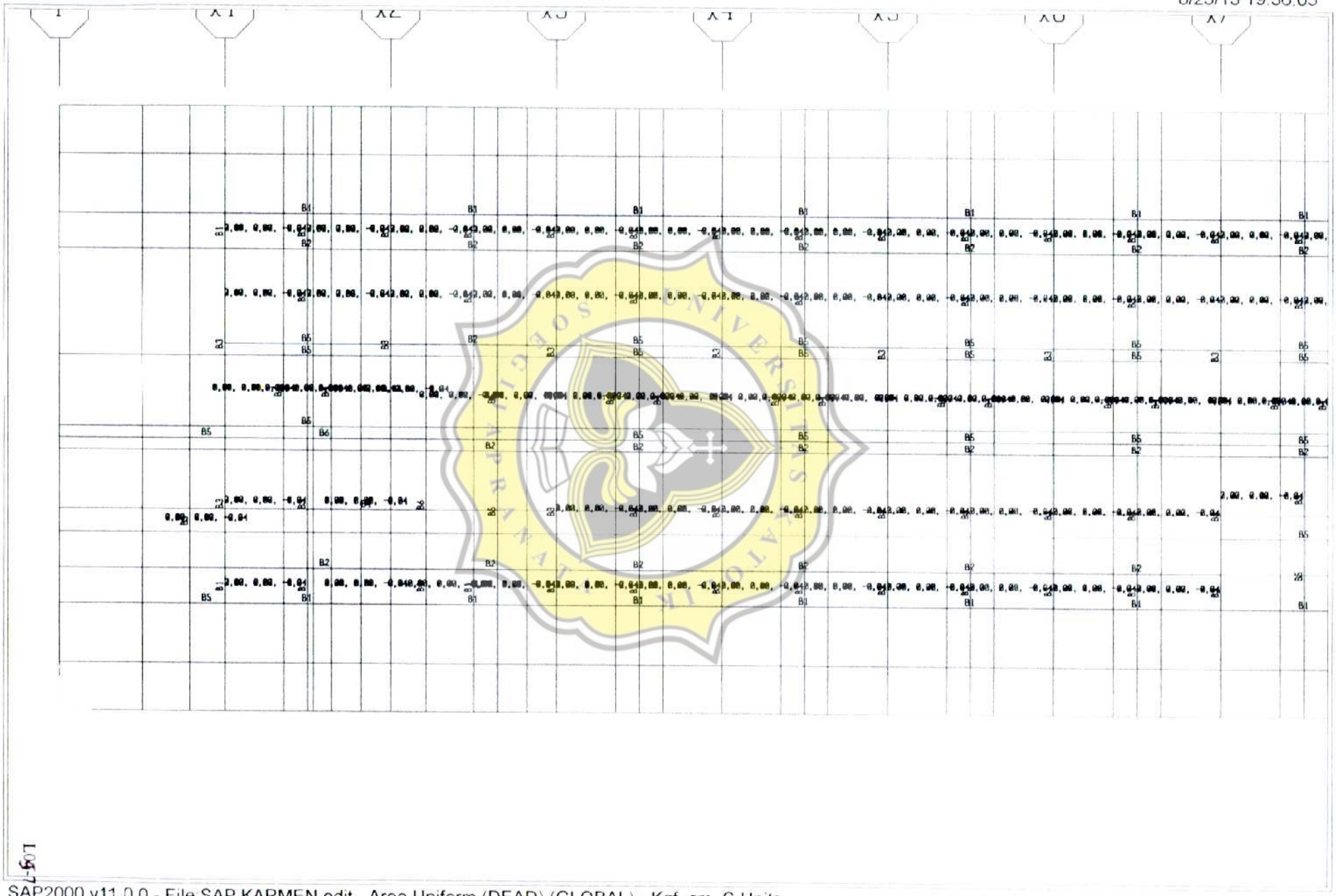
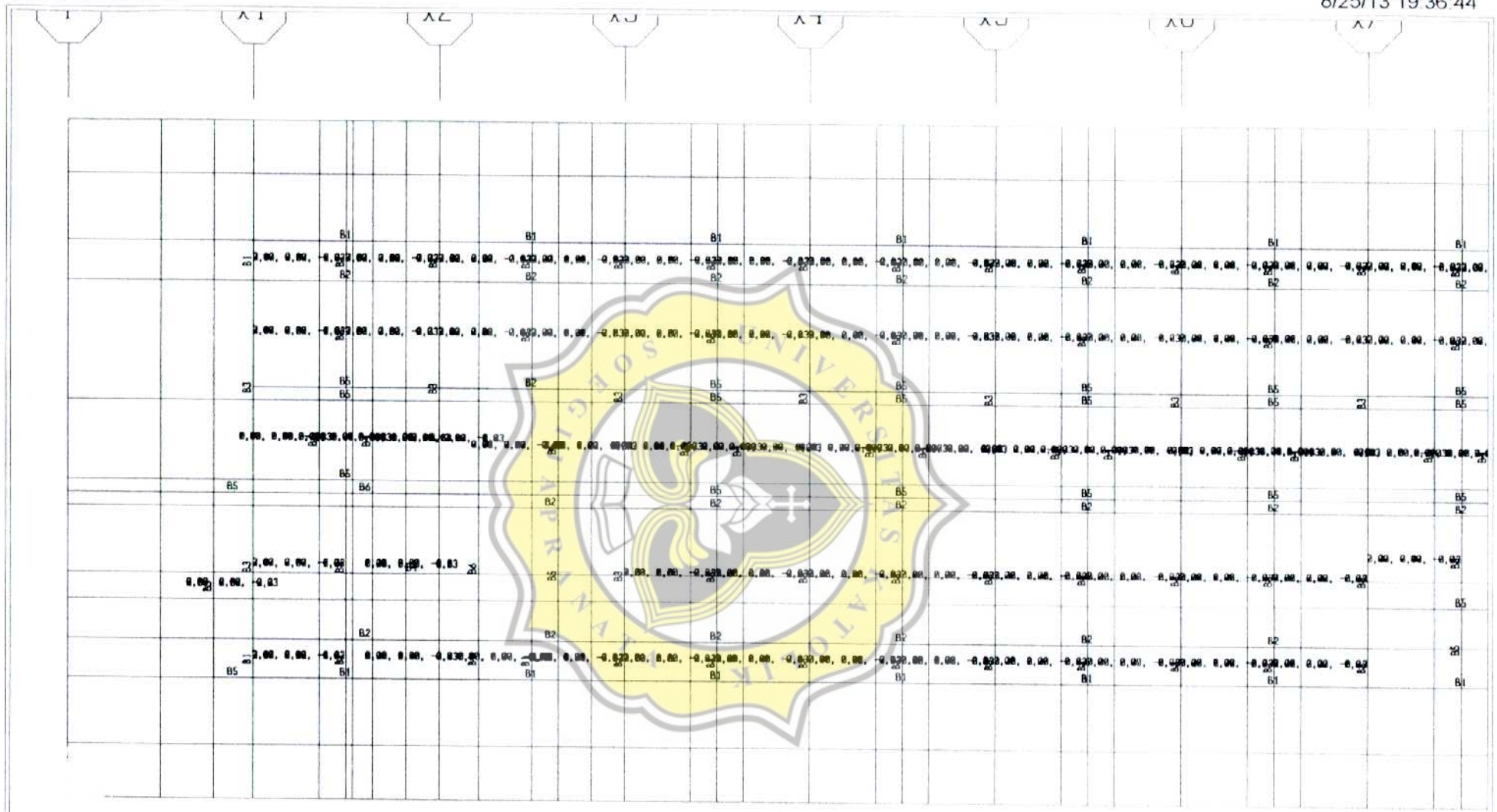
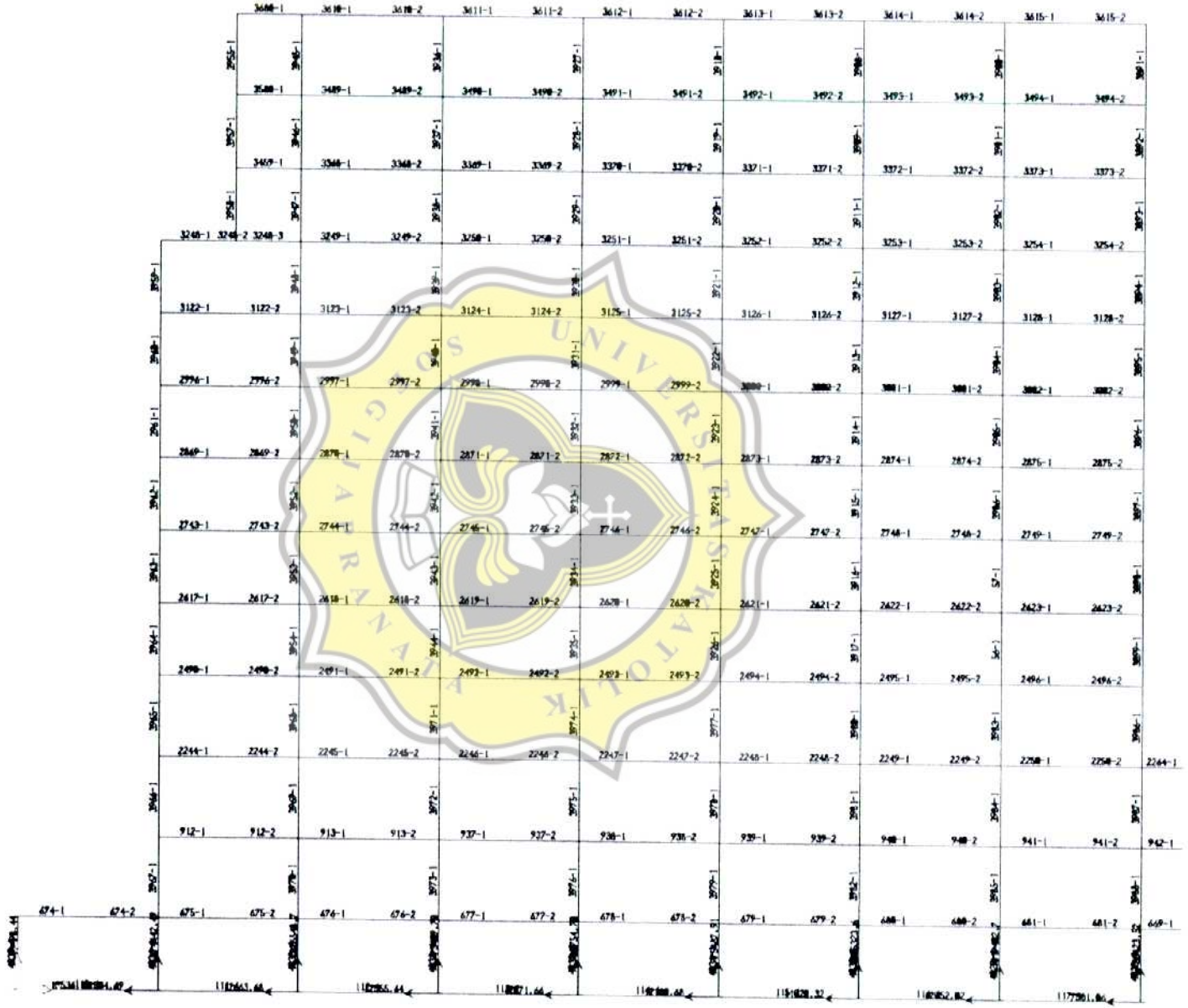
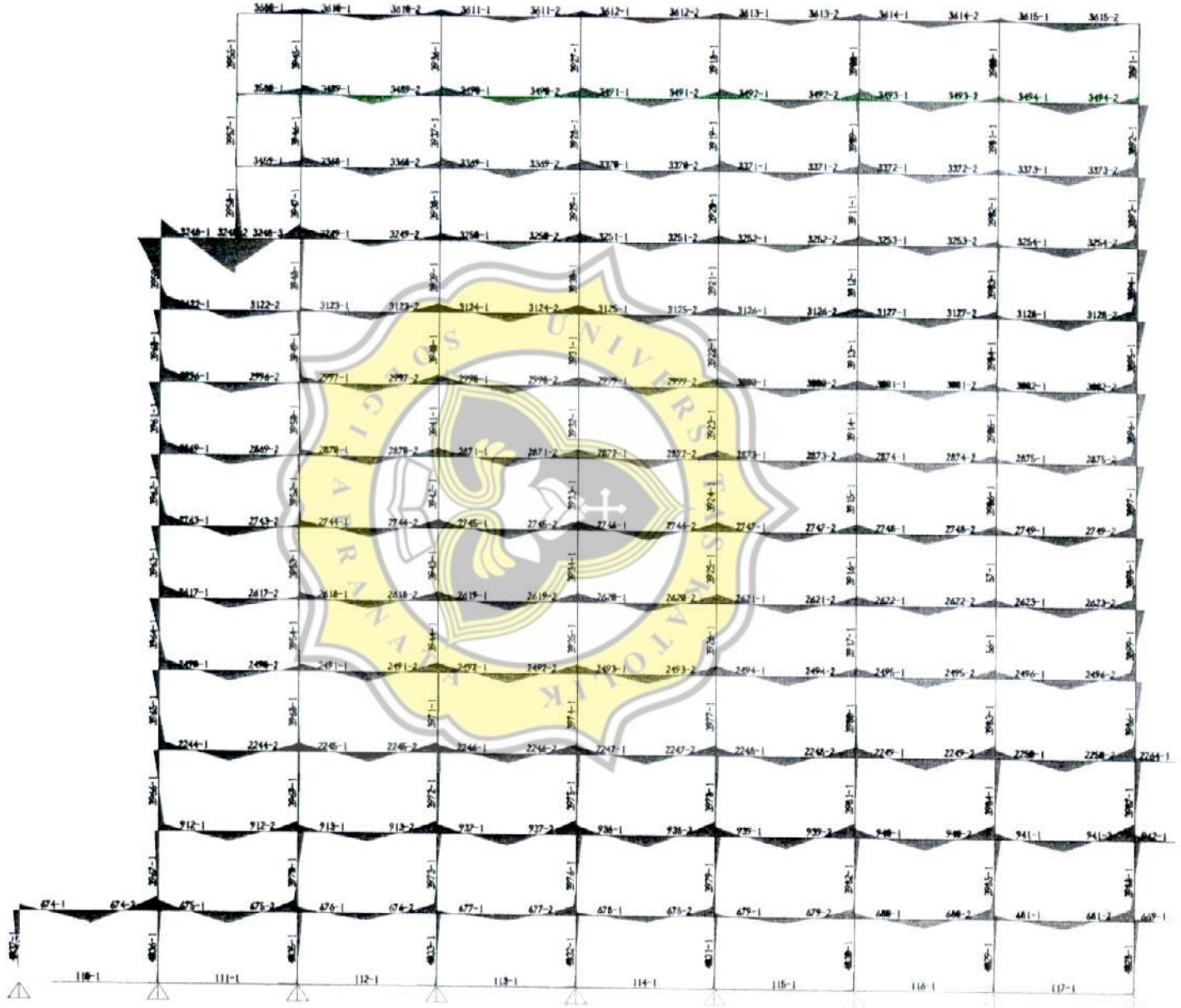








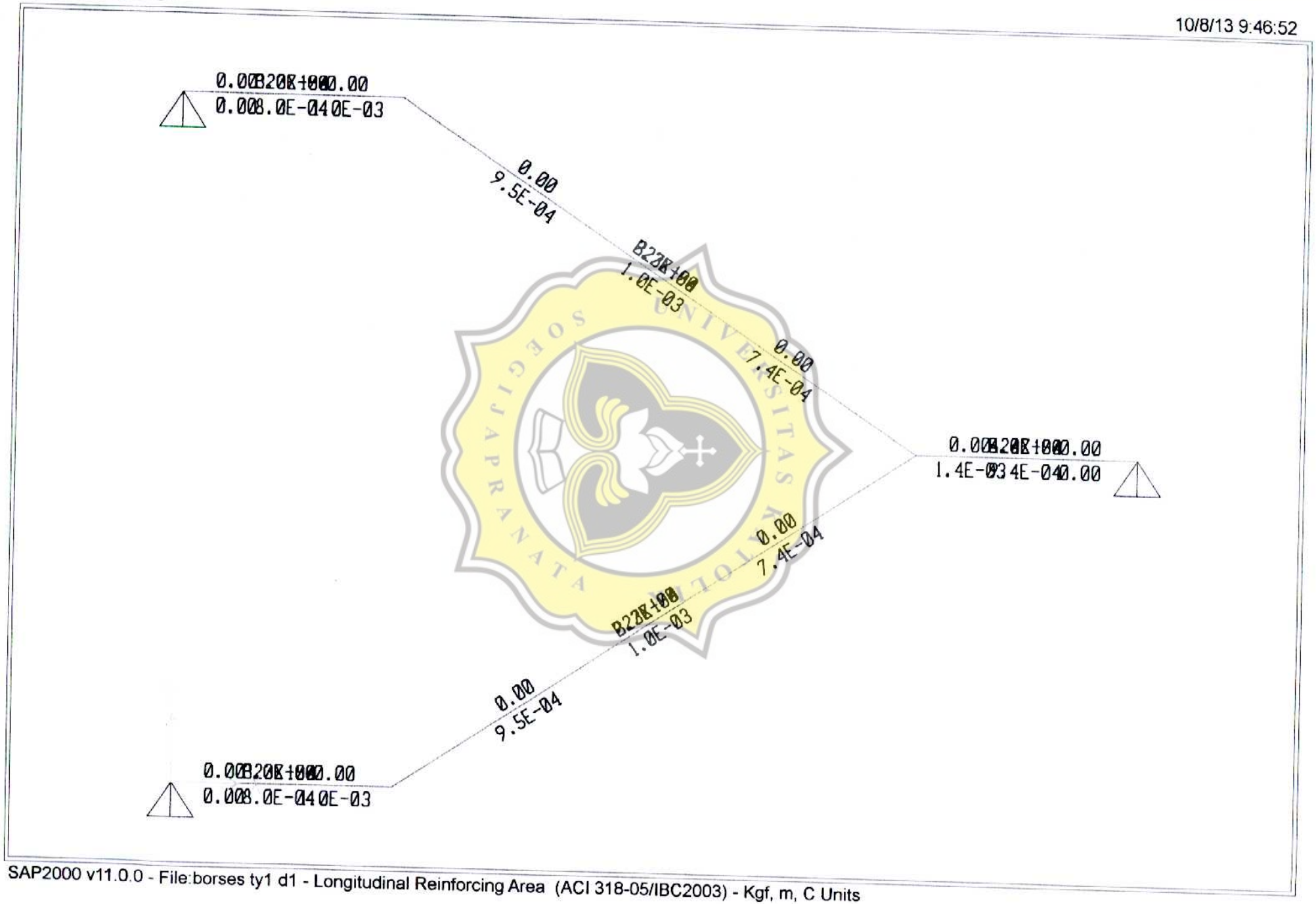


LOS-10

SAP2000 v11.0.0 - File:SAP KARMEN edit - Moment 3-3 Diagram (COMB1) - Kgf, cm, C Units

SAP2000

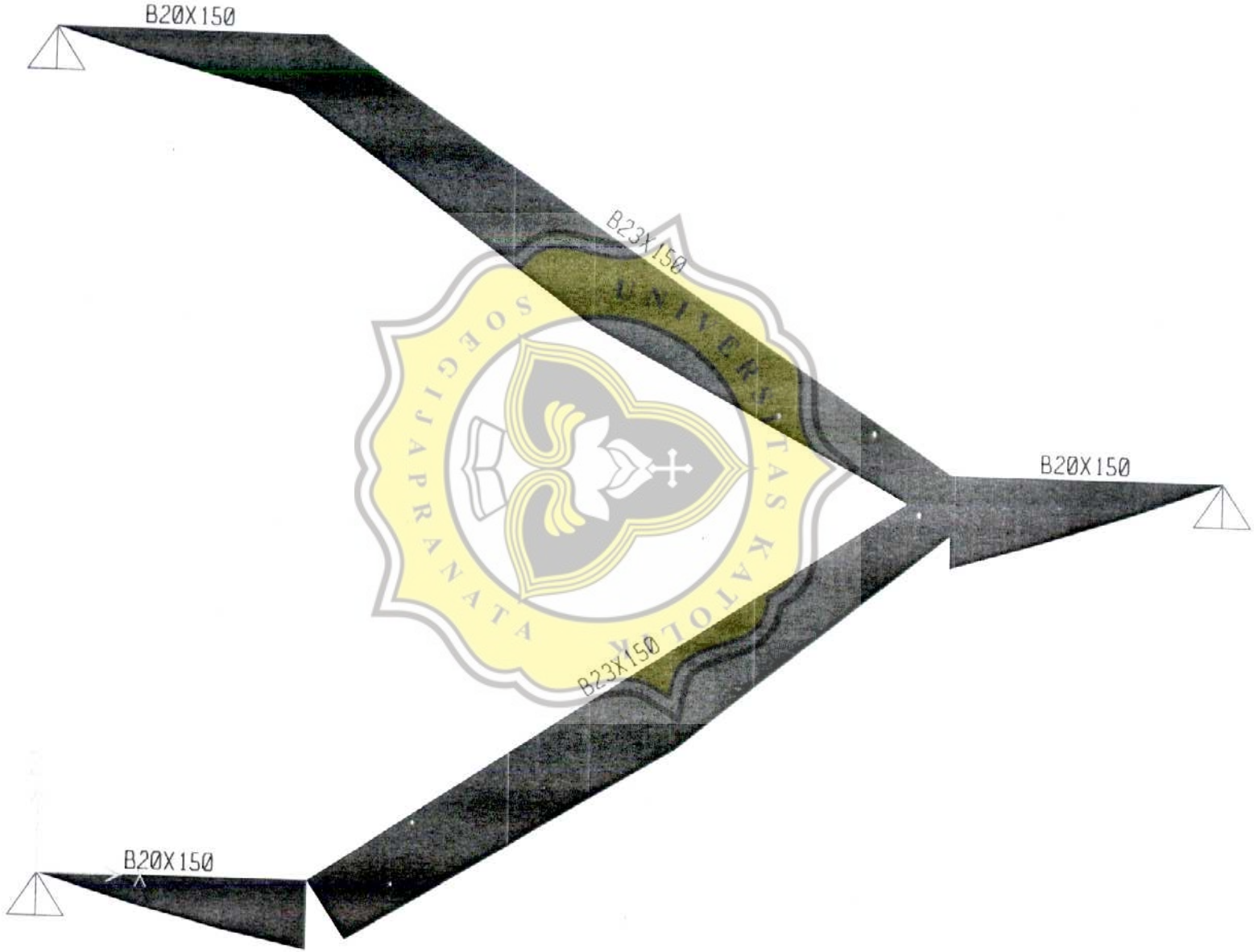
10/8/13 9:46:52



SAP2000 v11.0.0 - File:borses ty1 d1 - Longitudinal Reinforcing Area (ACI 318-05/IBC2003) - Kgf, m, C Units

SAP2000

10/11/13 13:25:52



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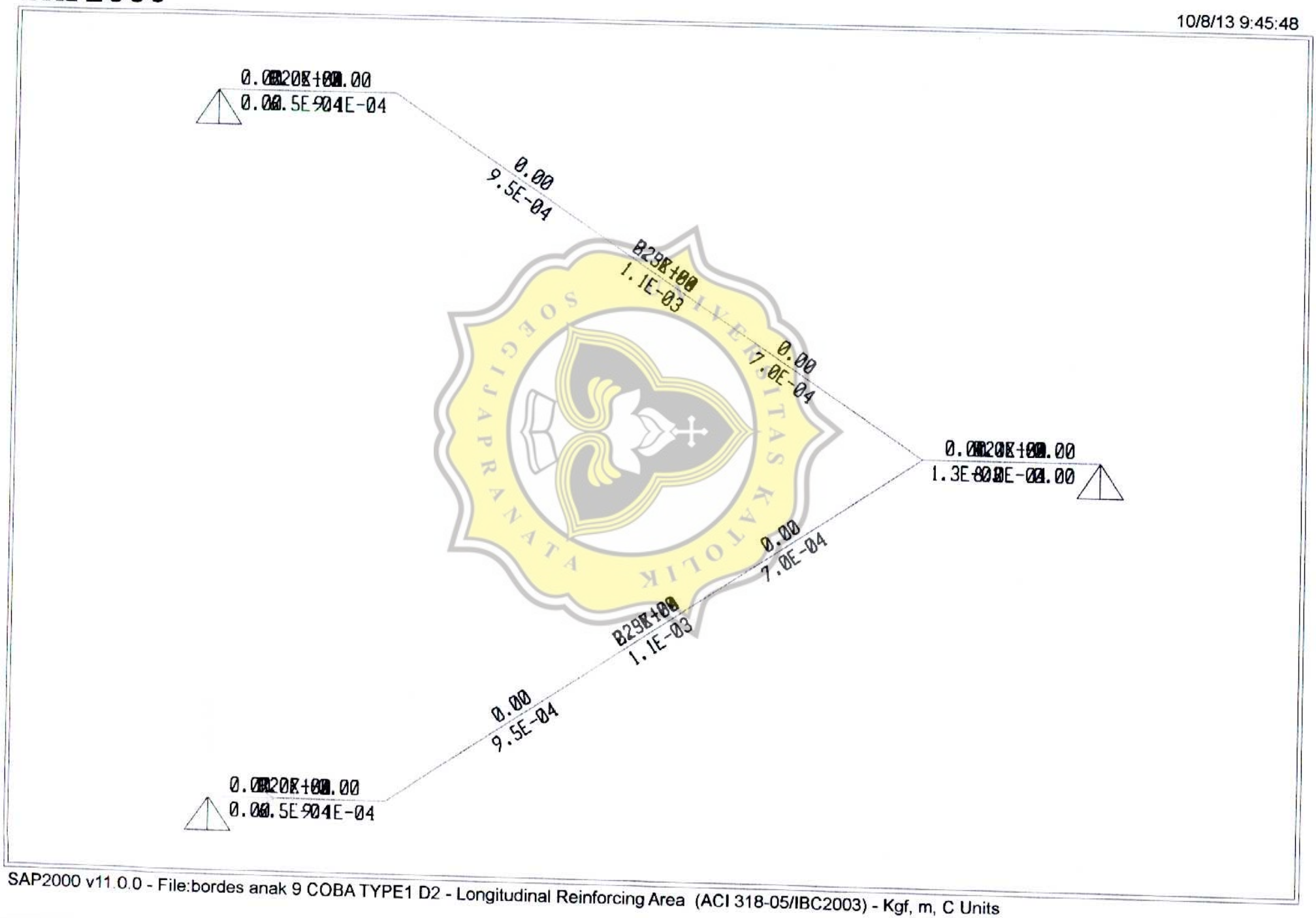
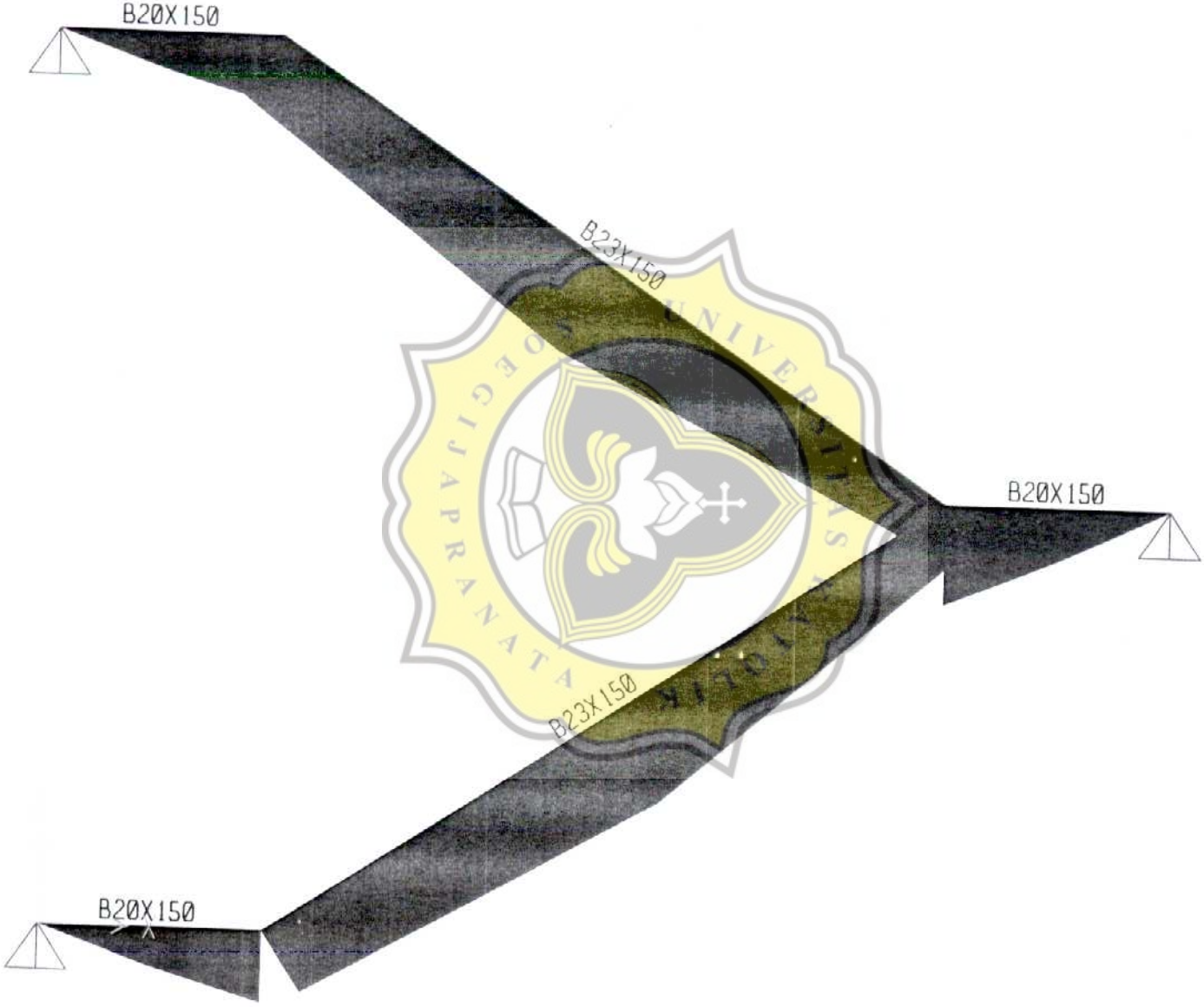
SAP2000

10/8/13 9:45:48



SAP2000

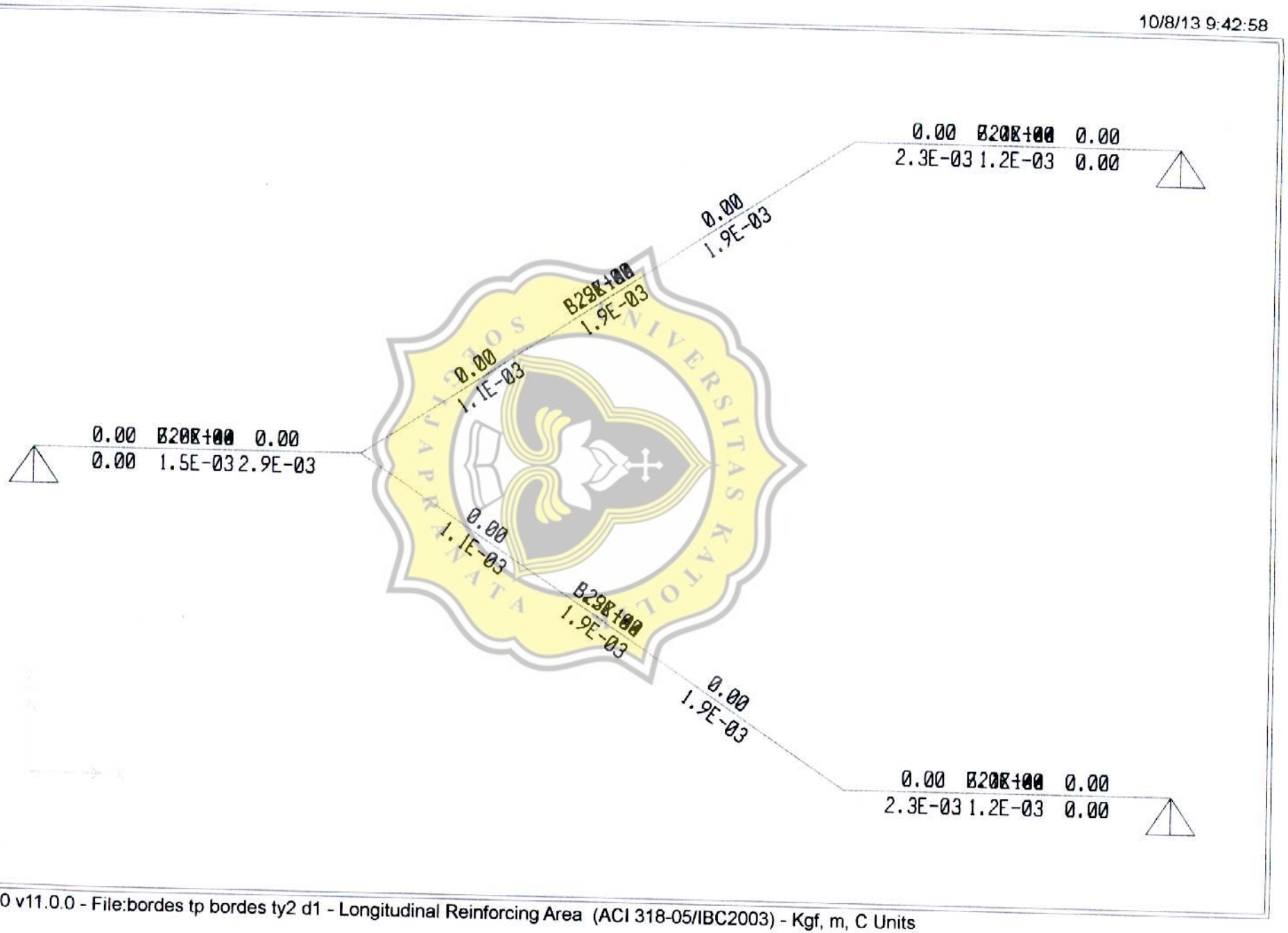
10/11/13 13:27:10



SAP2000 v11.0.0 - File:bordes anak 9 COBA TYPE1 D2 - Moment 3-3 Diagram (COMB1) - Kgf, m, C Units

SAP2000

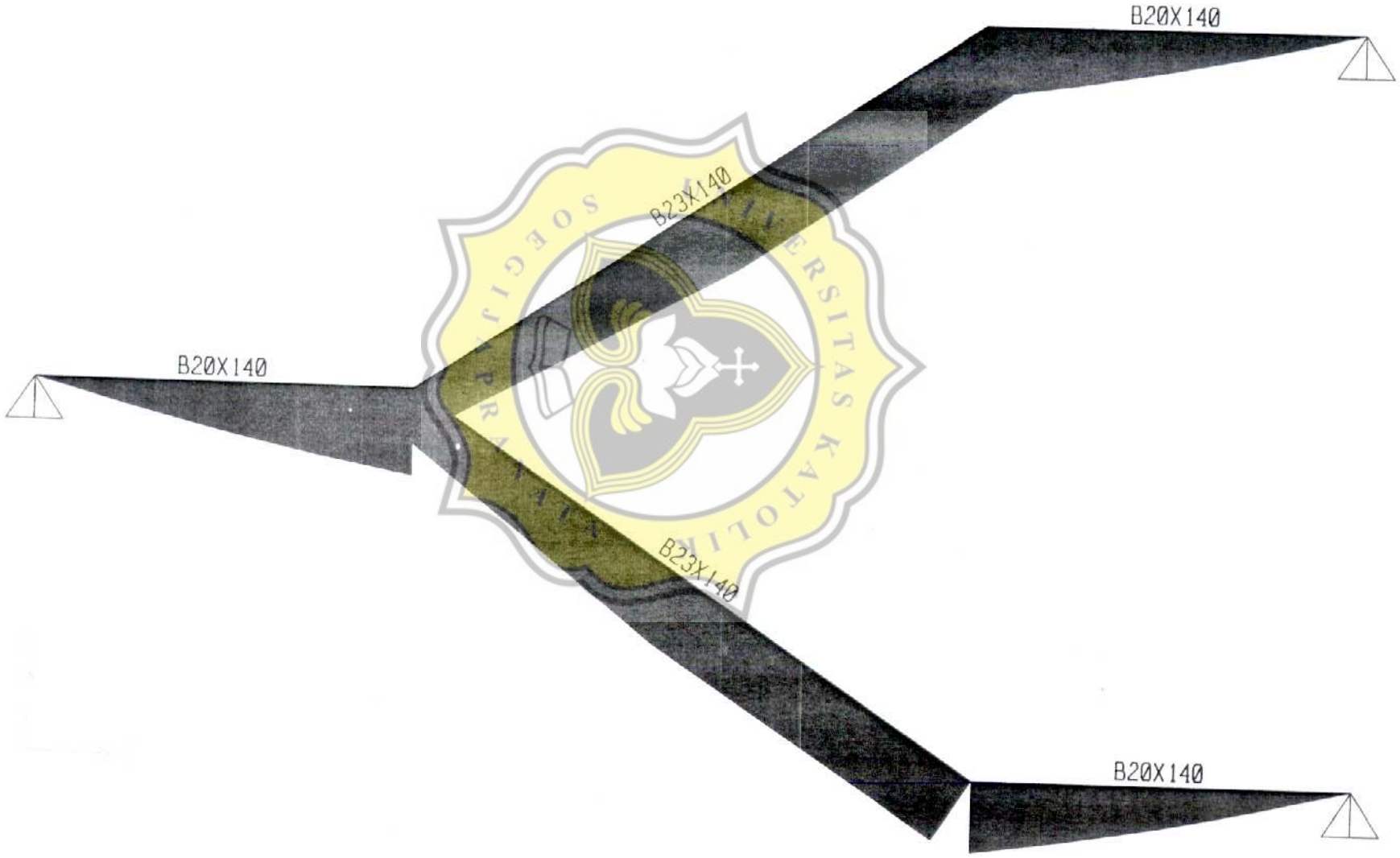
10/8/13 9:42:58



SAP2000 v11.0.0 - File:bordes tp bordes ty2 d1 - Longitudinal Reinforcing Area (ACI 318-05/IBC2003) - Kgf, m, C Units

SAP2000

10/11/13 13:28:09



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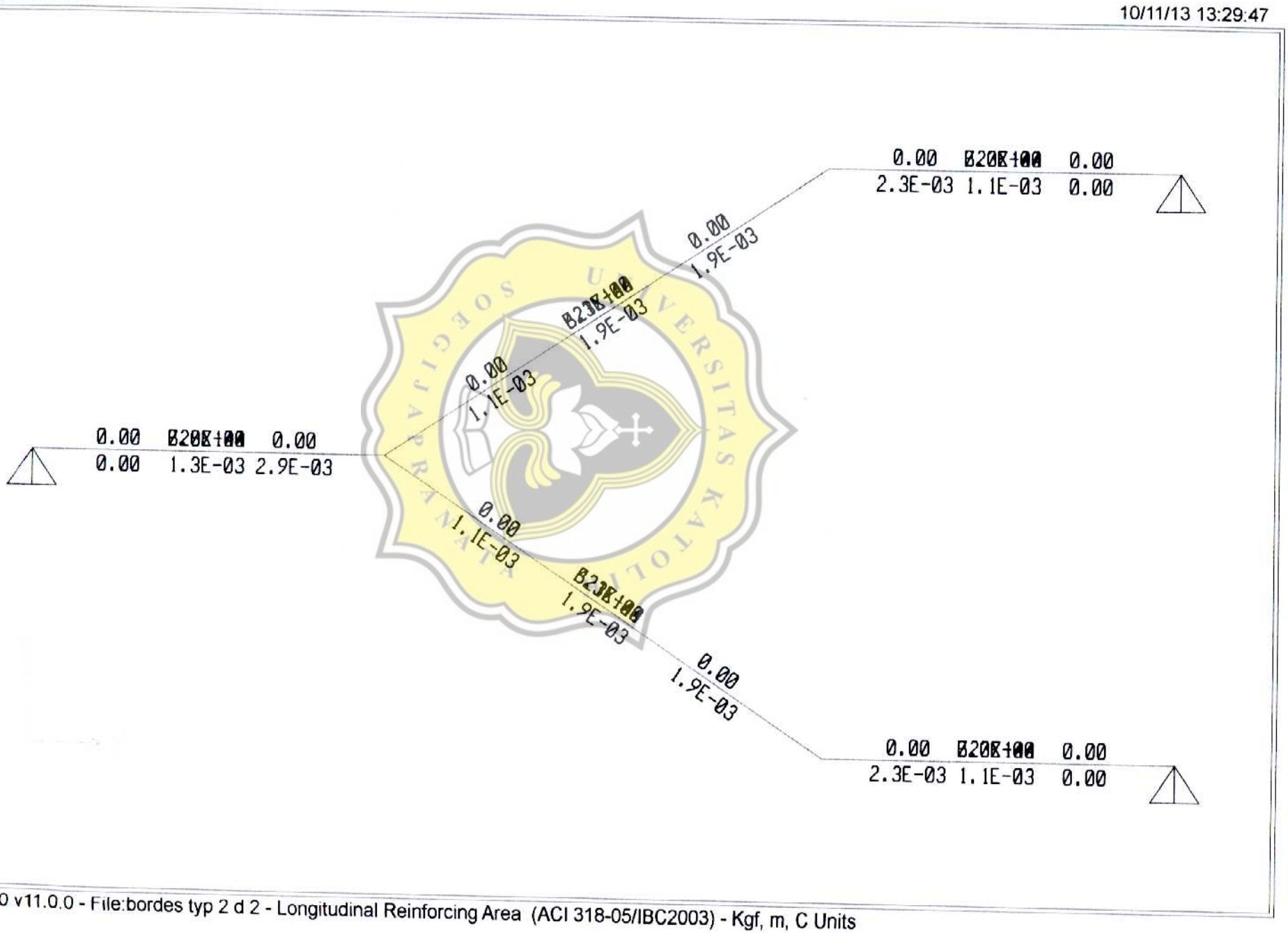
SAP2000

10/11/13 13:29:47



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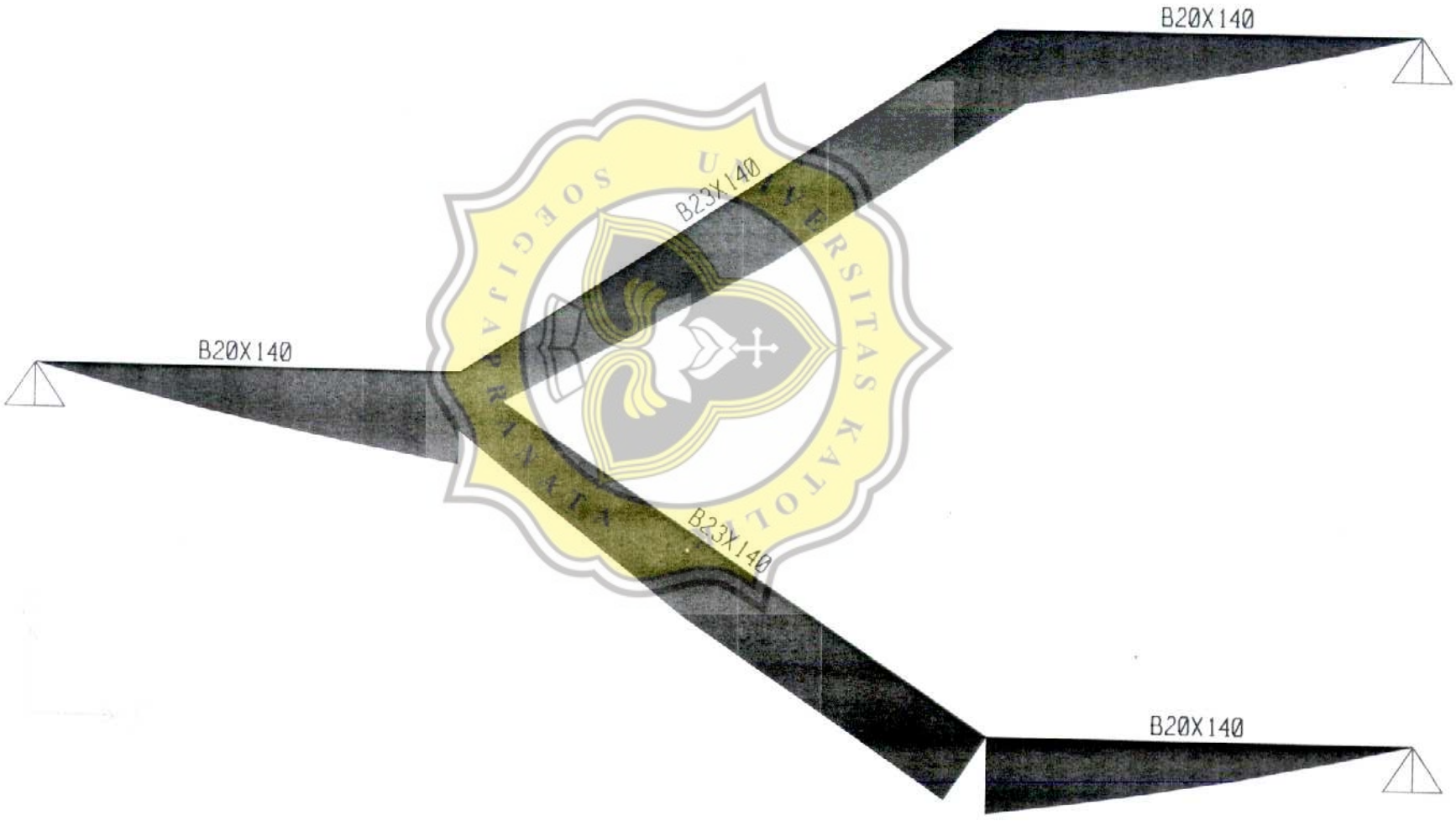
SAP2000

10/11/13 13:30:02



SAP2000 v11.0.0 - File:bordes typ 2 d 2 - Moment 3-3 Diagram (COMB1) - Kgf, m, C Units

LAMPIRAN 7

Network Diagram

LAMPIRAN 8
Gambar Kerja