LAMPIRAN PERHITUNGAN SENGKANG

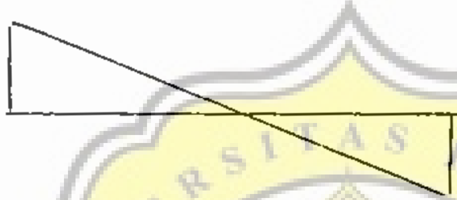
UNIVERSITAS KATOLIK SOEGIJAPRANATA

SEMARANG

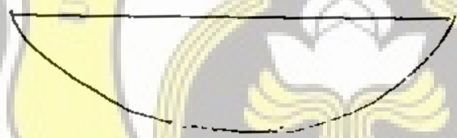
2000

PENGERTIAN DASAR TENTANG SENGKANG

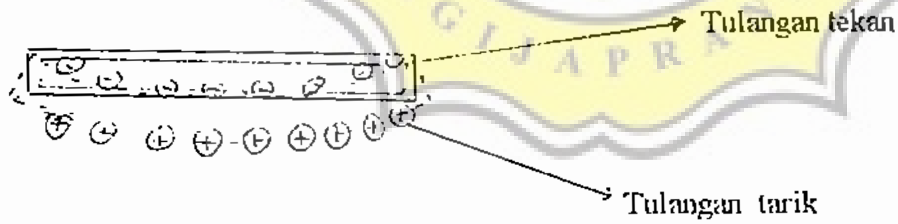
Akibat gaya lintang



Akibat momen

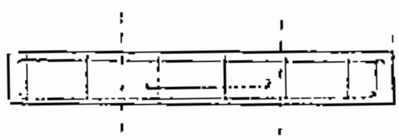


1. Akibat momen



Untuk mengatasi akibat momen maka dipasang tulangan

2. Akibat gaya lintang



Untuk mengatasi gaya lintang dipakai /dipasang sengkang-sengkang.

DASAR PERHITUNGAN SENGKANG
(PLASTIS)

PBI'71 HAL.179

1.Tegangan geser lentur beton akibat beban batas di tengah-tengah tinggi penampang dihitung dengan rumus :

$$\tau_{bu} = \frac{Qu}{b \;.\; Zu} < \bar{\tau}_{bu}$$

dimana : Qu = 1,5 . D maxs
Zu = 0,9 Hef.
B = lebar balok

2 Ketentuan lainnya.

\# bila $\tau_{bu} > \bar{\tau}_{bu}$ $< \tau_{bm}$ maka ukuran balok harus diperbesar

\# bila $\tau_{bu} > \bar{\tau}_{bu}$ $> \tau_{bm}$ maka tegangan geser lentur harus dipikulkan pada tulangan geser 100 %,jika didapat tulang an miring maka yang dipikulkan hanya 50%.

3.Jika terpenuhi pada point 1. maka tegangan geser lentur kelebihannya harus dipikul oleh sengkang-sengkang dengan rumus .

$$\tau_{su} = \frac{As.}{as.\; b} > \tau_{bu}$$

PERHITUNGANNYA

Dmaxs = Q = ½. P + ½ q ℓ

= ½ . 9,08 + ½ . 10,14 = 4,54 + 5,07

= 9,160 ton = 9160 kg.

Catatan : P = beban terpusat

q = qplat diratakan.

$$\tau_{bu} = \frac{1,5 \times Dmaxs}{b \cdot 0,9\ Hef.} < \bar{\tau}_{bu} = 9,5\ kg/cm^2$$

$$= \frac{1,5 \times 9610}{60 \cdot 0,9\ 53,75} < \bar{\tau}_{bu} = 9,5\ kg/cm^2$$

$$= \frac{14415}{2902,5} < \bar{\tau}_{bu} = 9,5\ kg/cm^2$$

= 4,9 < = 9,5 kg/cm² (terpenuhi point 1)

Untuk menahan geser maka diperlukan sengkang dengan perhitungan sebagai berikut :

Cara coba-coba

$$\tau_{su} = \frac{As.}{b.\ as} > \tau_{bu}$$

diketahui : $As = (\frac{1}{4}.3,14.1^2)$

$= 0,785\ cm^2$

$\sigma_{au} = 0,87 \times 2400 = 2088$

b = 60 cm

as diambil = 10 mm

$$\tau_{su} = \frac{2 \times 0,785 \cdot 2088}{60 \cdot 10} < \tau_{bu}$$

$= 5,46 > 4,9\ (\tau_{bu})$

langsung mencari as. (as = jarak sengkang)

diketahui τ_{su} = 5,46

b = 60 cm

$As = 0,785\ cm^2$

σ_{au} = 2088

$$as = \frac{2 \times 0,785 \cdot 2088}{60 \cdot 5,46}$$

= 10,006 cm maka dipakai sengkang ϕ 10 mm - 10 cm

ϕ10 - 10

(artinya diameter 10 jarak as-as sk 10cm)

LAMPIRAN DATA

UNIVERSITAS KATOLIK SOEGIJAPRANATA

SEMARANG

2000

GOVERNMENT OF THE REPUBLIC OF INDONESIA

DIRECTORATE GENERAL OF SEA COMMUNICATIONS

URGENT DEVELOPMENT PLAN OF SEMARANG PORT

PHASE II - STAGE I

PROPOSED DESIGN CONDITION AND CRITERIA

Page

PROPOSED DESIGN CONDITION AND CRITERIA

1. NATURAL CONDITIONS

Design Condition and Criteria are hereby proposed for design of container wharf, container yard and road.

1) Oceanographic Conditions

(1) Tidal Range

H.W.L.	+ 1.35 m
M.W.L.	+ 0.85 m
L.W.S (D.L)	± 0.00 m

Tidal record of 1983 thru 1991 are shown in Table 1. The present tidal level remains relatively high since the Engineering Service Stage (E/S) of 1989. However, the rate of increasingly higher trend of tidal level seems to subside gradually.

(2) Tidal Current and Wave

There are no material effects by tidal current and wave on facilities within the Port and therefore, it is not considered in designing.

2) Weather Conditions

(1) Wind

Based on the records during 1983 and 1991, Design Wind Velocity (V) is :

V = 25 m/sec

(2) Rainfall

From the records in these years shown in the Table 2, Rainfall as a design condition is:

100 mm per hour
250 mm per day

Amount of rainfall for designing of drainage shall be calculated separately based on the rainfall records above.

(period [illegible])

		JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DES.	YEAR
1983	H													
	M	–	–	–	–	–	–	–	–	53.0	56.9	62.3	63.2	58.9
	L													
1984	H									old tide station		134	134	134
	M	55.7	64.5	66.6	69.3	80.7	81	74	64	73	77	76.4	79.4	72.7
	L											22	24	22
1985	H	129	122	128	136	140	135	136	130	130	142	141	138	142
	M	[illegible]	74.8	76.5	78.8	84.1	88.6	87.2	79.5	77.3	83.9	80.9	82.0	81.2
	L	38	24	42	30	30	36	32	32	36	31	23	28	24
1986	H	133	128	130	138	145	139	130	121	126	129	134	138	145
	M	75.9	75.7	76.8	83.7	88.4	83.4	77.0	76.1	75.6	75.6	79.1	74.4	78.7
	L	34	31	32	32	31	26	30	34	37	37	13	18	13
1987	H	126	118	141	143	151	140	137	139	124	124	139	136	151
	M	71.7	74.1	79.2	82.7	89.1	88.2	85.3	80.6	76.7	76.7	79.6	83.6	80.5
	L	22	29	28	28	38	33	38	35	30	30	22	30	22
1988	H	146	139	136	151	145	164	143	139	138	138	153	152	164
	M	82.9	82.5	81.0	92.8	96.1	98.9	86.3	86.5	85.6	85.6	91.7	93.5	88.7
	L	37	42	31	45	39	44	32	40	48	48	23	46	23
1989	H	146	139	146	144	158	152	150	145	146	146	159	151	159
	M	90.3	86.2	90.4	90.0	99.5	103.7	101.3	98.3	95.7	95.7	98.0	95.7	95.4
	L	43	50	50	32	42	55	46	53	52	52	44	47	32
1990	H	144	142	140	159	158	153	146	146	146	146	150	149	159
	M	94.4	97.0	89.4	98.5	100.1	103.6	99.2	99.5	99.2	99.2	96.7	93.0	97.2
	L	40	60	54	50	52	50	53	69	59	59	44	48	40
1991	H	149	146	158	157	160	155	152	142	138	138	152	155	160
	M	92.5	97.2	104.3	101.7	109.1	102.4	98.0	93.6	93	93.4	94.4	100.0	98.7
	L	51	63	60	51	48	54	46	57	65	65	46	48	46
1992	H	140	142	150	155	170	164	148						170
	M	97.1	94.3	99.4	102.2	112.2	117.6	113.0	–	–	–	–	–	93.0
	L	60	56	59	54	57	72	73						54
83 ~ 92	H	149	146	158	159	170	164	152	146	146	152	159	155	170
	M	83.9	82.9	88.9	88.9	95.5	96.4	91.3	84.8	81.1	82.6	84.3	85.0	86.8
	L	22	24	28	28	30	26	30	32	30	27	13	18	13

H : Highest sea level; M : Mean sea level; L : Lowest sea level

Table 2 Amount of Rainfall

YEAR	5 min	10 min	30 min	60 min	24 hr	ANNUAL	REMARKS
1984	16.1	26.8	46.8	67.3	91.0	2987.6	
1985	15.0	25.0	54.5	95.9	252.6	2599.5	
1986	30.9	46.4	72.1	99.9	130.1	2088.3	
1987	27.4	32.0	60.0	87.5	138.6	1730.3	Excluding in September
1988	15.5	25.8	50.5	80.0	174.0	2782.6	
1989	9.7	16.9	37.0	46.3	213.9	2353.0	
1990	9.6	16.8	33.8	42.0	226.6	2493.0	
1991	9.0	16.6	30.2	39.3	198.3	2181.9	

3) Geological Conditions

(1) Design Seismic Coefficient

According to the Standard Design Criteria for ports in Indonesia.

$K = Kr \times Ki$

where :

Kr = Regional Seismic Coefficient

= 0.05 g (Zone IV, Soft soil)

Ki = Coefficient of importance

= 1.5 (Special class)

Therefore $Kh = 0.075$ g

$Kv = 0$

(2) Soil Condition

According to the Final Design report for Urgent Development Plan of Tanjung Emas Semarang Port Project, Phase II (February, 1990), the design condition is as follows (Fig. 1, Table 3).

2. CRITERIA AND CHARACTERISTIC VESSELS

1) Characteristics of Vessels

Characteristics of vessels for Container wharf shall be as follows : (by "Technical Criteria for Port and harbour facilities with commentary - Japan").

Table 4

Characteristics of Vessels for -12.0 m Container Wharf

VESSEL		CHARACTERISTICS				REMARKS
Generation		2nd	3rd			
Container Ship (D.W.T)		less than 20,000	20,000	30,000	40,000	
Capacity (TEU)		700-1,500	2,000 - 3,000			
Gross Tons		12,300	17,100	27,200	37,700	* 1
Displacement Tons		22,300	30,700	46,900	63,100 (56,300)	* 2
Length of Overall (m)		175	201	220	263	
Width (m)		25	27.1	32.2	32.2	
Depth (m)		12.5	15.6	19.0	20.7	
Draft (m)	Full	9.5	10.6	11.5	12.4	
	Light	4.5	4.5			

* 1 Gross Ton : $\log (G.T.) = -0.670 + 1.140 \log D.W.T.$
* 2 Displacement Ton: $D.T. = 1.014\ D.W.T.^{1.012}$

Note : Figures in parenthesis are -12.0 m Displacement Tons.

Maximum container vessel of 40,000 D.W.T Class is shown in Fig.2.

Table 5 shows Progress of Container Vessel Generation.

Table 5 Progress of Container Vessel Generation

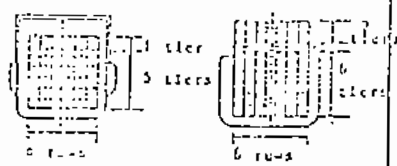
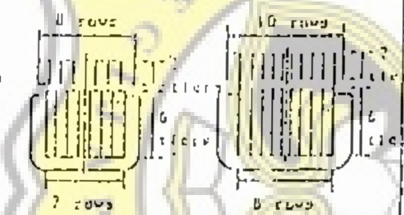
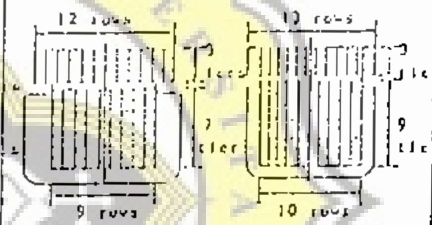
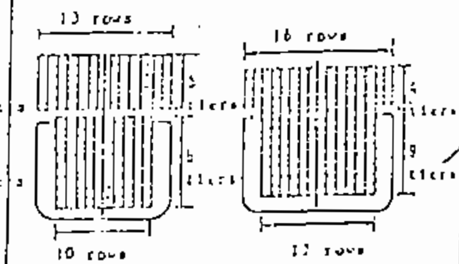
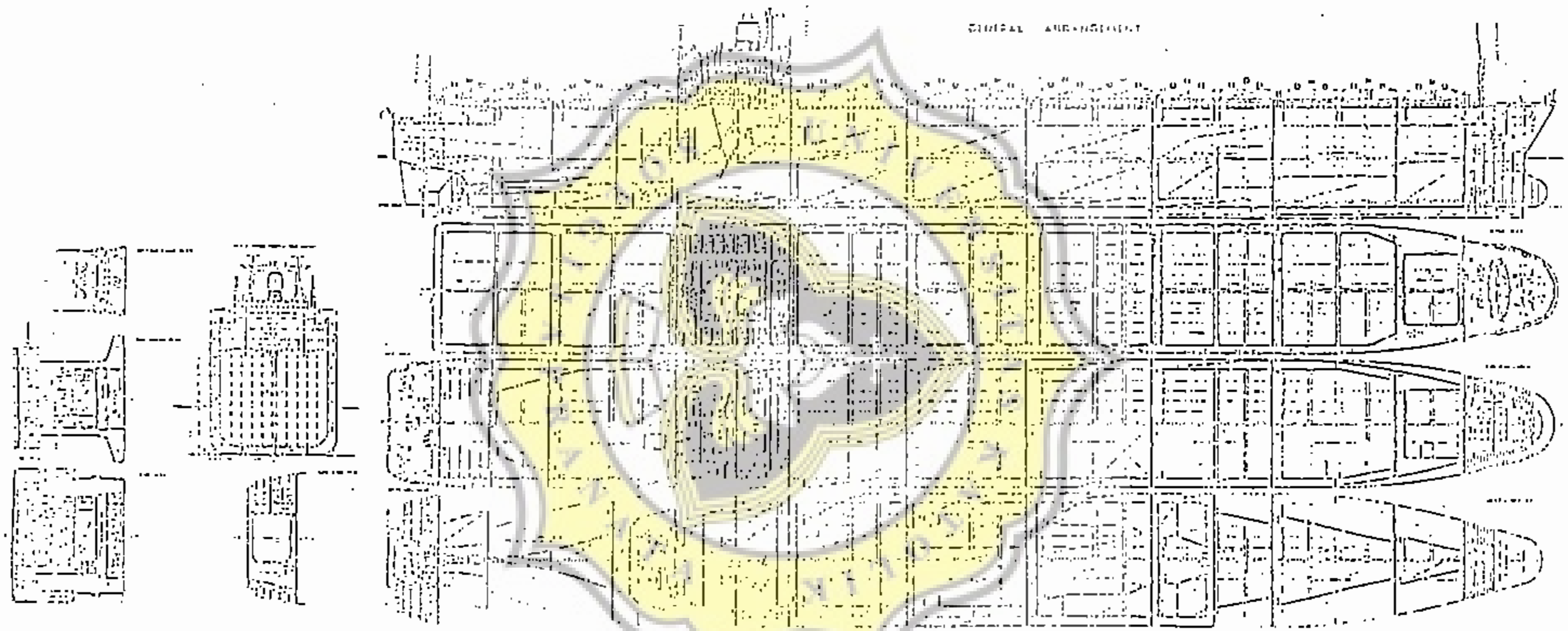
	The First Generation	The Second Generation	The Third Generation	The Fourth Generation
[illegible]ology	Age of domestic coastal services before 1966	Age of short international service across one ocean since 1966	Age of long international services through plural oceans since 1971	Age of round-the-world services since 1984
Samples of services	Coastal services in U.S.A. and Australia	Trans-Atlantic and Trans-Pacific services	Services between Europe and Far East, and U.S. West Coast and Europe	Round-the-world services by U.S.L. and Evergreen
Territories [illegible]	U.S.A., Australia	Advanced countries such as U.S.A., Europe, Australia, Japan, etc.	Developing countries in South-East Asia, Middle-East, South America, etc.	World-wide including China, India and Countries in Africa
Containers	Pr-ISO, Standard size ... 17', 24', 35' long	ISO Standard size ... 8'/8'-6' x 8x20'/40'	High cube type ... 9', 9'-6' high	Deviation from ISO Standard size ... 45', 48' long
Container-ships	Mainly, converted ships with on-board cranes "Gateway City" 135.7mx22mx7.7m 7,755 DWT on-board crane "Hawaiian Citizen" 151.6mx21.3mx5m 10,297 DWT  35'-46(deck)+35'-170(hold) total 35'-226 24'-112(d)+24'-256 24'-368 (h) Semi-containerships also engaged.	Purpose-built Ships of 700 - 1,500 TEU capacity "America Maru" 175mx25mx9.5m 15,440 DWT "Hakozaki Maru" 200mx30mx9.5m 19,914 DWT  279 TEU(d)+438TEU(h) 716 TEU 354 TEU(d)+656 TEU(h) 1010 TEU Ro/Ro-ships also appeared	Purpose-built ships over 2,000 TEU capacity (Panamax size) "Europe Maru" 242mx32.2mx10.5m "Frankfurt Express" 271mx32.2mx13.0m  850 TEU(d)+929 TEU (h) 1625 TEU 1105 TEU(d)+1940TEU (h) 3045 TEU LASH and Seabee appeared and disappeared	Purpose-built ships over 3,000 TEU capacity (Possibility of over-Panamax size) "ECONOSHIPS" 275mx32.2mx11.65m 57,800 DWT "Over-Panamax" (Planned) 39.6m (Breadth)  996 TEU(d)+1732TEU(h) 2728 TEU about 5500 TEU
Quay-side container cranes	Alameda, Matson Terminal Rated capacity 25.4t, 30-5m/min(hoist) x175m/min(traverse) Total weight 350t, 22.85m(outreach) x16.37m(span) x 11.63m(clear lift)	Kobe, Maya-Pier 25.4t, 30x130 464t, 33.5x16x19.5 Yokohama, Honmoku 30.5t, 36x160 600t, 32x30x21	Yokohama, Honmoku 30.5t, 49x152 640t, 36.1x37x27 Telescopic spreader Brisbane, AATL 36t, 40x152 850t, 37.3x25.3x29 Telescopic spreader	Rotterdam, ECT 55t, 50x210 1250t, 50x35x30 with 2nd trolley 60 cont/hour Tacoma, Sea-Land 40.6t (45.8t in future) 1000t, 39.9x30.5x37
Container terminals	Straddle carriers, Clark-525, 1 over 1, 165 PS (24')			
	Transfer cranes, (7 cont. lanes + 1 truck lane) x 2 over 1	(6 + 1) x 3 over 1	(6+1) x 4 over 1 (semi-automatic)	
	Large forklift trucks, Yard use tractors	Top-lift trucks, Side loader		
		Computerized	Computerized, Semi-automatic operation	Computerized, Advanced automatic operation
Remarks			Feeder service network Land-bridge operation	RVNIC Integrated service of surface with air transport

Fig.2 CONTAINER VESSEL EQUIVALENT TO 40,000 D/W
(Reference)



2) Fender System

(1) Berthing Speed of Vessels

Berthing of large size vessel is generally performed in such a way as a few numbers of tug boats push the vessel slowly towards the wharf which stop at the place 10 to 20 m away parallel to the wharf.

In case of wind blowing towards the wharf, tug boats must pull the vessel in her berthing. So is the case at -9.0 m General Cargo Wharf in Semarang with 2 tug boats of 1,500 HP and 800 HP.

Berth facilities by the above method of berthing are generally designed against the berthing speed of 10 to 15 cm/sec.

Therefore, design berthing speed of vessel (v) is :

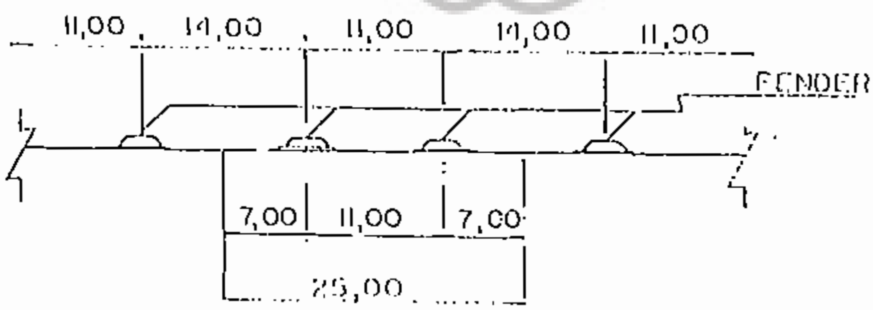
V = 10 cm/sec (40,000 D.W.T.),
V = 12 cm/sec (20,000 D.W.T.)

(2) Fender

The large and small Container vessel and Ro/Ro vessel which will berth at Container wharf is considered for layout of Fender.

The layout of Fender is shown in Fig. 3.

Fig. 3 LAYOUT OF FENDER



(3) Selection of Fender

(i) Ship's Berthing Energy

The Berthing energy (E) is obtained on the calculation mentioned below and the values taken are enlisted in the Table 6.

The ship's berthing energy should be calculated by a kinetic method by using equation (1).

$$Ef = \frac{WaV^2}{2g} Ce.Cm.Cs.Cc \quad \text{................} \quad (1)$$

Where Ef : Ship's berthing energy (t.m)

g : Acceleration gravity (m/s^2)

Wa : Water Displacement of the berthing ship (t)

V : Approach velocity of the berthing ship at the movement of impact against the fender (m/s)

Ce : Eccentricity factor

Cm : Virtual mass factor

Cs : Softness factor (1.0 as standard)

Cc : Shape factor of berth (1.0 as standard)

(a) Kinetic energy of the berthing ship Ef (tf.m) becomes equal to$(Ws/V^2)/(2g)$ if the ship moves only in the lateral direction. However, if a ship is berthed to the dolphin, the quay with fenders or berthing beams, then the energy to be absorbed by the fenders, etc., that is, the ship's berthing energy E is given by F.Es. Where F = Ce.Cm.Cs.Cc.

(b) The softness factor Cs is the ratio between the ship's berthing energy and the energy absorbed by the deformation of the ship's hull. Normally the energy absorbed by the deformation of the ship's hull is small and thus Cs = 1.0 is used.

(ii) Eccentricity Factor

The eccentricity factor during the ship's berthing should be calculated by using equation (2) with the consideration of the maneuvering of the ship, the properties of the ship, the arrangement of the fenders and the other factors.

$$Ce = \frac{1}{1+(\ell/r)^2} \quad \dots\dots\dots\dots\dots\dots\dots\dots (2)$$

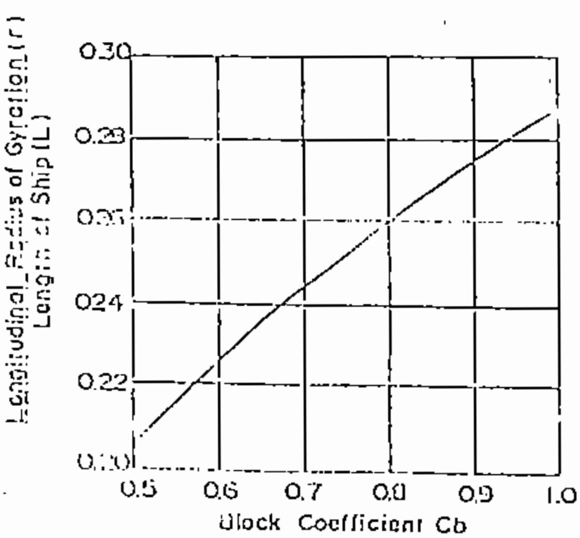
where ℓ : Distance measured in parallel to the mooring facility from the contact point to the center of gravity of the ship (m).

r : Longitudinal radius of gyration of the ship (m).

(a) A ship in the berthing operation is not parallel to the quay line, and due to the reaction from the fender, the ship will start to rotate (yawing) around the contact point with the mooring facility (fenders) and also will start rolling. As the result, part of the kinetic energy is dissipated. However, the energy dissipation by rolling is smaller than that by yawing, and thus may be negligible. Therefore, only the energy dissipation by yawing will be considered here.

(b) The Longitudinal radius of gyration can be determined from Fig. 4.

Fig. 4 Longitudinal Radius of Gyration as Function of Block Coefficient (Myers 1969)



(iii) Virtual Mass Factor

Values calculated by equation (3) should be used as the standard of the virtual mass coefficient.

$$Cm = 1 + \frac{\pi}{2}.Cb.\frac{d}{B} \quad .... (3)$$

where,

Cb : Block Coefficient [=Ws/(LBdwo)]
d : Draft (m)
B : Moulded of the ship (m)
L : Length of the ship (m)
wo : Specific weight of sea water (t/m^3)

(a) At the time of the ship's berthing, both the mass of the ship (Ms) and the mass of water around the ship (Mw) decelerate at the same time. Therefore, the inertial force due to the mass of water will be added to the mass of the ship.

From the above, the virtual mass factor is defined by equation (4).

$$Cm = \frac{Ms + Mw}{Ms} \quad .... (4)$$

Where,

Cm : Virtual mass factor
Ms : Mass of the ship (ship's displacement/acceleration of gravity), (t)
Mw : Added mass of the water mass around the ship (t)

(b) Equation (3) was proposed by Ueda based on the results of the field observation and the model experiment. Length of the ship (L) means the length between perpendiculars.

Table 6 Effective Berthing Energy (Ef)

I t e m	Results of Calculation	
	20,000 D/W	40,000 D/W
V (m/s)	0.12	0.10
Displacement tons	30,700	56,200
Ef (t.m)	20.23	24.27

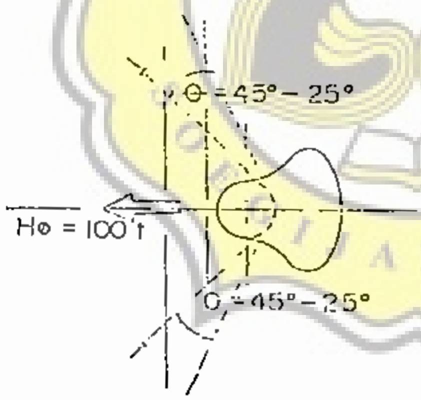
3) Pulling Capacity of Bollard

In accordance with Technical Criteria for port and harbour facilities with commentary - Japan, design pulling capacity of bollard is determined as below.

100 tons for - 12.0 M Container Wharf

The pulling force is assumed to act in all direction as shown in the Fig. 5.

Fig. 5 Active Direction of Pulling Force



The Bollard shall be installed in the center of the superstructure at interval of 25 meter each.

4) Others

Other facilities to be incorporated are curbing, nosing, ladder, mooring ring, steel frame, etc.

LAYOUT AND SIZE OF PORT FACILITIES

1) Channels and Basins

Layout and size of Channels and Basins are shown in the Table 7 and Fig. 6.

Table 7 Size of Channels and Basins

No.	Location	Depth of Channel/Basin (m)	Width (m)
1	Main Channel (Existing)	- 9.0	150
2	West Basin (New)	- 10.0	500

The vertical section of dredging area is as per Fig. 7.

Slope at the edges of the dredging area is decided based on the actual soil condition.

2) Container Wharf

Apron elevation should be the same as for -9.0 M General Cargo Wharf situated on the extension line.

Standard section of the Container Wharf is determined as shown in Fig. 8.

* Apron elevation : DL + 2.20 M
* Apron width : B = 25.0 M
* Design depth : DL - 12.0 M

3) Revised Shape of Container Terminal

The Container Terminal is required to be placed in a rectangular shape to allow optimum utilization and effective operation of the Container Terminal.

FIG. 6 PLAN OF CHANNEL AND BASIN

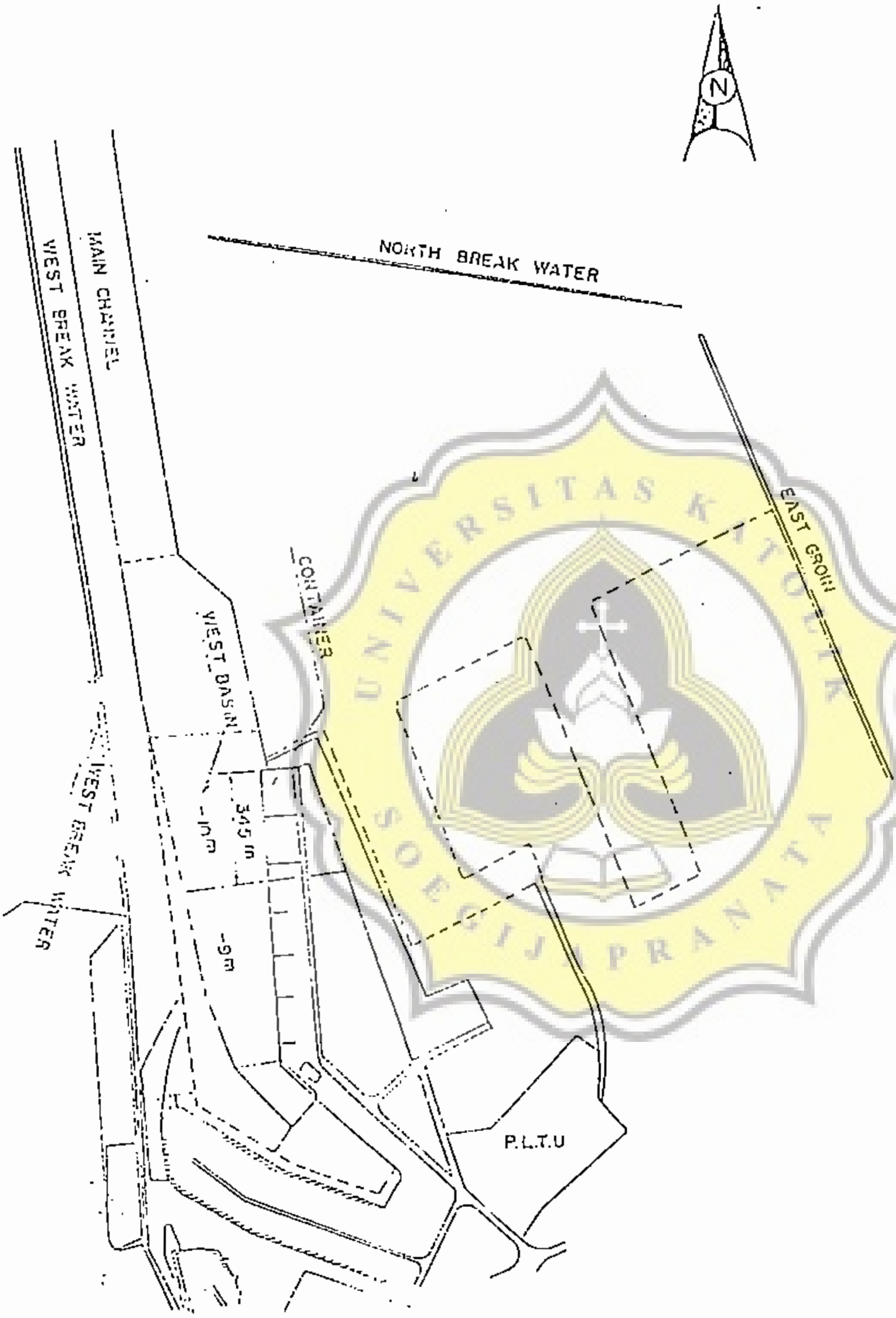


FIG. 7 SLOPE AT THE EDGES FOR THE DREDGING AREA

(u,m)

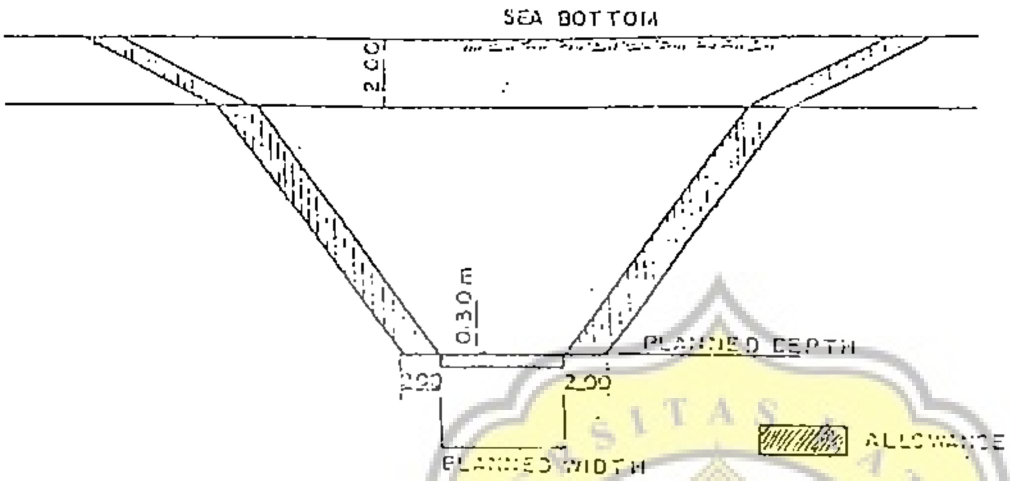
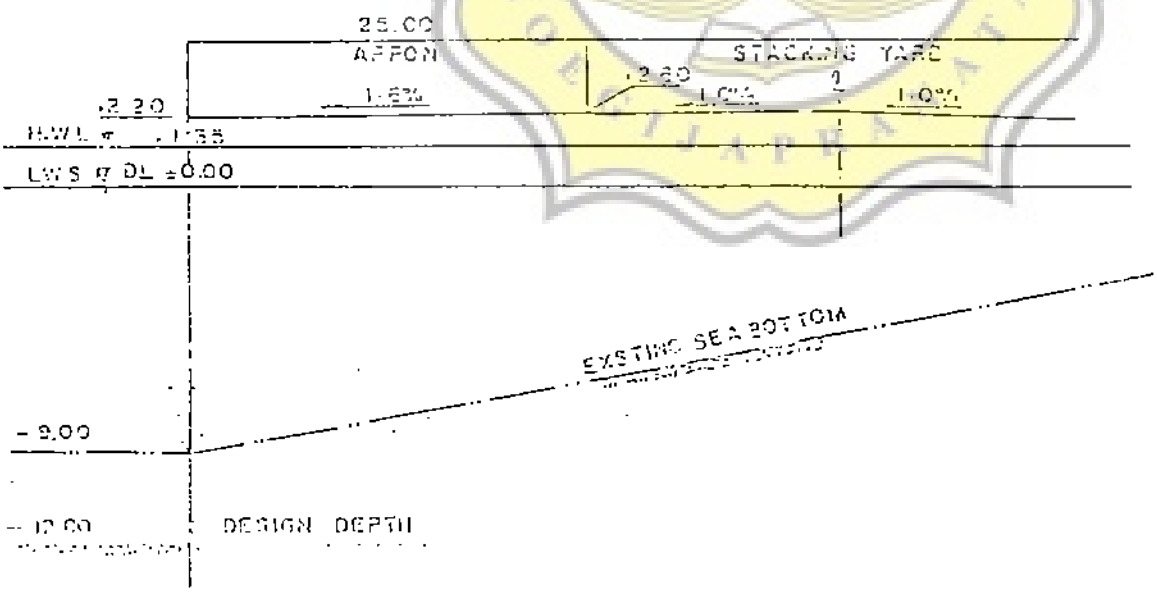


FIG. 8 STANDARD DIMENSION OF CONTAINER WHARF

(u,m)



LOAD CONDITION

Load condition are subject to change according to kinds of cargo to be handled, vehicles to be utilized and cargo handling equipment etc. to be used at the back of wharf and facilities. Load conditions are determined as described below, taking possible future plan of cargo handling system into consideration.

1) Vehicle Load and Load by cargo Handling Equipment

(1) Vehicle : 20 ton trucks

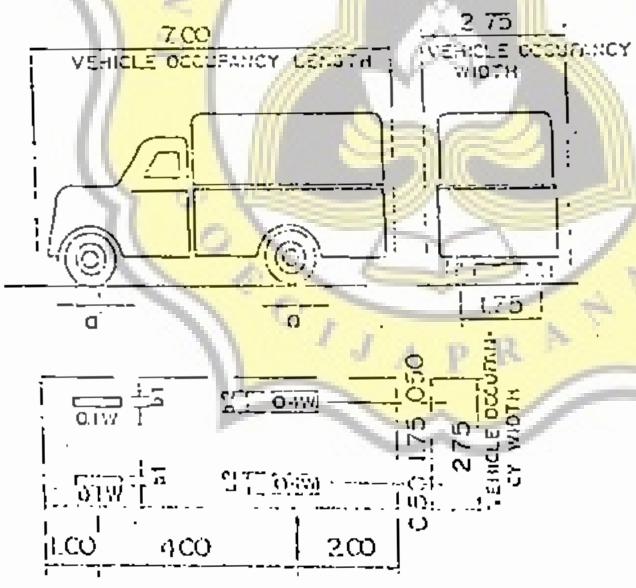
(2) Tractor and Trailer feet container : 20′ and 40′

(3) Forklift : 13.5 ton and 2 ton

(4) Others

Specified particulars of vehicle cargo handling equipment are shown in the Figs 9. and 11.

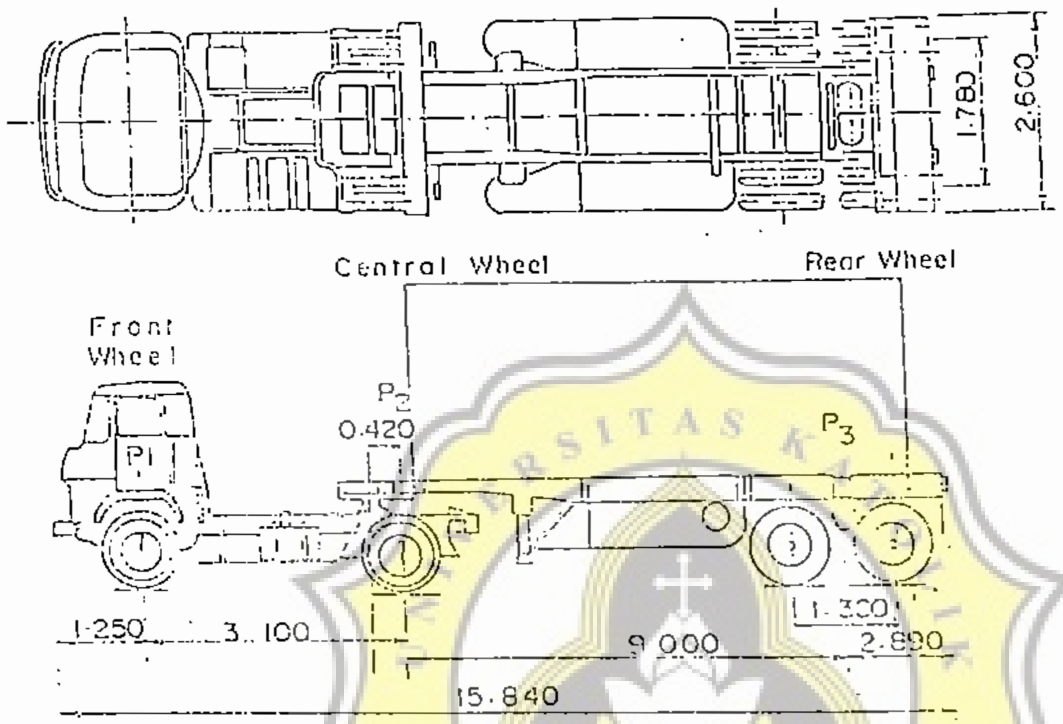
Fig.9 Load for Truck (T - 20)



Vehicle Load

	Vehicle Load Max.	Wheel Contact a x b
Front wheel	0.1 w 2.00 t	0.20 m x 0.125 m
Rear wheel	0.4 w 8.00 t	0.20 m x 0.50 m

Fig. 10 Tractor Trailer for 40' container

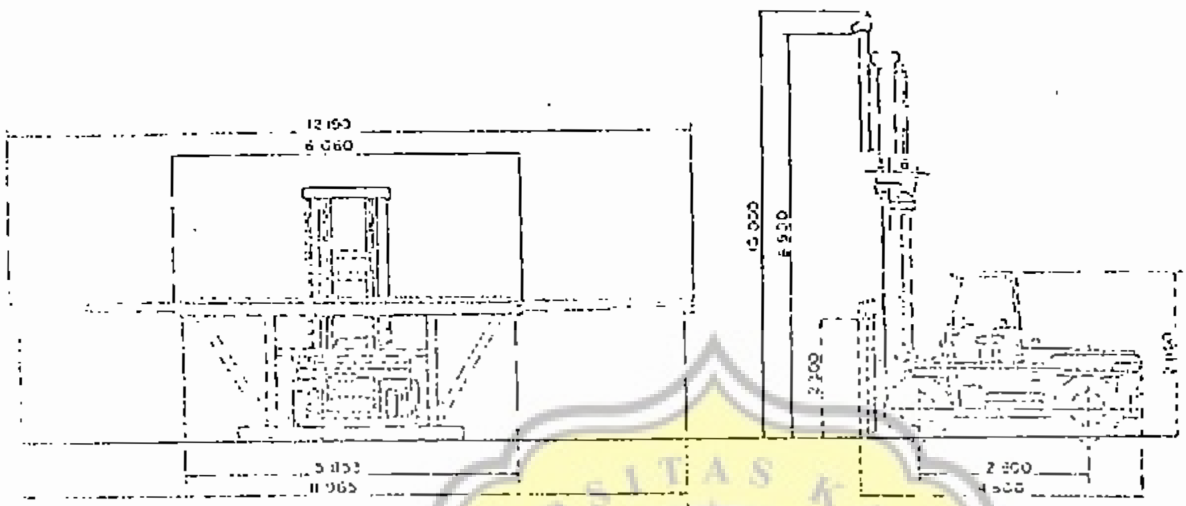


Vehicle Load

	Gross weight of vehicle	Front Wheel	Center Wheel	Rear Wheel
For 40' container	41.4	4.9	13.4	23.1

Notes: 1. 41.4 ton is inclusive of tare of 40' container with full cargo.
2. The contact width and length shall be equal to those of truck.

Fig. 11   13.5 TON FORKLIFT TRUCK



Vehicle Load

	Vehicle Load
Front Wheel	5.63

2) Design Load for Cranes

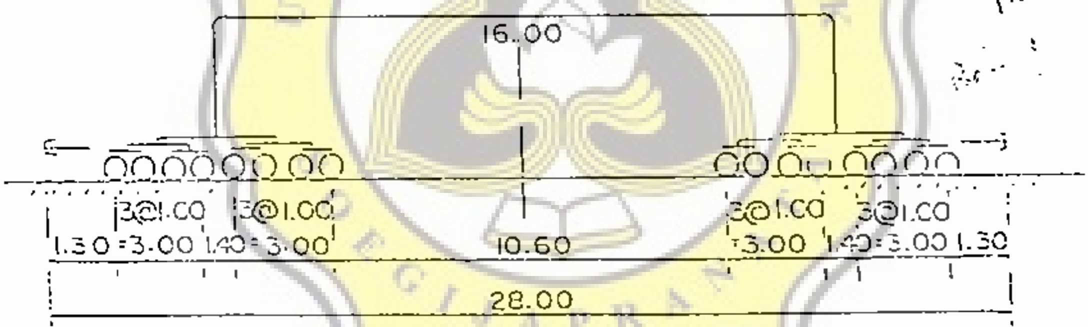
Container Crane to be installed at the container wharf and Transfer crane for stacking yard are considered as design load.

(1) Container Crane

Rail is of CR 73 KG and Crane load are as follows : (Fig. 12)

Lifting Capacity of Under Spreader	:	35.6 (Spreader weight approximately 11.5t)
Cross weight of crane	:	Approx. 700 t unit
Outreach (from seaside rail center)	:	38.0 m.
Wheel load (working)	:	37 t/wheel (8x2) Seaward
(Working)	:	28 t /wheel (8x2)Landward
(Storm)	:	24.0 t/ wheel Seaward
	:	33 t/ Wheel Landward
Wheel Span	:	1.0 m
Rail span	:	16.0 m

Fig. 12 Wheel Distance of Container Crane



(2) Transfer Crane

The type for the transfer crane is eight rubber tired diesel electric powered gantry type travelling crane . The condition for the design load is as follows : (Fig . 13)

Rated capacity	:	41.0 t / unit
Gross weight of crane	:	Approx 210 t / unit
Wheel load (working)	:	32 t / wheel
(Storm)	:	26 t / wheel

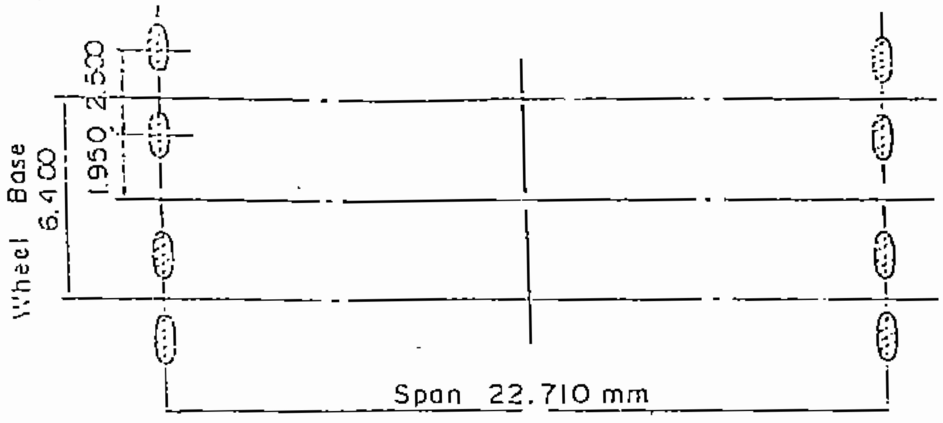


Fig. 13 Wheel Arrangement of Transfer Crane

3) Load by Cargo

(1) Distributed Load

Equally distributed load for the respective Port facilities is as the followings :

i) Container Wharf

Normal condition	q	= 2.0 t / m^2
Earthquake	q	= 1.0 t / m^2

ii) Stacking yard

Normal condition	q	= 3.0 t / m^2
Earthquake	q	= 1.5 t / m^2

iii) For slope stability

Normal condition	q	= 2.0 t / m^2
Earthquake	q	= 1.0 t / m^2

The distributed value mentioned above are to be applied for the container yard without pile foundation at its container stacking yard.

(2) Concentrated Load

The various concentrated loads such reaction forces as container at supporting points etc. are to be incorporated into design, if necessary.

(3) Impact Load

The 10 percent of impact load shall be considered to the design load in respect of the vertical load of the Container Crane, Transfer Crane and Tractor Shassis.

(4) Design Load of Container Stacking

Value of the point load (P) obtained from at the four supporting points of Container bottom regarding three tiers stacking Container is as follows.

The 10 percent of impact load is considered when Container box is stacking on the top tier of Container.

Case of 20′ x 8′ x 8.6′ container (20.3 t)

$$P = \frac{20.3 \times 2 + 20.3 (1 + 0.1)}{4} \doteqdot 16 \text{ t/point}$$

Case of 40′ x 8′ x 9.6′ container (30.5 t)

$$P = \frac{30.5 \times 2 + 30.5 (1 + 0.1)}{4} \doteqdot 24 \text{ t/point}$$

Most of the container boxes stacked in the container yard rarely contains full capacity of the container box. Therefore the design load to be applied for the foundation of the container stacking yard shall be at least 60% of the value above mentioned.

(5) Combination of Loads

Individual load proposed in the above shall be combined with other load (s) in designing, taking every possible case of utilization of the facility into consideration.

5 DESIGN CONDITION FOR ROAD

1) Design Condition for Road

(1) Width of Road

- West Terminal road : 20 m
- Trans - over road : 20 m

(2) Load

12 ton Axle load

(3) CBR of Subgrade

CBR 3 % is adopted for design.

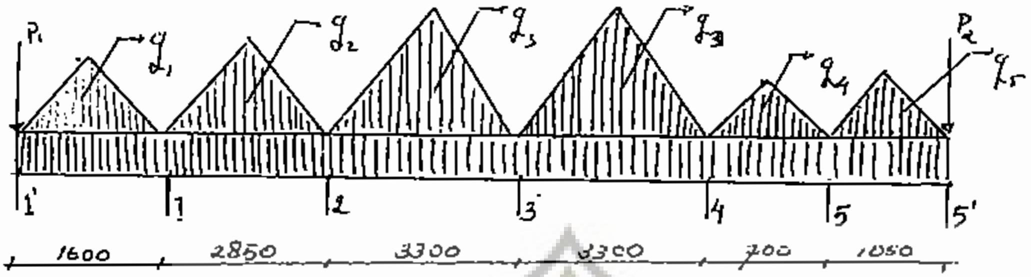
DAFTAR LAMPIRAN GAMBAR DAN TABEL

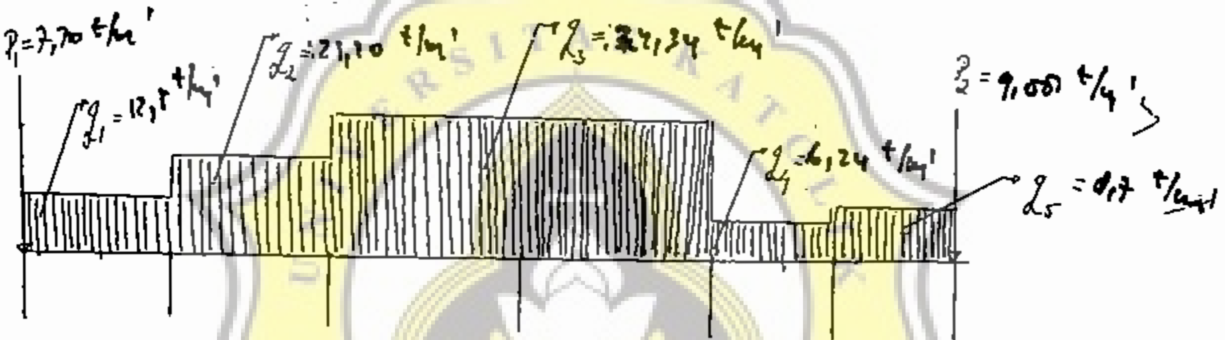
UNIVERSITAS KATOLIK SOEGIJAPRANATA

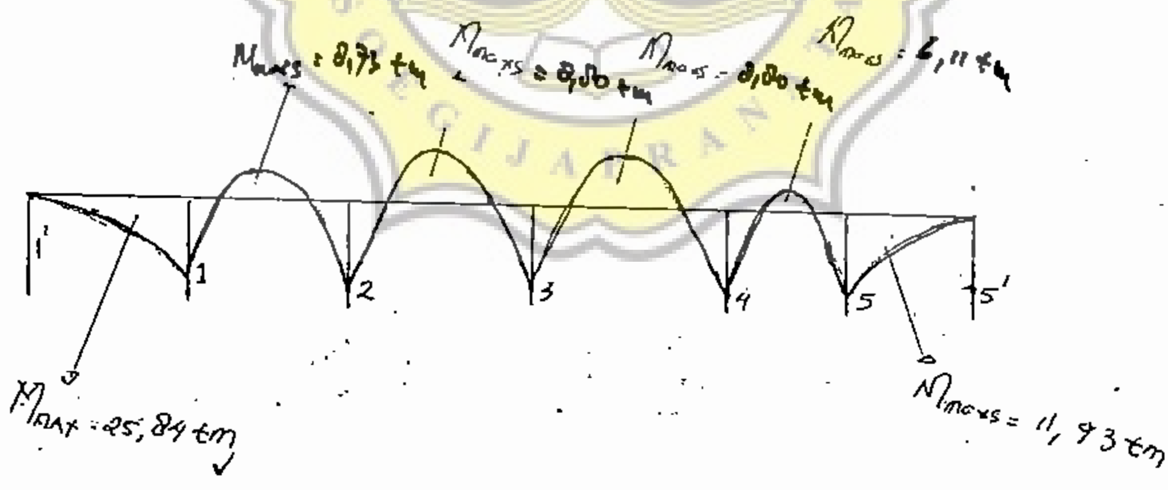
SEMARANG

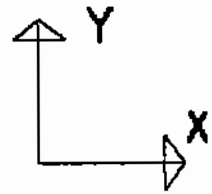
2000

DISTRIBUSI BEBAN PADA BALOK (1 '1 2 3 4 5 5')





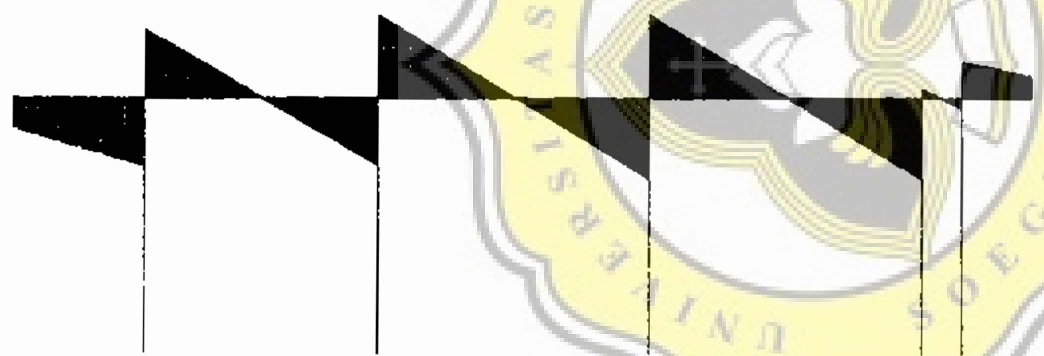


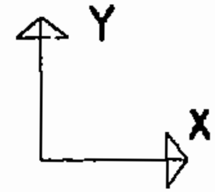


B2
FRAME
OUTPUT M33
LOAD 1

ENVELOPES
MIN < 1>
-.2584E+02
AT 1.60
MAX < 3>
.8797E+01
AT 1.65

SAP 90





B2
FRAME
OUTPUT V22
LOAD 1

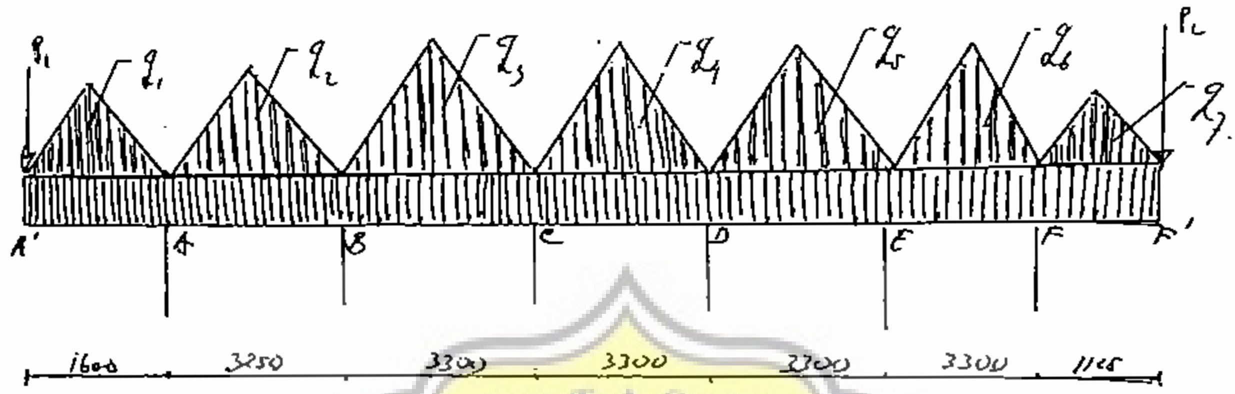
ENVELOPES
MIN < 3>
-.3199E+02
AT 3.30
MAX < 3>
.3199E+02
AT .00

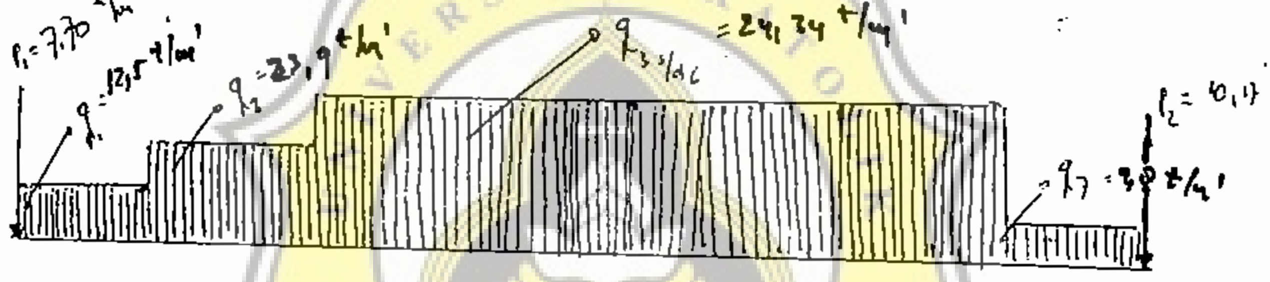
SAP 90

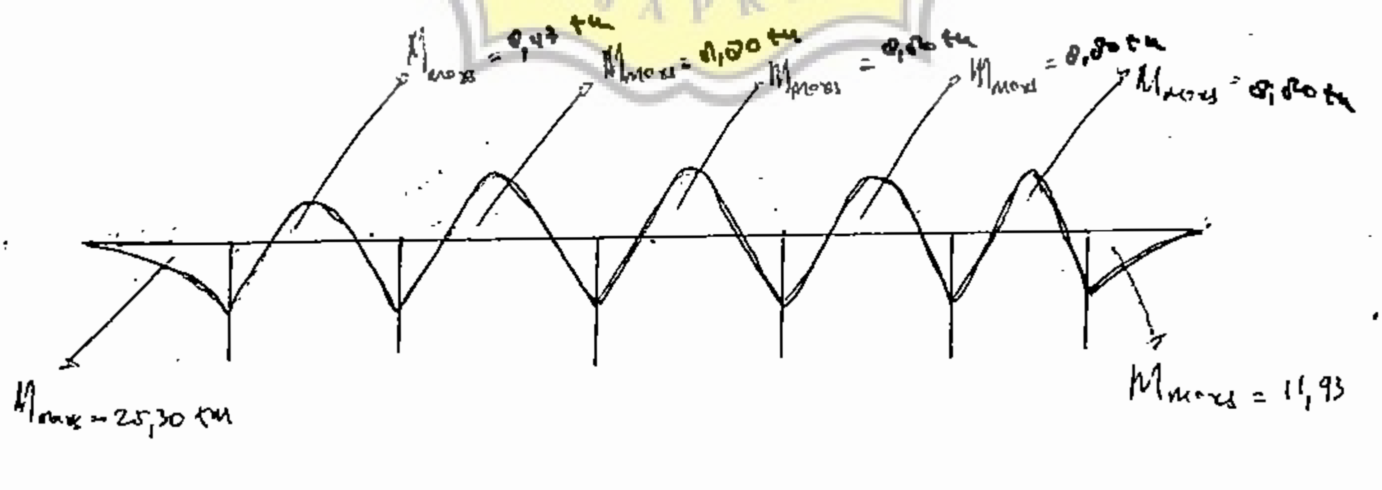
FRAME ELEMENT FORCES

ELT ID	LOAD COND	AXIAL FORCE	DIST ENDI	1-2 PLANE SHEAR	MOMENT
1					
	1	.00			
			.0	-7.70	
			1.6	-24.43	-25.84
	2	.00			
	3	.00			
2					
	1	.00			
			.0	20.14	-12.83
			1.7	.00	5.73
			2.8	-20.14	-12.83
	2	.00			
	3	.00			
3					
	1	.00			
			.0	31.99	-17.59
			1.7	.00	8.80
			3.3	-31.99	-17.59
	2	.00			
	3	.00			
4					
	1	.00			
			.0	31.99	-17.59
			1.7	.00	8.80
			3.3	-31.99	-17.59
	2	.00			
	3	.00			
5					
	1	.00			
			.0	0.43	0.24
			1.7	.00	0.11
			0.7	-0.43	-0.24
	2	.00			
	3	.00			
6					
	1	.00		14.86	-11.93
			.0	.00	.00
	2	.00	1.1		
	3	.00			

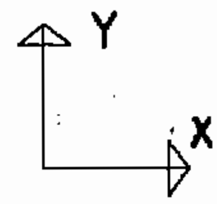
DISTRIBUSI BEBAN PADA BALOK (A' A B C D E F F')







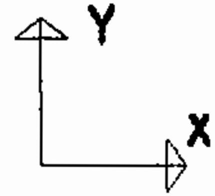
[illegible]



BDI
FRAME
OUTPUT M33
LOAD 1

ENVELOPES
MIN < 1>
-.2641E+02
AT 1.60
MAX < 3>
.9791E+01
AT 1.65

SAP 90



BDI
FRAME
OUTPUT V22
LOAD 1

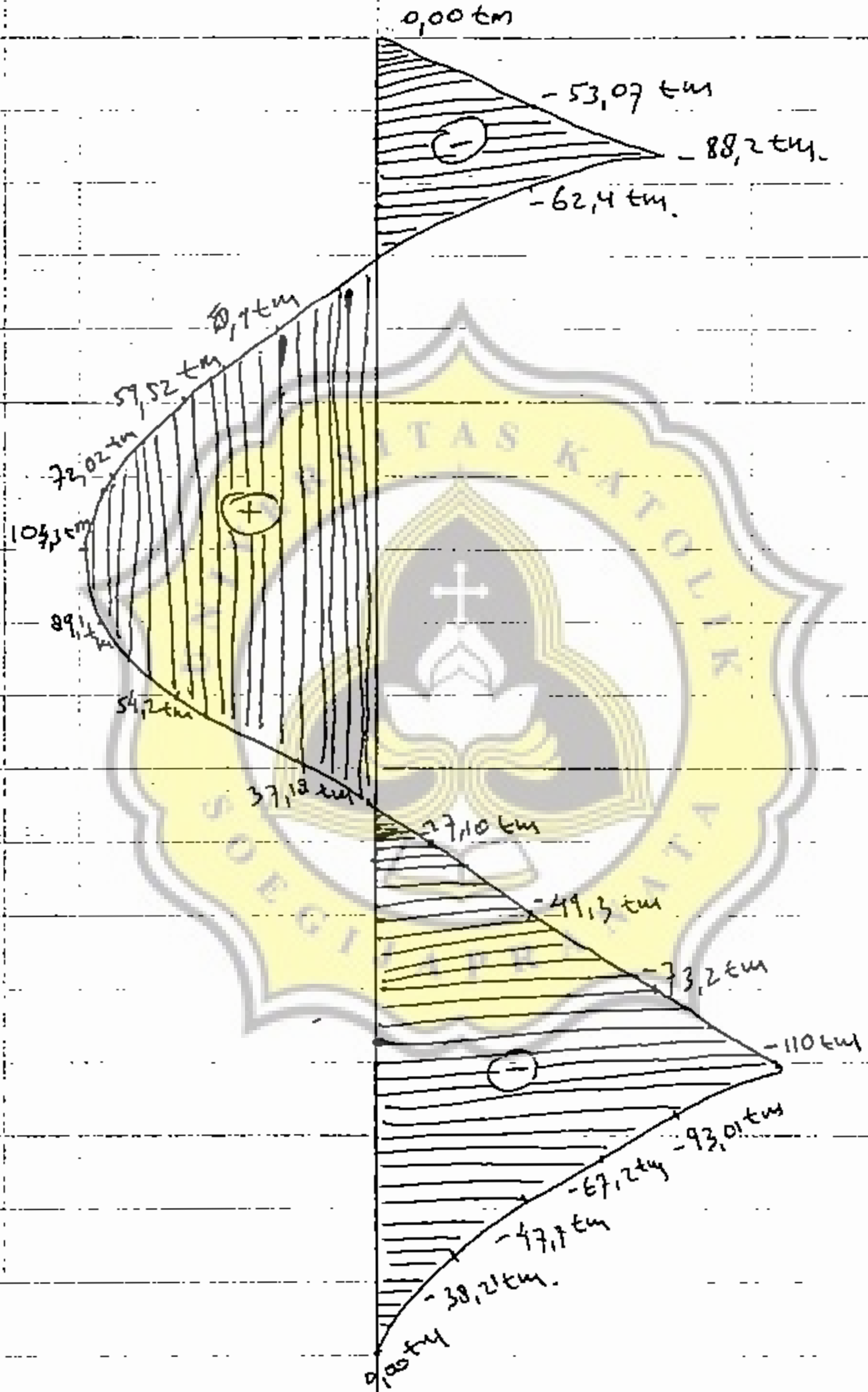
ENVELOPES
MIN < 3>
-.3278E+02
AT 3.30
MAX < 3>
.3278E+02
AT .00

SAP 90

F R A M E   E L E M E N T   F O R C E S

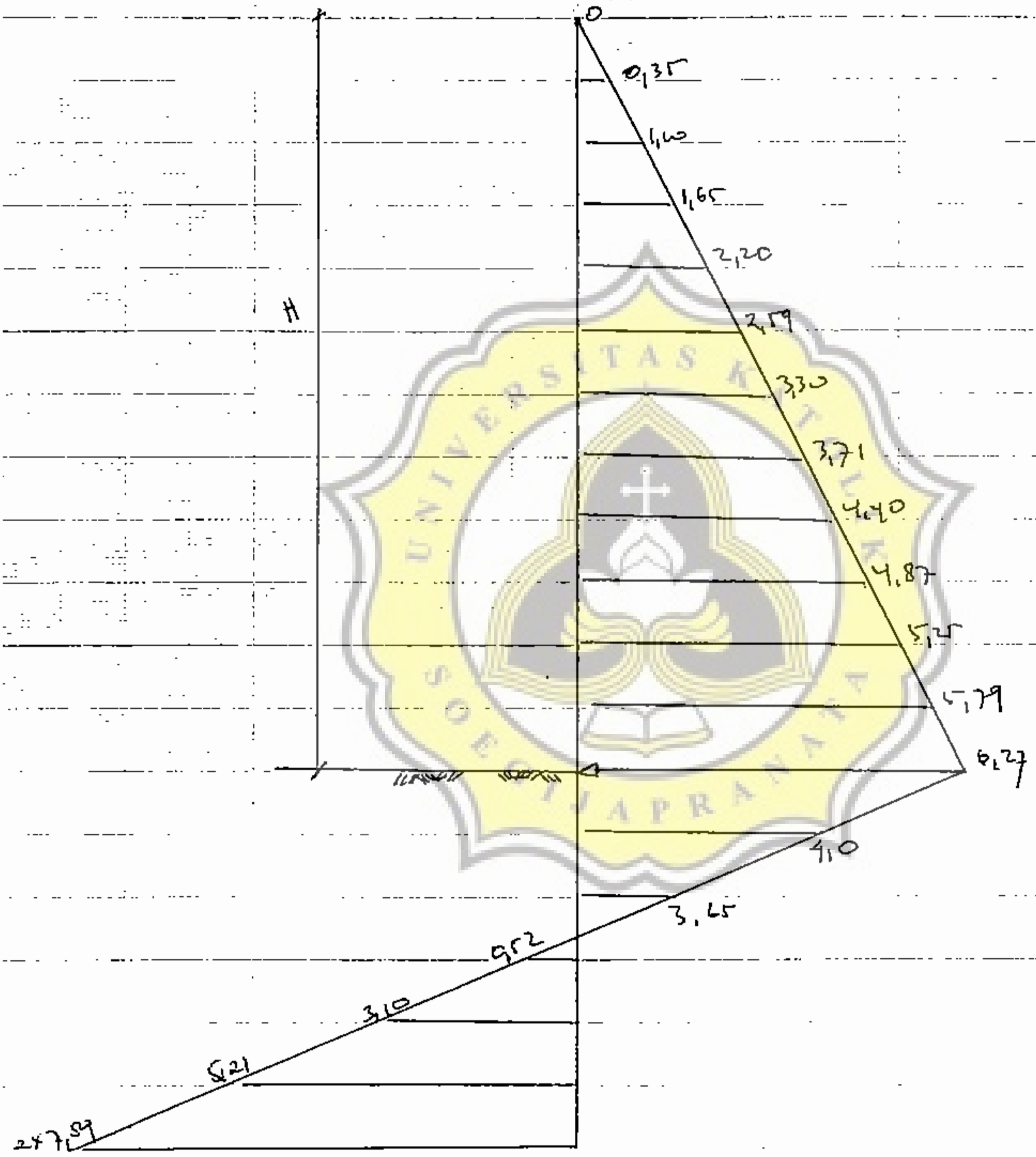
ELT ID	LOAD COND	AXIAL FORCE	DIST END1	1-2 PLANE SHEAR	MOMENT
1					
	1	.00			
			.0	-7.70	.00
			1.6	-23.92	-25.30
	2	.00			
	3	.00			
2					
	1	.00			
			.0	31.07	-16.57
			1.6	.00	8.41
			3.2	-31.07	-16.83
	2	.00			
	3	.00			
3					
	1	.00			
			.0	31.99	-17.59
			1.7	.00	8.60
			3.3	-31.99	-17.59
	2	.00			
	3	.00			
4					
	1	.00			
			.0	31.99	-17.59
			1.7	.00	8.60
			3.3	-31.99	-17.51
	2	.00			
	3	.00			
5					
	1	.00			
			.0	31.99	-17.59
			1.7	.00	8.60
			3.3	-31.99	-17.59
	2	.00			
	3	.00			
6					
	1	.00			
			.0	31.99	-17.59
			1.7	.00	8.60
			3.3	-31.99	-17.59
	2	.00			
	3	.00			
7					
	1	.00			
			.0	14.86	-11.93
			1.1	.00	.00
	2	.00			
	3	.00			

BIDANG M

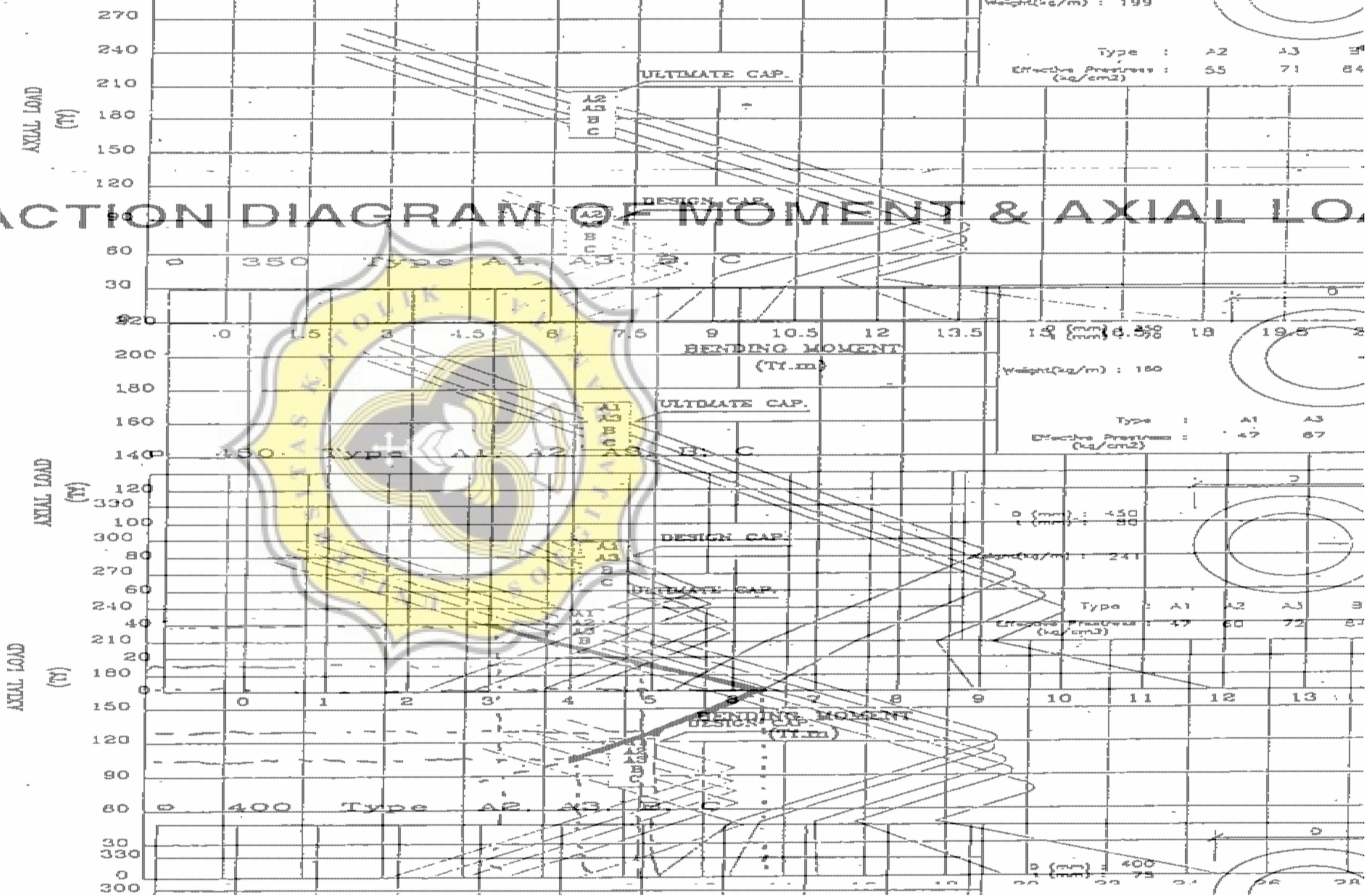


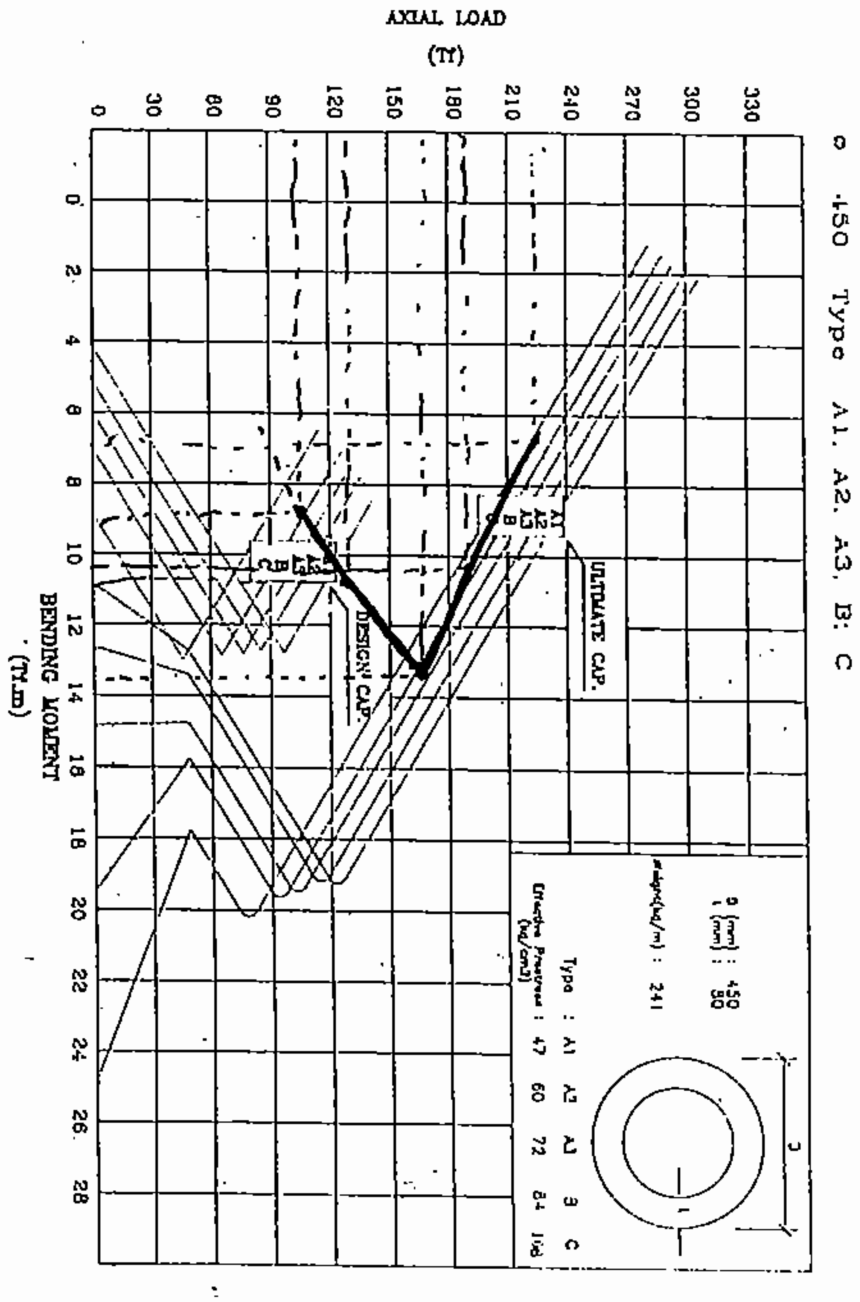
0,00 tm
-53,07 tm
-88,2 tm
-62,4 tm
30,1 tm
57,52 tm
72,02 tm
104,3 tm
89,1 tm
54,2 tm
37,18 tm
-7,10 tm
-49,3 tm
-73,2 tm
-110 tm
-93,01 tm
-67,2 tm
-47,1 tm
-38,21 tm
0,00 tm

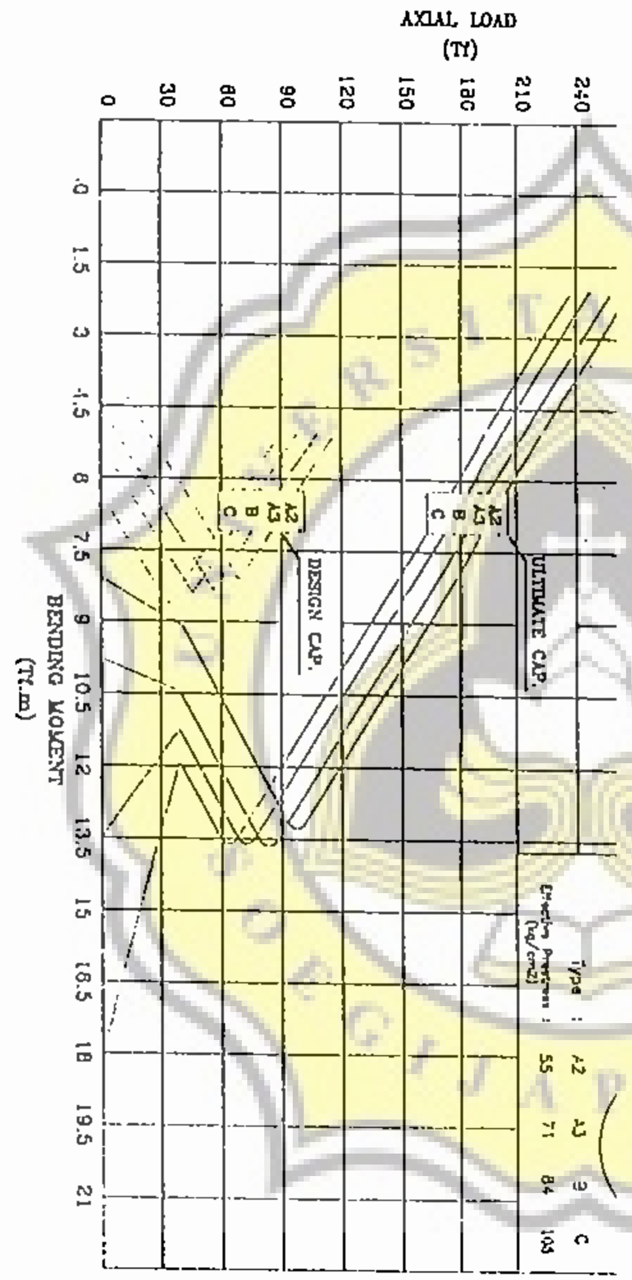
Elastic line methode
untuk menghitung M_{maxs}.



INTERACTION DIAGRAM OF MOMENT & AXIAL LOA




AXIAL LOAD
(Tf)
BENDING MOMENT
(Tf.m)
ø 450 Type A1, A2, A3, B, C
ULTIMATE CAP.
DESIGN CAP.
Type : A1 A2 A3 B C
Effective Prestress (kg/cm2) : 47 60 72 84 106


AXIAL LOAD
(Tf)
BENDING MOMENT
(Tf.m)
ULTIMATE CAP.
DESIGN CAP.
Type : A2 A3 B C
Effective Prestress (kg/cm2) : 55 71 84 103