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MINISTRY OF COMMUNICATIONS
DIRECTORATE GENERAL OF LAND TRANSPORT
AND INLAND WATERWAYS

TENDER DOCUMENTS
FOR
NEW RAILWAY LINE FOR CENGKARENG AIRPORT
CONSTRUCTION PROJECT

STRUCTURAL CALCULATION SHEETS

PACKAGE I CIVIL AND ARCHITECTURAL WORK

5 of 11

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JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

SDF
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STRUCTURAL CALCULATION SHEETS

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§§8. VIADUCT V094

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§1. Design criteria

1-1 Type of structure

Elevated structure of Rahmen (Rigid frame) type made of R.C.

1-2 Type of track

Ballast type track

1-3 Type of substructure

Foundation piles are P.C. piles driven into the ground.

(1). Type of footing.

Cannected type footing.

(2). Bearing stratum

Dcs stratum. Supposed $N > 30$

1-4 Design Load

(1). Dead Load (Unit Weight)

Track assembly weight	0.45	t/m
Ballast	1.9	t/m³
Reinforced Concrete	2.5	t/m³
Plain Concrete	2.35	t/m³

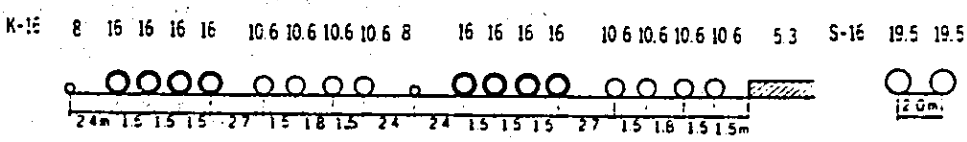
Steel materials 7.85 t/m³

Handrail 0.2 t/m

Material will be used actual unit weight of relevant

(2). Train Load

Train Load will be equivalent to KS-16



(K-Loading) (S-Loading)

Equivalent uniformly distributed load

span (m)	KS-16		
	W M1 (t/m)	W M2 (t/m)	W S (t/m)
7	5.6	4.8	6.4
8	5.4	4.6	6.0
9	5.2	4.4	5.8
10	5.1	4.2	5.6

W_{M1}: Applied for positive span bending moment, also for negative span bending moment at the first support point.

W_{M2}: Applied for negative bending moment at the intermediate support point.

W_s : Applied for shearing stress.

(3). Impact Load

The impact of train load shall be the train load multipied by the following impact coefficient

Impact coefficient (KS-Loading)

Span l (m)	0	5	10	20
impact coefficient (i_0)	0.60	0.48	0.43	0.37

For the double track structure, impact coefficient is reduced followed the equation.

$$i = i_0 \times \left(1 - \frac{l}{200}\right)$$

l : Span length (m)

(4). Centrifugal Load

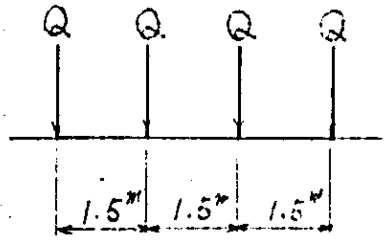
The magnitude of centrifugal load shall be the train load multiplied by the following coefficient as shown below. The working height of load is 1.8^m above the rail level. The acting direction of load is horizontal and right angle to the track.

Curve Radius R (m)	Centrifugal Coefficient α
R ≦ 700	0.12
700 < R ≦ 1000	0.10
1000 < R ≦ 1800	0.08
1800 < R	0

(5). Train Lateral Load

Train lateral load under KS loading scheme shall be Q loading diagram as shown on the figure which is 15% of a driving axle load per track under K-loading scheme working horizontall on the track at rail level in direction of right angle to the track.

In the case of structure supporting the line with two or more tracks. Train lateral load is assumed as the load of only one track.



(6). Brake Load and Traction

Brake load and traction load per track shall be the value as indicated below, working parallel to the track in the track center profile at 1.8 m above rail level.

Brake load	15% of the train load
Traction load	25% of the weight of the driving axle

(7). Earth Pressure

Coulomb and Rankine's coefficient of earth pressure will be used

(8). Seismic Effect

Seismic effect of eartquake is assumed as dead load and surcharge load multiplied by seismic coefficient plus seismic earth pressure.

$K_h = 0.10$ ····· in horizontal direction.

$K_v = 0$ ····· in vertical direction.

(9). Temperature Load

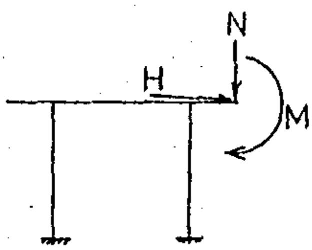
The temperature change considered in the structural analysis of statically indeterminate structure and the drying shrinkage shall be as follows:

Temperature Change ± 10°C

Drying Shrinkage - 15°C

Coefficient of temperture swelling of reinforced concrete shall be $1 \times 10^{-5} / 1C°$

(10). Load caused by catenary pole



Ordinary case

$$\begin{cases} M = 5.0^{t \cdot m} \\ N = 2.0^{t} \\ H = 0.5^{t} \end{cases}$$

(11). Perestrian Load

For the structure of station and platform

slab	500 kg/m²
beam	350 kg/m²
earthquake case	210 kg/m²

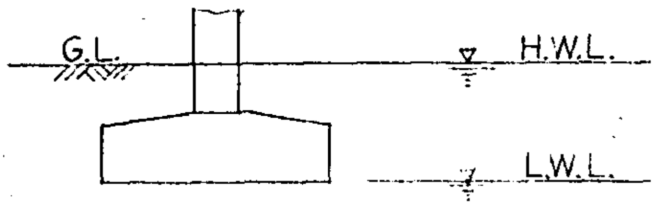
1-5. Other conditions

(1). Effect of Gelber girder

Construction of shoe used for Gelber girder is made, combined rubber shoe and steel rod stopper. Employed the said type of shoe for both support ends and accordingly eliminated distinction between movable and fixed end, shoe are supposed to share the load evenly half and half.

(2). Water level

Water level for the design is supposed as follows.



L.W.L. ······ Stays at the bottom face level of footing.

H.W.L. ······ Stays at ground level.

(3). Concrete minimum Cover

slab part		25 mm	(net thickness)
beam		30 mm	(〃)
column		35 mm	(〃)
footing	top or side face	50 mm	(net thickness)
	bottom face	150	(from bar center to concrete face)

1-6. Material and allowable stress

(1). Material

1). Concrete $\sigma_{ck} = 240\ kg/cm^2$

2). Reinforcing bar SD30

3). Max size of coarse aggregate 25 mm

(2). Allowable Stress

1). Reinforced Concrete

			Design stress
Allowable compressive stress			90 kg/cm^2
Allowable shearing stress	Diagonal tension member	Bending shear τ_{a1}	3.9 〃
		Punching shear τ_{ap}	5.4 〃
		τ_{a2}	17 〃
Allowable bonding stress		Deformed reinforcing bar	18 〃

2). Reinforcing Bar

Type of reinforcing bar	SD30
Allowable tensile stress determined by yielding point	1800 kg/cm²

Allowable stress for analysis, against cracking

Surrounding condition	Allowable value corresponding to dead load	
	Slab	beam
Permanent wet condition	σ_{sa1} = 1200 kg/cm²	σ_{sa1} = 1400 kg/cm²
	σ_{sa2} = 1400 "	σ_{sa2} = 1600 "
Alternate dry and wet condition	σ_{sa1} = 800 "	σ_{sa1} = 1000 "
	σ_{sa2} = 1000 "	σ_{sa2} = 1200 "

$$\sigma_{sa1} : \alpha = \frac{\sigma_{l+i}}{\sigma_d + \sigma_{l+i}} \geqq 0.25$$

$$\sigma_{sa2} : \alpha = \frac{\sigma_{l+i}}{\sigma_d + \sigma_{l+i}} < 0.25$$

σ_d : Tensile stress of re-bar subjected dead load

σ_{l+i} : Tensile stress of re-bar subjected train load and impact load

1-7 Allowable stress, subjected combined load

(1). Track carrying structure

Combination of load	Given Extra
D + T + I (+E)	1.00
D + T + I + C (+E)	1.00
D + T + I + C + TL (+E)	1.15
D + T + I + B (+E)	1.15
D + TE (+E)	1.15
D + S (+E)	1.50

D : Dead load

T : Train load

I : Impact load

C : Centrifugal load

TL : Train lateral load

TE : Temperature load

B : Brake load

S : Seismic Force

E : Catenary pole

Load listed above with (+) expression is considered when the combined load including (+) brought dangerous result.

(2). Platform structure

Combination of load	Given Extra
D + P + EP	1.00
D + P + EP + TE	1.15
D + P + EP + S	1.50

D : Dead load

P : Pedestrian load

EP : Earth pressure

TE : Temperature load

S : Seismic Force

1-8. Allowable Reaction of pile.

$Q = 30 \cdot \overline{N} \cdot A_P$

$\overline{N}$: Mean N value obtained from the N values measured within 4D vertical distance from pile bottom. $\overline{N} = 25$

AP : Base area of pile. $A_P = \frac{1}{4} \cdot \pi \times 0.35^2 = 0.0962^{m^2}$

Q : Ultimate reaction of pile.

D : Diameter $D = 0.35^m$

$Q = 30 \times 25 \times 0.0962 = 72^t$

Under ordinary condition $R_a = \frac{Q}{F} = \frac{72}{3} = 24^t/\text{Pile}$

Under the condition of ordinary plus temporary

$R_a = \frac{72}{2} = 36^t/\text{Pile}$

Under the condition of earthquake

$R_a = \frac{72}{1.5} = 48^t/\text{Pile}$

Over-turning analysis

Under ordinary condition

Ratio of minimum and maximum reaction of pile shall be 0.3 or more. $\frac{R_{min}}{R_{max}} > 0.3$

1-9. Calculation for the pile elasticity, horizontal direction

$$K_h = 0.4 \times \alpha' \times \alpha E_o B_h^{-\frac{3}{4}}$$

Where

K_h : Coefficient of elasticity, horizontal direction (kg/cm^3)

α' : Correction factor for the pile sides
$\alpha' = 1.2$ (circular section)

α : For the permanent load $\alpha = 2$
For the Temporary load $\alpha = 4$

E_o : Deformation factor of the ground.
Assumed the average N value to be $E_o = 2\ kg/cm^2$ as observed from the boring log.

B_h : Equivalent width of the pile
$B_h = \sqrt{D \times l_m}$
D : Diameter of pile
l_m: Depth of the first nonmove pint.

$$\beta = \sqrt[4]{\frac{K_h \cdot D}{4 \cdot E \cdot I}}$$

D: Diameter of pile

I: Moment of inertia of pile

E: Modulus of elasticity. $E = 3.5 \times 10^5$ kg/cm²

$$Kn = 0.32\,(\alpha E_o)^{1.103} \times D^{-0.310} \times (EI)^{-0.103}$$

$$l_m = \frac{\pi}{2\beta}$$ D = 35 cm

$E = 3.5 \times 10^5$ kg/cm²

$E_o = 2$ kg/cm²

Under the condition	For the permanent load	For the Temporary load
$(\alpha.E)^{-0.103}$	9.91	21.29
I	62130	62130
$D^{-0.310}$	0.332	0.332
$(E.I)^{-0.103}$	0.086	0.086
Kn	0.091	0.195
β	2.46×10^{-3}	2.98×10^{-3}

1-10. P.C. Pile

(1). Given conditions for preparing MN Diagram

Coefficient to be multiplied to basic allowable stress	Allowable compressive stress of concrete	Allowable tensile stress of Tendon used for P.C. pile
1.0	150 kg/cm^2	90 kg/mm^2
1.1	165 "	100 "
1.2	180 "	110 "
1.5	225 "	135 "
1.65	250 "	150 "

Young's modulus of concrete.

$$E_c = 3.5 \times 10^5 \ kg/cm^2$$

Young's modulus of Tendon

$$E_s = 2.0 \times 10^6 \ kg/cm^2$$

$$n = \frac{E_s}{E_c} = 5.7$$

Design standard of concrete stress

$$\sigma_{ck} = 500 \ kg/cm^2$$

Prestressing Tendon

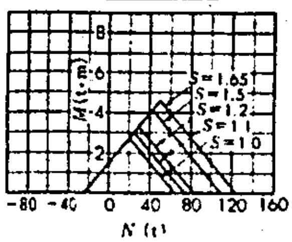
$$\sigma_{pa} = 0.6\,\sigma_{pu} \text{ or } 0.75\,\sigma_{py}$$

$$= 90 \ kg/mm^2 \ (\phi 7.0^{mm})$$

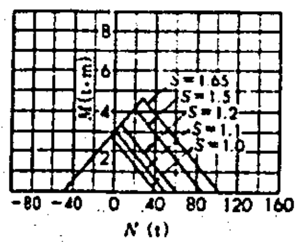
Where, concrete stress shall be $\sigma_c > 0$

Diameter of pile (mm)	Wall thickness of pile (mm)	Category of pile prestressing	Cross sectional area of Tendon used for P.C. pile (cm^2)	MN Diagram No.
350	65	A	3.1	1
		B	6.1	2
500	90	A	6.1	3
		B	12.2	4

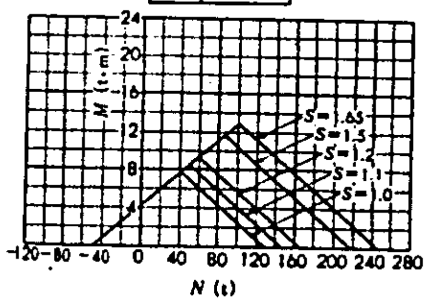
1 D350-A



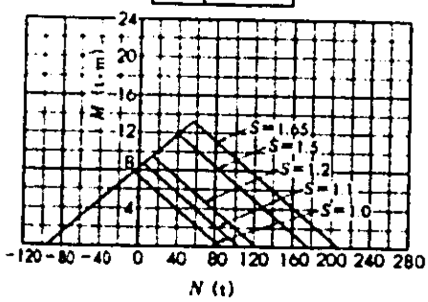
2 D350-B



3 D500-A

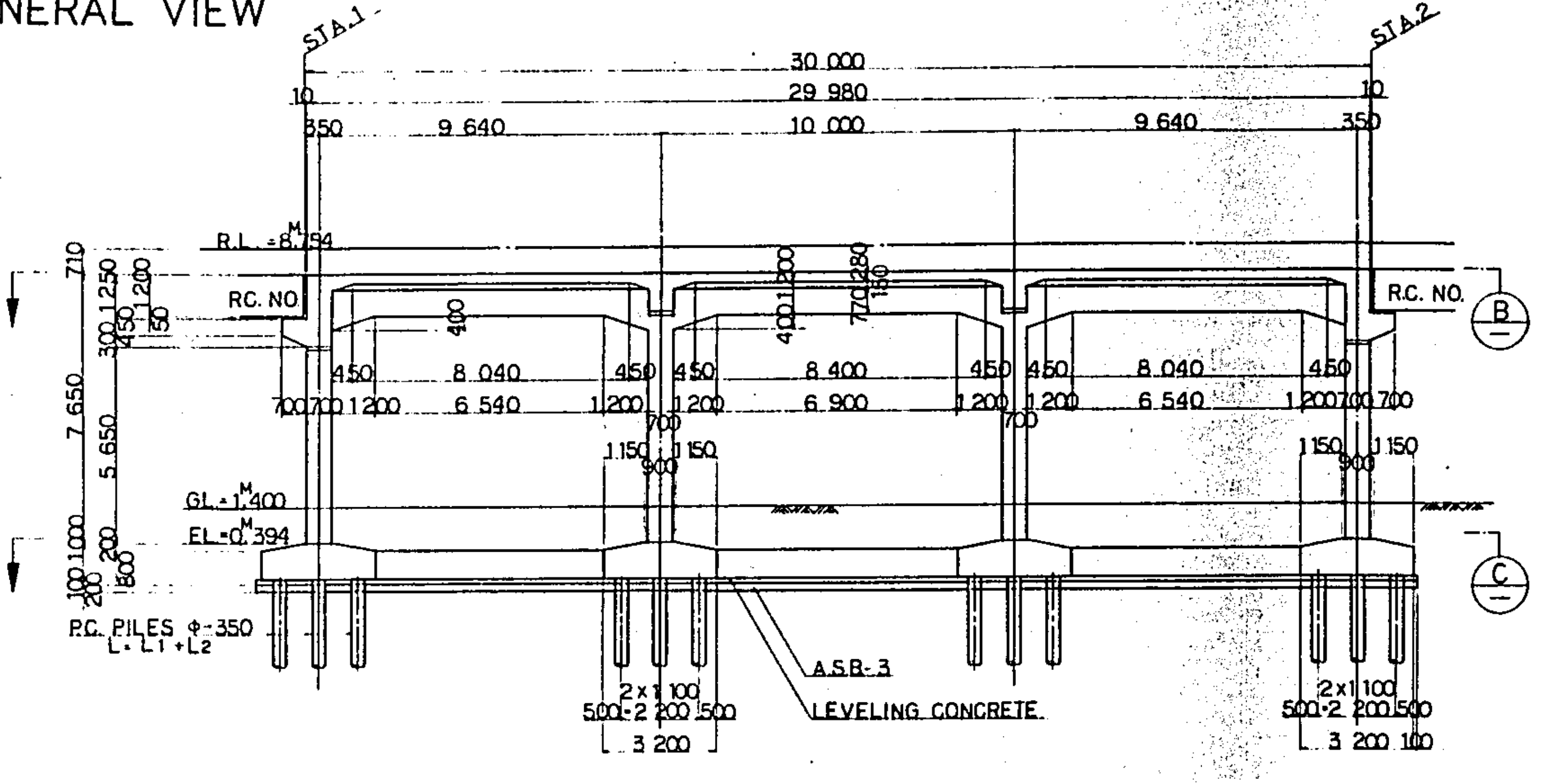


4 D500-B

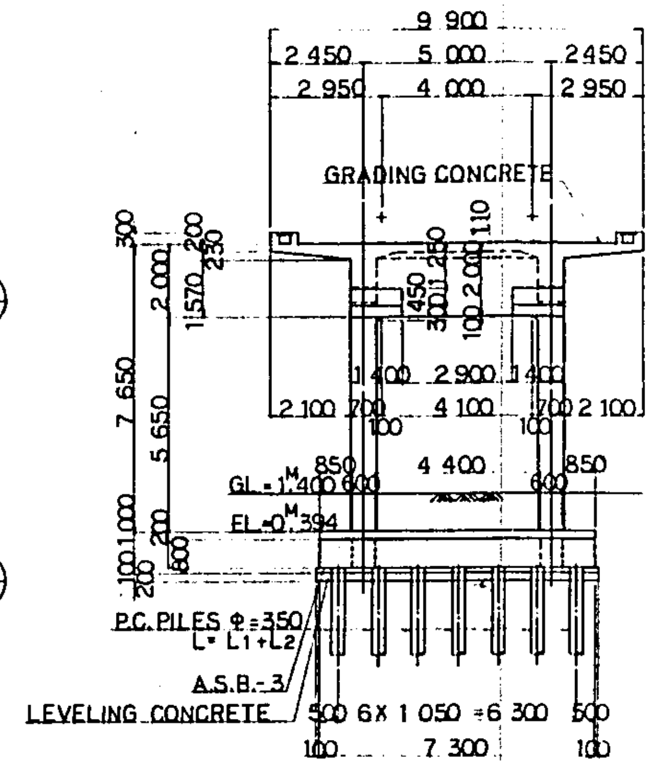


MN Diagram

S2. GENERAL VIEW



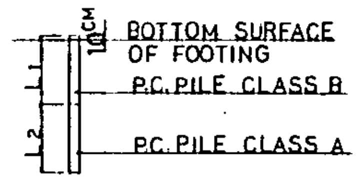
SECTION (A)



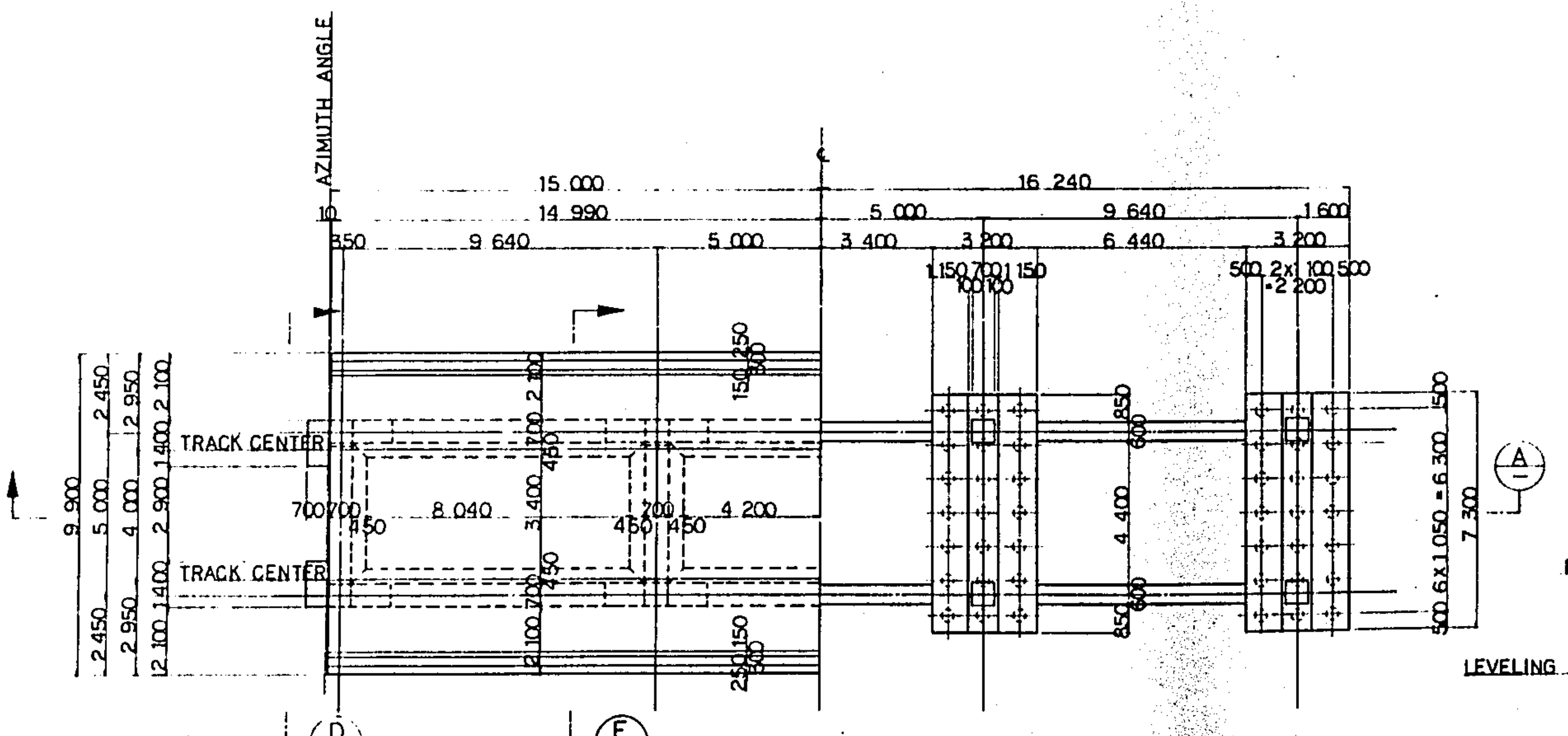
SECTION (D)

NOTES.

1. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS UNLESS OTHERWISE INDICATED
2. REFERENCE DRAWING FOR BAR ARRANGEMENT: CS-204~209, CS-223
3. TYPES OF P.C. PILE

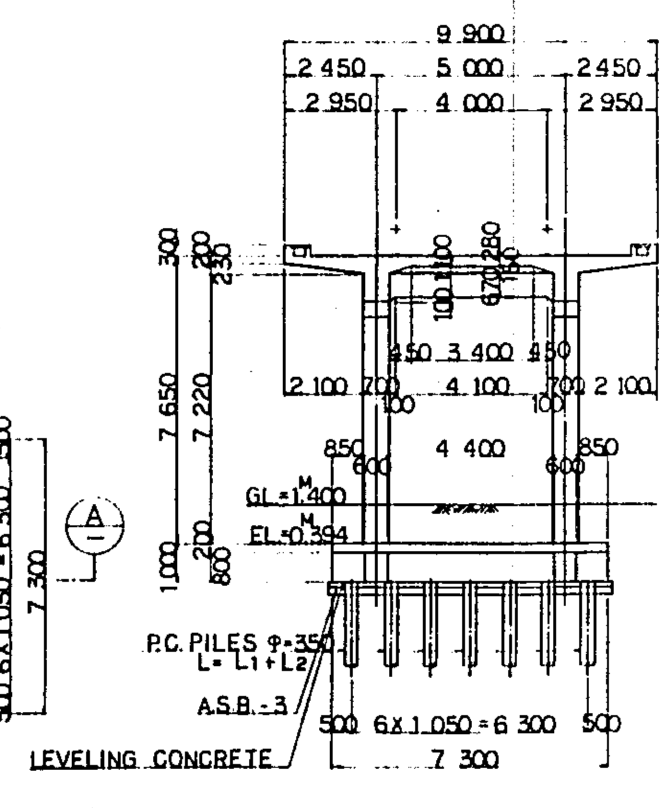


4. GRADING CONCRETE SHALL BE SIMULTANEOUSLY PLACED WITH SLAB CONCRETE



SECTION (B)

SECTION (C)



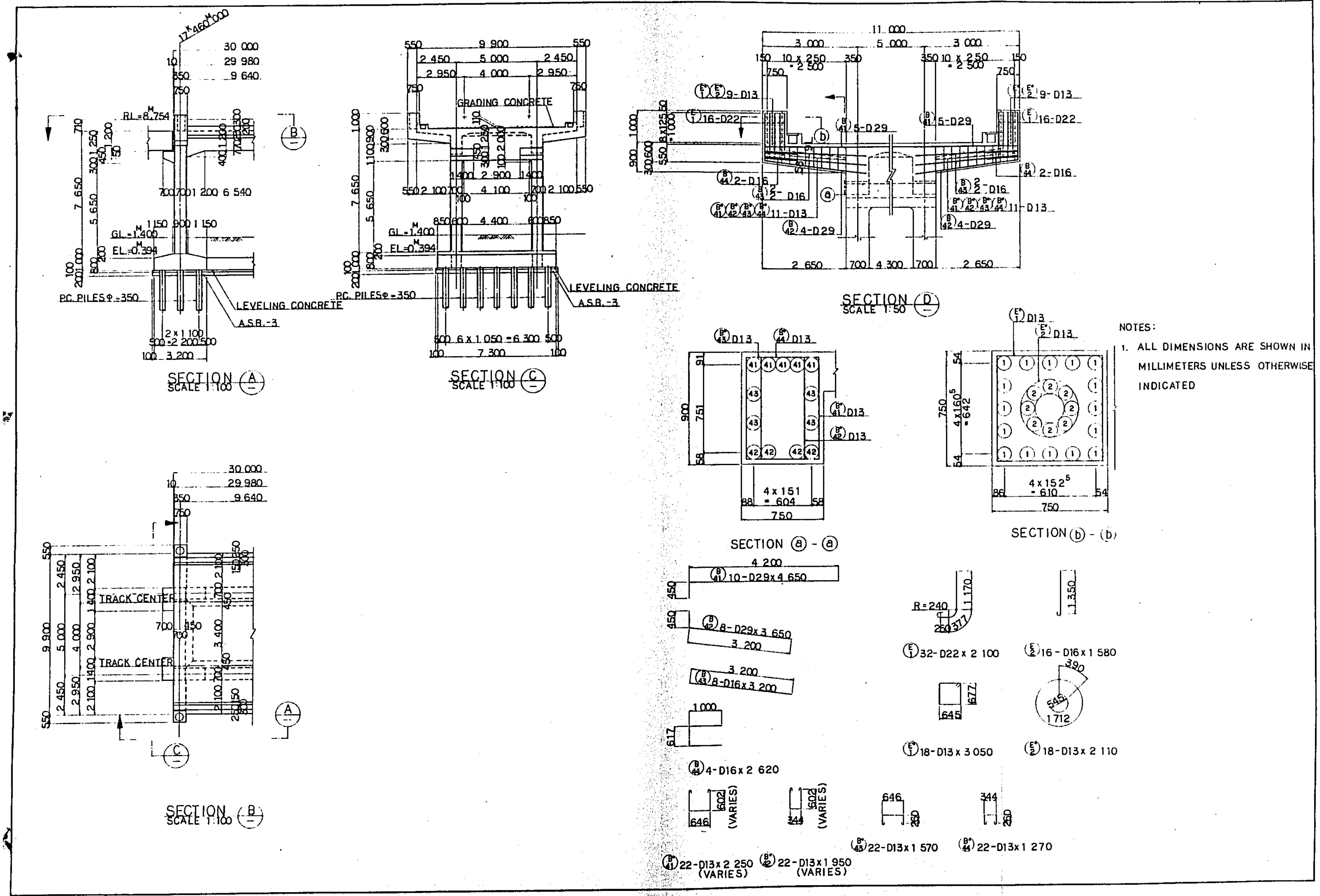
SECTION (E)

DIMENSION SCHEDULE

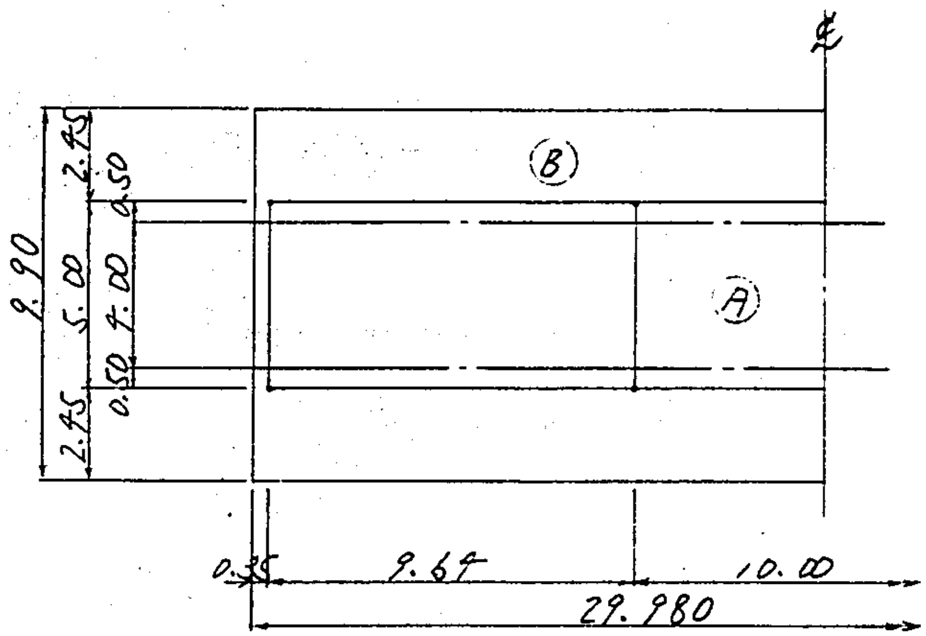
		STATION	R.L.	L1	L2	AZIMUTH ANGLE	CENGKAREN AIRPOAT LINE COORDINATE	RC. NO.
V090	STA.1	$17^{K}270^{M}000$	$8^{M}.754$	8 000	13 000	345° 30′ 45″	U.12 $121^{M}.415$ T. 1 $070^{M}.633$	RC.18
	STA.2	$17^{K}300^{M}000$	〃			〃	U.12 $128^{M}.920$ T. 1 $099^{M}.679$	RC.19
V091	STA.1	$17^{K}310^{M}000$	$8^{M}.754$	8 000	13 000	345° 30′ 45″	U.12 $131^{M}.422$ T. 1 $109^{M}.361$	RC.19
	STA.2	$17^{K}340^{M}000$	〃			〃	U.12 $138^{M}.927$ T. 1 $138^{M}.407$	RC.20
V092	STA.1	$17^{K}350^{M}000$	$8^{M}.754$	8 000	13 000	345° 30′ 45″	U.12 $141^{M}.429$ T. 1 $148^{M}.089$	RC.20
	STA.2	$17^{K}380^{M}000$	〃			〃	U.12 $148^{M}.934$ T. 1 $177^{M}.135$	RC.21
V093	STA.1	$17^{K}390^{M}000$	$8^{M}.754$	8 000	13 000	345° 30′ 45″	U.12 $151^{M}.435$ T. 1 $186^{M}.817$	RC.21
	STA.2	$17^{K}420^{M}000$	〃			〃	U.12 $158^{M}.941$ T. 1 $215^{M}.863$	RC.22
V094	STA.1	$17^{K}430^{M}000$	$8^{M}.754$	8 000	12 000	345° 30′ 45″	U.12 $161^{M}.442$ T. 1 $225^{M}.545$	RC.22
	STA.2	$17^{K}460^{M}000$	〃			〃	U.12 $168^{M}.947$ T. 1 $254^{M}.591$	RC.23

NOTES :

1. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS UNLESS OTHERWISE INDICATED
2. REFERENCE DRAWING FOR GENERAL VIEW : CS-202


SECTION (A)
SCALE 1:100
SECTION (C)
SCALE 1:100
SECTION (B)
SCALE 1:100
SECTION (D)
SCALE 1:50
SECTION (a) - (a)
SECTION (b) - (b)
GRADING CONCRETE
LEVELING CONCRETE
A.S.B.-3
P.C. PILES φ=350
GL.=1.400
EL.=0.394
RL.=8.754
TRACK CENTER
17K460M000
(B41) 10-D29x4 650
(B42) 8-D29x3 650
(B43) 8-D16x3 200
(B44) 4-D16x2 620
(E1) 32-D22x2 100
(E2) 16-D16x1 580
(E'1) 18-D13x3 050
(E'2) 18-D13x2 110
(B'41) 22-D13x2 250 (VARIES)
(B'42) 22-D13x1 950 (VARIES)
(B'43) 22-D13x1 570
(B'44) 22-D13x1 270
NOTES:
1. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS UNLESS OTHERWISE INDICATED

§3. Calculation of Slab



(1) Slab for calculation

Slab Ⓐ ------- Two-way Slab

Slab Ⓑ ------- Cantilever Slab

(2) Calculation of slab Ⓐ

Four sides fixed span

l_{dx} = 5.00 − 0.70 = 4.30 m

l_{dy} = 10.00 − 0.70 = 9.30 "

Four sides semi-fixed span

l_{ex} = 4.30 + 0.28 = 4.58 m

l_{ey} = 9.30 + 0.28 = 9.58 "

• Span ratio

$$m_d = \frac{l_{dx}}{l_{dy}} = \frac{4.30}{9.30} = 0.46 > 0.4$$

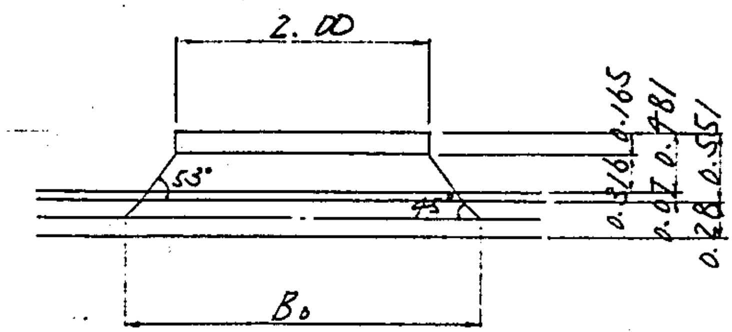
$$m_e = \frac{l_{ex}}{l_{ey}} = \frac{4.58}{9.58} = 0.48 > 0.4$$

From the above, the slab is considered as a two-way slab for calculation.

1. Load Calculations

(1) Dead Load

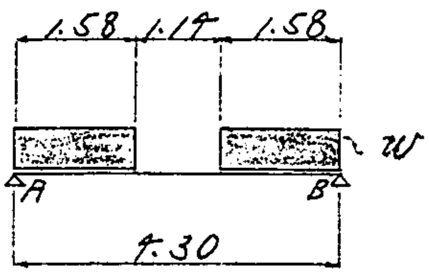
Effective width



$$B_0 = 2.00 + 1.5 \times (0.316 + 0.07) + 0.28 \doteqdot 2.86^{m}$$

(a) Weight of track assembly

$$w = 0.45\ {}^{t}/_{m} / 2.86 = 0.157\ {}^{t}/_{m^2}$$



$$R_A = R_B = 0.157 \times 1.58 = 0.25^{t}$$

i) At the $\ell/4$ point

$$M_{\ell/4} = 0.25 \times 1.075 - 0.157 \times 1.075^2 \times 1/2 = 0.18^{tm}$$

$$w'_{\ell/4} = \frac{32 \times 0.18}{3 \times 4.30^2} = 0.10\ {}^{t}/_{m^2} > w'_{\ell/2} = 0.09\ {}^{t}/_{m^2}$$

ii) At the $l/2$ point

$$M_{l/2} = 0.25 \times 2.15 - 0.157 \times 1.58 \times \left(2.15 - \frac{1.58}{2}\right)$$
$$= 0.20 \ tm$$

$$W_{l/2} = \frac{8 \times 0.20}{4.30^2} = 0.09 \ t/m^2$$

Sloping concrete	$2.35 \ t/m^3 \times 0.07$	=	$0.165 \ t/m^2$
Ballast	1.9 " $\times 0.481$	=	0.914 "
Slab	2.5 " $\times 0.28$	=	0.700 "

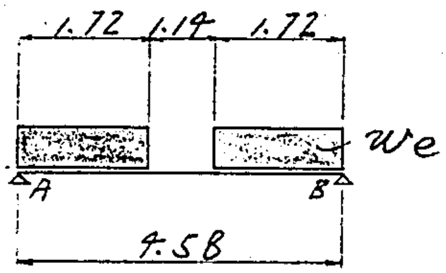
$$Wd_1 = 1.78 \ t/m^2$$

(b) Uniformly distributed load

$$\Sigma Wd = 0.10 + 1.78 = 1.88 \ t/m^2$$

(2) Train Load (single track)

$$w_e = \frac{16}{1.50 \times 2.86} = 3.73\ t/m^2$$



$$R_A = R_B = 3.73 \times 1.72 = 6.42\ t$$

i) At the ℓ/4 point

$$M_{\ell/4} = 6.42 \times 1.145 - 3.73 \times 1.145 \times 1/2 = 5.22\ tm$$

$$w_{\ell/4} = \frac{32 \times 5.22}{3 \times 4.58^2} = \underline{2.65\ t/m^2} > w_{\ell/2} = 2.11\ t/m^2$$

ii) At the ℓ/2 point

$$M_{\ell/2} = 6.42 \times 2.29 - 3.73 \times 1.72 \times (2.29 - \frac{1.72}{2})$$

$$= 5.53\ tm$$

$$w_{\ell/2} = \frac{8 \times 5.53}{4.58^2} = 2.11\ t/m^2$$

(3) Impact coefficient

$\ell = 4.58^m \longrightarrow i_o = 0.490$

Reduction of impact coefficient

$i = 0.490 \times (1 - \frac{4.58}{200}) = 0.479$

$\therefore W_{\ell+i} = 2.65 \times (1 + 0.479) = 3.92 \, t/m^2$

2. Bending moment

(1) Dead Load

(a) Sharing of load

$\ell dx = 4.30^m \qquad \ell dy = 9.30^m$

coefficient of load sharing in the direction of x or y

$$Cx = \frac{9.30^4}{4.30^4 + 9.30^4} = 0.956$$

$$Cy = \frac{4.30^4}{4.30^4 + 9.30^4} = 0.044$$

(b) Shared load

$Wdx = 1.88 \, t/m^2 \times 0.956 = 1.80 \, t/m^2$

$Wdy = 1.88 \times 0.044 = 0.08$ "

(c) Torsional coefficient

$$\varphi dx = \varphi dy = \frac{5}{18} \times \frac{4.30^2 \times 9.30^2}{4.30^4 + 9.30^4} = 0.057$$

(d) Bending moment

i) At the support point

$$Mdx = -1/12 \times 1.80 \times 4.30^2 = -2.77^{\,tm}$$

$$Mdy = -1/24 \times 1.88 \times 4.30^2 = -1.45 \text{ "}$$

ii) At the span center point

$$Mdx = 1/24 \times 1.80 \times 4.30^2 \times (1 - 0.057) = 1.31^{\,tm}$$

$$Mdy = 1/24 \times 0.08 \times 9.30^2 \times (1 - 0.057) = 0.27 \text{ "}$$

(2) Train Load (Single track)

(a) Sharing of load

$ldx = 9.58^{m}$ $ldy = 4.58^{m}$

Coefficient of load sharing in the direction of x or y

$$Cex = \frac{9.58^4}{4.58^4 + 9.58^4} = 0.950$$

$$Cey = \frac{4.58^4}{4.58^4 + 9.58^4} = 0.050$$

(b) Coefficient of load sharing

$W_{\ell+ix} = 3.92 \times 0.950 \doteq 3.72$ t/m²

$W_{\ell+iy} = 3.92 \times 0.050 = 0.20$ 〃

(c) Torsional coefficient

$$\varphi x = \varphi y = \frac{25}{36} \times \frac{4.58^2 \times 4.58^2}{4.58^4 + 4.58^4} = 0.151$$

(d) Bending moment

Train Load and Impact

i) At the support point

$M_{\ell+ix} = -1/12 \times 3.72 \times 4.58^2 = -6.50$ tm

$M_{\ell+iy} = -1/24 \times 3.92 \times 4.58^2 = -3.43$ 〃

ii) At the span center point

$M_{\ell+ix} = 1/12 \times 3.72 \times 4.58^2 \times (1 - 0.151) = 5.52$ tm

$M_{\ell+iy} = 1/12 \times 0.20 \times 4.58^2 \times (1 - 0.151) = 1.30$ 〃

(3) Combined moment

		Dead Load	Train Load and Impact	Total load
At the support point	x	-2.77	-6.50	-9.27
	y	-1.45	-3.43	-4.88
At the span center point	x	1.31	5.52	6.83
	y	0.27	1.30	1.57

Allowable stress, safe against cracking

$\Sigma M \times 0.25 = 9.27 \times 0.25 = 2.32^{tm}$

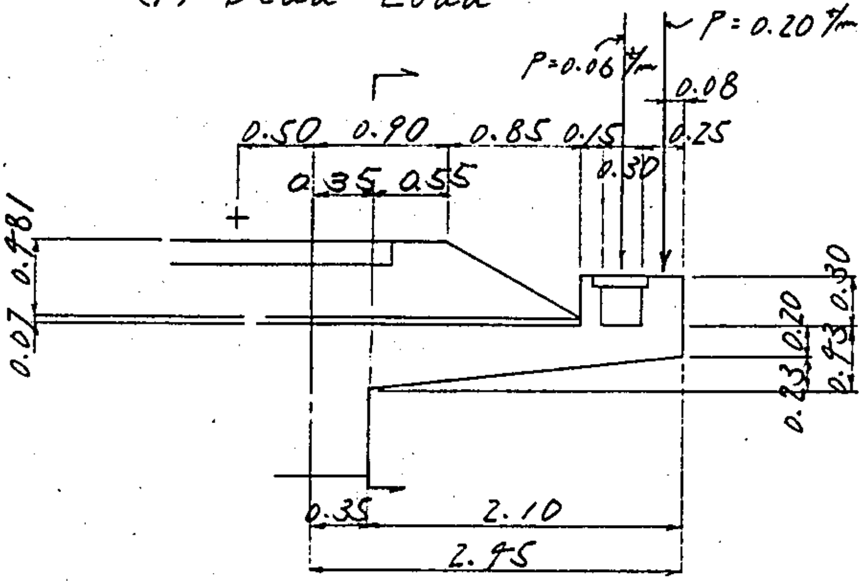
$< M_{\ell+i} = 6.50^{tm}$

Therefore, $\sigma_{sa} = 800\ ^{kg}/_{cm^2}$

(3) Calculation of slab Ⓑ

1. Calculation of cantilever slab

(1) Dead Load



	Calculation	N	x	N·x
hand rail		0.20	2.02	0.40
curb	2.5 t/m³ × 0.30 × 0.25	0.19	1.975	0.38
Duct cover	2.5 " × 0.05 × 0.30	0.04	1.700	0.07
cable		0.06	1.700	0.10
ballast stopper	2.5 × 0.15 × 0.30	0.11	1.475	0.16
sloping concrete	2.35 × 0.07 × 1.40	0.23	0.700	0.16
bellast (A)	1.9 × 0.481 × 0.85 × 1/2	0.39	0.833	0.32
bellast (B)	1.9 × 0.481 × 0.55	0.50	0.275	0.14
Distributed load by Track weight	0.45 × 1/2.86 × 0.58	0.09	0.290	0.03
Slab (A)	2.5 × 0.20 × 2.10	1.05	1.050	1.10
Slab (B)	2.5 × 0.23 × 2.10 × 1/2	0.60	0.700	0.42
TOTAL				3.28

(2) Pedestrian Load

$P = 0.50\,t/m^2 \times 0.50 = 0.25^{t}$

$M = 0.25 \times 1.61 = 0.40$

(3) Dead Load and Pedestrian

$Md+w = 3.28 + 0.40 = 3.68^{tm}$

(4) Train Load and Impact

$We = \frac{16}{1.5 \times 2.86} = 3.73\,t/m^2$

$Me = 3.73 \times 0.58^2 \times 1/2 = 0.63^{tm}$

(a) Impact Coefficient

$\ell = 0.58^{m} \longrightarrow i = 0.587$

$Me+i = 0.63 \times (1 + 0.587) = 1.00^{tm}$

(b) Combined Stress

Dead Load + Train Load and Impact ($\alpha = 1.00$)

$M = 3.28 + 1.00 = 4.28^{tm} > 4.07^{tm}$

(c) Dead Load + Train Load and Impact
Pedestrian Load ($\alpha = 1.15$)

$M = (3.68 + 1.00) \times 1/1.15 = 4.07^{tm}$

Allowable stress, safe against cracking

$M \times 0.25 = 4.28 \times 0.25 = 1.07^{tm} > M_{cri} = 1.00^{tm}$

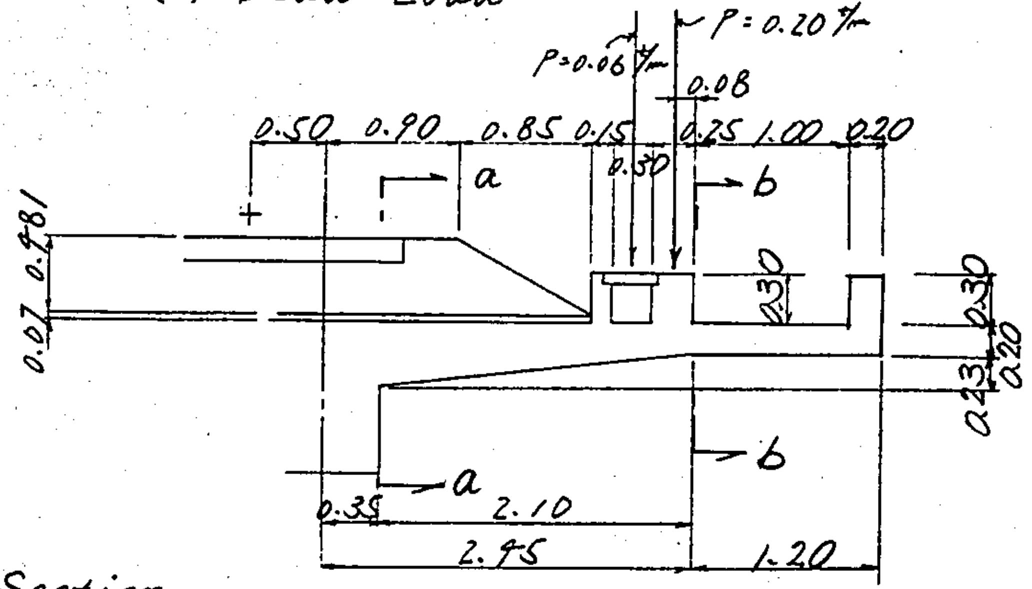
Therefore $\sigma_{sa} = 1000\ kg/cm^2$

	Ⓐ Slab				Ⓑ Slab	
	Direction of railway cross section		Direction of railway profile		cantilever slab	
	At support point	At span center point	At support point	At span center point		
M (tm)	(−2.77) −9.27	6.83	−4.88	1.57	3.28	4.28
N (t)						
S (t)						
b (cm)	100	100	100	100	100	100
h (cm)	43	28	43	28	43	43
d (cm)	39.5	24.5	37.8	22.9	39.5	39.5
d' (cm)	3.5	3.5	5.2	5.1	3.5	3.5
As (cm²)	D19-300 ctc D16-300 " =16.17	D19-150 ctc = 19.11	D16-400 ctc D13-400 " = 8.13	D13-200 ctc = 6.34	D19-300 ctc D16-300 " = 16.17	D19-300 ctc D16-300 " = 16.17
p	0.00409	0.00780	0.00215	0.00277	0.00409	0.00409
As' (cm²)						
p'						
e=M/N (cm)						
e=M/N+u (cm)						
e=M/N−u (cm)						
e/h						
d/e						
d'/h						
d'/d						
Ne/bd² (kg/cm²)						
k						
c						
j						
1/Lc	7.53	6.02	9.64	8.74		7.53
1/Ls	270	147	503	394	270	270
β=σs/σc						
σc (kg/cm²)	44.8	68.5	33.0	26.1		20.7
σs (kg/cm²)	(480) 1610	1670	1720	1180	570	740
τ (kg/cm²)						
σsa (kg/cm²)	(800) 1800	1800	"	"	1000	1800
σca (kg/cm²)	90	90	"	"		90
τa (kg/cm²)						
combination	(D) D+T+I	D+T+I	D+T+I	D+T+I	D	D+T+I
Nomogram number	M-1	"	"	"	"	"

(4) Calculation of the cantilever slab for equipment space

1) Calculation of loads

(a) Dead Load



a-a Section

	Calculation	N (t)	X (m)	N·X (t·m)
hand rail		0.20	2.02	0.40
curb	2.5 t/m³ × 0.30 × 0.25	0.19	1.975	0.38
duct lib	2.5 " × 0.05 × 0.30	0.04	1.700	0.07
cable		0.06	1.700	0.10
ballast stopper	2.5" × 0.15 × 0.30	0.11	1.475	0.16
sloping concrete	2.35" × 0.07 × 1.40	0.23	0.700	0.16
bellast (A)	1.9" × 0.481 × 0.85 × 1/2	0.39	0.833	0.32
bellast (B)	1.9" × 0.481 × 0.55	0.50	0.275	0.14
distributed load by Track weight	0.45 t/m × 1/2.86 × 0.58	0.09	0.290	0.03
slab (A)	2.5 t/m³ × 0.20 × 2.10	1.05	1.050	1.10
slab (B)	2.5" × 0.23 × 2.10 × 1/2	0.60	0.700	0.42
widening of slab	2.5" × 0.20 × 1.20	0.60	2.700	1.62

widening of curb	$2.5^{t/m^3} \times 0.20 \times 0.30$	0.15	3.200	1.48
Pedestrian load	$0.50^{t/m^2} \times 1.00$	0.50	2.600	1.30
total				6.68^{tm}

b-b Section

	Calculation	$N^{(t)}$	$x^{(m)}$	$N \cdot x^{(tm)}$
widening of slab	$2.5^{t/m^3} \times 0.20 \times 1.20$	0.60	0.60	0.36
widening of curb	$2.5 \times 0.20 \times 0.30$	0.15	1.10	0.17
Pedestrians load	$0.50^{t/m^2} \times 1.00$	0.50	0.50	0.25
total				0.78

Stress acting at section a-a

1) Pedestrian Load

$P = 0.50^{t/m^2} \times 0.50 = 0.25^{t}$

$M = 0.25 \times 1.61 = 0.40$

2) Dead Load and Pedestrian Load

$M_{d+w} = 6.68 + 0.40 = 7.08^{tm}$

3) Train Load and Impact

$W_e = \frac{16}{1.5 \times 2.86} = 3.73^{t/m^2}$

$M_e = 3.73 \times 0.58^2 \times 1/2 = 0.63^{tm}$

Impact Coefficient

$l = 0.58^{m} \longrightarrow i = 0.587$

$M_{e+i} = 0.63 \times (1 + 0.587) = 1.00^{tm}$

Resultant stress

Dead Load + Train Load and Impact $(\alpha = 1.00)$

$M = 6.68 + 1.00 = 7.68^{tm} > 7.03^{tm}$

Dead Load + Train Load and Impact
Pedestrian Load $(\alpha = 1.15)$

$M = (7.08 + 1.00) \times 1/1.15 = 7.03^{tm}$

allowable stress, safe against cracking

$M \times 0.25 = 7.68 \times 0.25 = 1.92^{tm} > M_{cri} = 1.00^{tm}$

$\sigma_{sa} = 1.000\ kg/cm^2$

Stress acting at section b-b

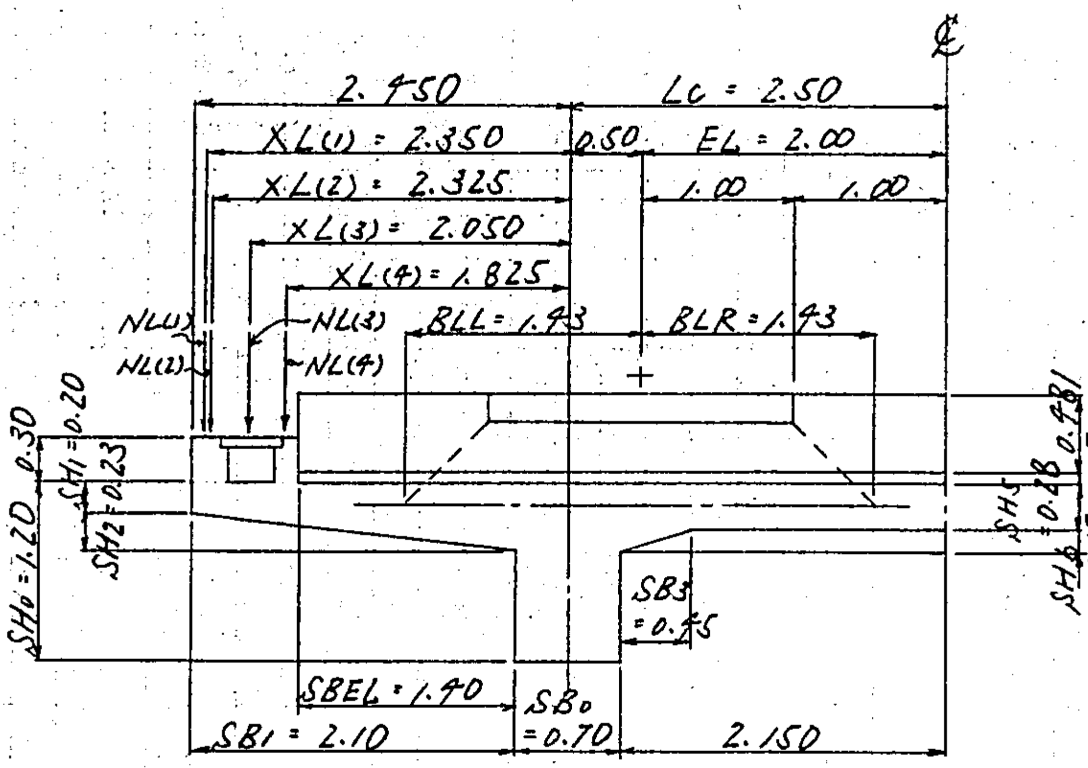
$M_{b-b} = 0.78^{tm}$ (Dead load)

Stress calculation

	a - a		b - b	
M (tm)	6.68	7.68	0.78	
N (t)				
S (t)				
b (cm)	100		100	
h (cm)	43		20	
d (cm)	39.5		16.7	
d' (cm)	3.5		3.3	
As (cm²)	D19 - 300 ctc D16 - 300 " D16 - 300 " } = 22.27		D16 - 300 ctc = 6.62	
p	0.00564		0.00396	
As' (cm²)				
p'				
e = M/N (cm)				
e = M/N + u (cm)				
e = M/N − u (cm)				
e/h				
d/e				
d'/h				
d'/d				
Ne/bd² (kg/cm²)				
k				
c				
j				
1/Lc	6.72		7.62	
1/Ls	200		279	
β = σs/σc				
σc (kg/cm²)		33.1		
σs (kg/cm²)	860	980	780	
τ (kg/cm²)				
σsa (kg/cm²)	1000	1800	1000	
σca (kg/cm²)		90		
τa (kg/cm²)				
combination	D	D+T+I	D	
Nomagram number	M-1	"	"	

§4 Calculation of torsional moment.

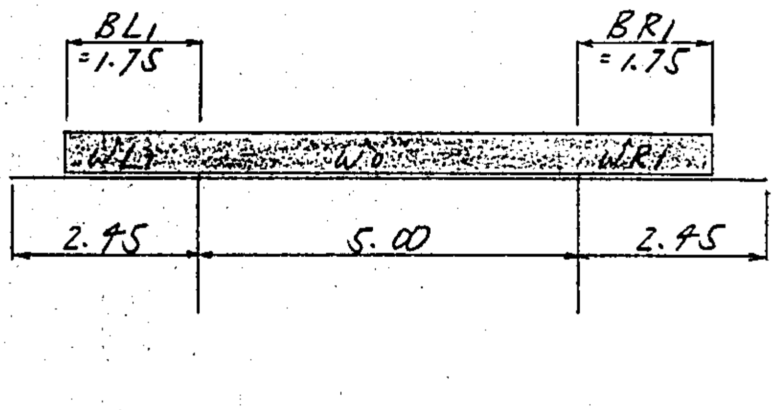
(1) Load calculations



Distributed width

$$Be = 2.00 + 1.5 \times (0.316 + 0.07) + 0.28 = 2.86^{m}$$

1. Weight of elements on the slub except truck weight



a). Distributed Load

Sloping Concrete $2.35\ t/m^3 \times 0.07 = 0.165\ t/m^2$

Ballast $1.9\ " \times 0.481 = 0.914\ "$

$w_{L1} = w_0 = w_{R1} = 1.08\ t/m^2$

b). Concentrated load

1) hand rail $N_{L(1)} = 0.20\ t/m$

2) curb $N_{L(2)} = 2.5\ t/m^3 \times 0.25 \times 0.30 = 0.19\ t/m$

3) Cable and Duct lib

$N_{L(3)} = 0.06\ t/m + 2.5\ t/m^3 \times 0.05 \times 0.30 = 0.10\ t/m$

4) ballast stopper

$N_{L(4)} = 2.5\ t/m^3 \times 0.15 \times 0.30 = 0.11\ "$

c) Distributed loads by Track Weight

$w' = 0.45\ t/m$

$w = \frac{0.45}{2.86} = 0.16\ t/m$

2. Train Load (Single track)

$\ell = 10.00^{m}$

Distribution loads

KS - 16

$W_{M2} = 4.2 \times 2 = 8.40\ t/m$

$P_{1\sim4} = \dfrac{8.40}{2.86} = 2.94\ t/m^2$

· AT END of viaduct

$LL = 9.640^{m}$

· AT Intermediate of viaduct

$LL = 10.00^{m}$

· Points of computing stress

$X_1 = 0.350^{m}$

$X_2 = 1.150$ " $(h/2)$

$X_3 = 1.550$ "

· AT END of viaduct

```
0.........1.........2.........3.........4.........5.........6.........7.........8
1.........0.........0.........0.........0.........0.........0.........0.........0
```

1	** NEJIRI MOMENT		FUKUSEN **					
2	9.650	5.0	0.4	0.0	0.0	2.5	4	
3	1.20	0.20	0.23	0.20	0.23	0.28	0.15	
4	0.70	2.10	2.10	0.45	1.40	1.40		
5	0.20	0.19	0.1	0.11	0.0			
6	2.350	2.325	2.050	1.825	0.0			
7	0.20	0.19	0.1	0.11	0.0			
8	2.350	2.325	2.050	1.825	0.0			
9	1.08	0.0	1.08	0.0				
10	1.75	0.0	1.75	0.0				
11	0.16	0.16	0.16	0.16	2.94	2.94	2.94	2.94
12	1.08	2.0	2.0	0.35	1.55	0.0		
13	1.43	1.43	1.43	1.43				

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0.........1.........2.........3.........4.........5.........6.........7.........8
1.........0.........0.........0.........0.........0.........0.........0.........0
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No. 37

** NEJIRI MOMENT FUKUSEN **

```
***** FUKUSEN-SAIKA *****

TATE BARI NO NEJIRI MOMENT

NEJIRI KEISU NO KEISAN

     SMALL HR =  .277      SMALL BER = 1.400
     SMALL HL =  .277      SMALL BEL = 1.400

     MAGE DANMEN NIJI MOMENT            I  =  .20360

     NEJIRI DANMEN NIJI MOMENT          IT =  .11083

     SLAB NO MAGE DANMEN NIJI MOMENT    IS =  .00183

     NEJIRI KEISU     SMALL K1 =  .7497    SMALL K2 = -.0987

KAJYU HENSIN NI YORU NEJRI MOMENT

     SHIKAJYU            WD = 21.981      SMALL ED = 0.000

     RESSHA KAJYU        WL = 16.817      SMALL EL = 0.000

     SYOGEKI KEISU  SMALL I1 =   .413

     HENSIN NI YORU NEJIRI MOMENT WA SHOJINAI
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No. 39

KOTEITAN MOMENT NO SANI YORU NEJIRI MOMENT

SHIKAJYU (CHUKAN SLAB)	SMALL CY = .933	SMALL WDY = 1.764		
RESSHA KAJYU	SMALL WLL = 2.940	SMALL WLR = 2.940	SMALL WRL = 2.940	SMALL WRR = 2.94
SAIKAHABA	SMALL BLD = .930	SMALL BL = 1.930	SMALL BR = 1.930	SMALL BRD = .93
SHOGEKI KEISU	SMALL I2 = .468	SMALL IL = .575	SMALL IR = .575	

SHITEN MOMENT NO SA

SHIKAJYU	ML =-11.889	MR = 11.889
RESSHA KAJYU	ML = 8.403	MR = -8.403
SHOGEKI KAJYU	ML = 3.276	MR = -3.276

L BARI

	X	D	L	I	D+L+I
MT A	0.000	-10.086	7.129	2.780	-.177
MT 1	.350	-9.354	6.612	2.578	-.164
MT 2	1.550	-6.846	4.839	1.887	-.120
MT C	4.825	0.000	0.000	0.000	0.000

R BARI

	X	D	L	I	D+L+I
MT A	0.000	10.086	-7.129	-2.780	.177
MT 1	.350	9.354	-6.612	-2.578	.164
MT 2	1.550	6.846	-4.839	-1.887	.120
MT C	4.825	0.000	0.000	0.000	0.000

No. 40

NEJIRI MOMENT NO GOSEI (double track)

SHUBARI FUKUBU NO NEJIRI MOMENT BUNTANRITHU

L BARI ALFA L1 = .850 ALFA L2 = .790

R BARI ALFA R1 = .850 ALFA R2 = .790

L BARI

	X	D	L	I	D+L+I	SHUBARI NO BUNTAN
MT A	0.000	-10.086	7.129	2.780	-.177	
MT 1	.350	-9.354	6.612	2.578	-.164	-.140
MT 2	1.550	-6.846	4.839	1.887	-.120	-.095
MT C	4.825	0.000	0.000	0.000	0.000	0.000

R BARI

	X	D	L	I	D+L+I	SHUBARI NO BUNTAN
MT A	0.000	10.086	-7.129	-2.780	.177	
MT 1	.350	9.354	-6.612	-2.578	.164	.140
MT 2	1.550	6.846	-4.839	-1.887	.120	.095
MT C	4.825	0.000	0.000	0.000	0.000	0.000

***** TANSEN-SAIKA *****

KAJYU HENSIN NI YORU NEJRI MOMENT

SHIKAJYU	WD = 21.981	SMALL ED = 0.000
RESSHA KAJYU	WL = 8.408	SMALL EL = 2.000
SYOGEKI KEISU	SMALL I1 = .413	

	X	D	L	I	D+L+I
MT A	0.000	0.000	9.135	3.769	12.905
MT 1	.350	0.000	8.473	3.496	11.968
MT 2	1.550	0.000	6.201	2.558	8.759
MT C	4.825	0.000	0.000	0.000	0.000

KOTEITAN MOMENT NO SANI YORU NEJIRI MOMENT

SHIKAJYU (CHUKAN SLAB)	SMALL CY = .933	SMALL WDY = 1.764		
RESSHA KAJYU	SMALL WLL = 2.940	SMALL WLR = 2.940	SMALL WRL = 2.940	SMALL WRR = 2.9
SAIKAHABA	SMALL BLD = .930	SMALL BL = 1.930	SMALL BR = 1.930	SMALL BRD = .9
SHOGEKI KEISU	SMALL I2 = .468	SMALL IL = .575	SMALL IR = .575	

SHITEN MOMENT NO SA

SHIKAJYU	ML =-11.889	MR = 11.889
RESSHA KAJYU	ML = 3.579	MR = -4.824
SHOGEKI KAJYU	ML = 1.675	MR = -1.601

L BARI

	X	D	L	I	D+L+I
MT A	0.000	-10.086	3.159	1.414	-5.513
MT 1	.350	-9.354	2.930	1.311	-5.113
MT 2	1.550	-6.846	2.144	.960	-3.742
MT C	4.825	0.000	0.000	0.000	0.000

R BARI

	X	D	L	I	D+L+I
MT A	0.000	10.086	-3.970	-1.366	4.750
MT 1	.350	9.354	-3.682	-1.267	4.406
MT 2	1.550	6.846	-2.695	-.927	3.224
MT C	4.825	0.000	0.000	0.000	0.000

No. 43

NEJIRI MOMENT NO GOSEI (Single track)

SHUBARI FUKUBU NO NEJIRI MOMENT BUNTANRITHU

L BARI ALFA L1 = .850 ALFA L2 = .790

R BARI ALFA R1 = .850 ALFA R2 = .790

L BARI

	X	D	L	I	D+L+I	SHUBARI NO BUNTAN
MT A	0.000	-10.086	12.295	5.183	7.391	
MT 1	.350	-9.354	11.403	4.807	6.855	5.830
MT 2	1.550	-6.846	8.345	3.518	5.017	3.962
MT C	4.825	0.000	0.000	0.000	0.000	0.000

R BARI

	X	D	L	I	D+L+I	SHUBARI NO BUNTAN
MT A	0.000	10.086	5.166	2.403	17.655	
MT 1	.350	9.354	4.791	2.229	16.374	13.925
MT 2	1.550	6.846	3.506	1.631	11.983	9.463
MT C	4.825	0.000	0.000	0.000	0.000	0.000

No. 44

AT Intermedlate of viaduct

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     0.........1.........2.........3.........4.........5.........6.........7.........8
     1.........0.........0.........0.........0.........0.........0.........0.........0
1    **   NEJIRI MOMENT    FUKUSEN  **
2    10.00     5.0       0.4       0.0       0.0       2.5       4
3    1.20      0.20      0.23      0.20      0.23      0.28      0.15
4    0.70      2.10      2.10      0.45      1.40      1.40
5    0.20      0.19      0.1       0.11      0.0
6    2.350     2.325     2.050     1.825     0.0
7    0.20      0.19      0.1       0.11      0.0
8    2.350     2.325     2.050     1.825     0.0
9    1.08      0.0       1.08      0.0
10   1.75      0.0       1.75      0.0
11   0.16      0.16      0.16      0.16      2.94      2.94      2.94      2.94
12   1.08      2.0       2.0       0.35      1.55      0.0
13   1.43      1.43      1.43      1.43
     0.........1.........2.........3.........4.........5.........6.........7.........8
     1.........0.........0.........0.........0.........0.........0.........0.........0
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No. 45

** NEJIRI MOMENT FUKUSEN **

No 46

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***** FUKUSEN-SAIKA *****

  TATE BARI NO NEJIRI MOMENT

NEJIRI KEISU NO KEISAN

     SMALL HR =  .277      SMALL BER = 1.400
     SMALL HL =  .277      SMALL BEL = 1.400

     MAGE DANMEN NIJI MOMENT             I  =  .20360

     NEJIRI DANMEN NIJI MOMENT           IT =  .11083

     SLAB NO MAGE DANMEN NIJI MOMENT     IS =  .00183

     NEJIRI KEISU      SMALL K1 =  .7368    SMALL K2 = -.1022

KAJYU HENSIN NI YORU NEJRI MOMENT

     SHIKAJYU            WD = 21.981      SMALL ED = 0.000

     RESSHA KAJYU        WL = 16.817      SMALL EL = 0.000

     SYOGEKI KEISU  SMALL II =   .408

     HENSIN NI YORU NEJIRI MOMENT WA SHOJINAI
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No. 47

KOTEITAN MOMENT NO SANI YORU NEJIRI MOMENT

SHIKAJYU (CHUKAN SLAB)	SMALL CY = .941	SMALL WDY = 1.780		
RESSHA KAJYU	SMALL WLL = 2.940	SMALL WLR = 2.940	SMALL WRL = 2.940	SMALL WRR = 2.940
SAIKAHABA	SMALL BLD = .930	SMALL BL = 1.930	SMALL BR = 1.930	SMALL BRD = .930
SHOGEKI KEISU	SMALL I2 = .468	SMALL IL = .575	SMALL IR = .575	

SHITEN MOMENT NO SA

SHIKAJYU	ML =-12.029	MR = 12.029
RESSHA KAJYU	ML = 8.893	MR = -8.893
SHOGEKI KAJYU	ML = 3.482	MR = -3.482

L BARI

	X	D	L	I	D+L+I
MT A	0.000	-10.092	7.461	2.921	.289
MT 1	.350	-9.386	6.938	2.716	.269
MT 2	1.550	-6.964	5.148	2.015	.200
MT C	5.000	0.000	0.000	0.000	0.000

R BARI

	X	D	L	I	D+L+I
MT A	0.000	10.092	-7.461	-2.921	-.289
MT 1	.350	9.386	-6.938	-2.716	-.269
MT 2	1.550	6.964	-5.148	-2.015	-.200
MT C	5.000	0.000	0.000	0.000	0.000

NEJIRI MOMENT NO GOSEI (double track)

SHUBARI FUKUBU NO NEJIRI MOMENT BUNTANRITHU

L BARI ALFA L1 = .850 ALFA L2 = .790

R BARI ALFA R1 = .850 ALFA R2 = .790

L BARI

	X	D	L	I	D+L+I	SHUBARI NO BUNTAN
MT A	0.000	-10.092	7.461	2.921	.289	
MT 1	.350	-9.386	6.938	2.716	.269	.229
MT 2	1.550	-6.964	5.148	2.015	.200	.158
MT C	5.000	0.000	0.000	0.000	0.000	0.000

R BARI

	X	D	L	I	D+L+I	SHUBARI NO BUNTAN
MT A	0.000	10.092	-7.461	-2.921	-.289	
MT 1	.350	9.386	-6.938	-2.716	-.269	-.229
MT 2	1.550	6.964	-5.148	-2.015	-.200	-.158
MT C	5.000	0.000	0.000	0.000	0.000	0.000

No. 49

***** TANSEN-SAIKA *****

KAJYU HENSIN NI YORU NEJRI MOMENT

SHIKAJYU	WD = 21.981	SMALL ED = 0.000
RESSHA KAJYU	WL = 8.408	SMALL EL = 2.000
SYOGEKI KEISU	SMALL I1 = .408	

	X	D	L	I	D+L+I
MT A	0.000	0.000	10.000	4.085	14.084
MT 1	.350	0.000	9.300	3.799	13.099
MT 2	1.550	0.000	6.900	2.819	9.718
MT C	5.000	0.000	0.000	0.000	0.000

No. 50

KOTEITAN MOMENT NO SANI YORU NEJIRI MOMENT

SHIKAJYU (CHUKAN SLAB)	SMALL CY = .941	SMALL WDY = 1.780		
RESSHA KAJYU	SMALL WLL = 2.940	SMALL WLR = 2.940	SMALL WRL = 2.940	SMALL WRR = 2.94
SAIKAHABA	SMALL BLD = .930	SMALL BL = 1.930	SMALL BR = 1.930	SMALL BRD = .93
SHOGEKI KEISU	SMALL I2 = .468	SMALL IL = .575	SMALL IR = .575	

SHITEN MOMENT NO SA

SHIKAJYU	ML =-12.029	MR = 12.029
RESSHA KAJYU	ML = 3.754	MR = -5.138
SHOGEKI KAJYU	ML = 1.757	MR = -1.725

L BARI

	X	D	L	I	D+L+I
MT A	0.000	-10.092	3.291	1.471	-5.330
MT 1	.350	-9.386	3.061	1.368	-4.957
MT 2	1.550	-6.964	2.271	1.015	-3.678
MT C	5.000	0.000	0.000	0.000	0.000

R BARI

	X	D	L	I	D+L+I
MT A	0.000	10.092	-4.169	-1.450	4.473
MT 1	.350	9.386	-3.878	-1.349	4.159
MT 2	1.550	6.964	-2.877	-1.001	3.086
MT C	5.000	0.000	0.000	0.000	0.000

No. 51

NEJIRI MOMENT NO GOSEI (Single track)

SHUBARI FUKUBU NO NEJIRI MOMENT BUNTANRITHU

L BARI   ALFA L1 = .850   ALFA L2 = .790

R BARI   ALFA R1 = .850   ALFA R2 = .790

L BARI

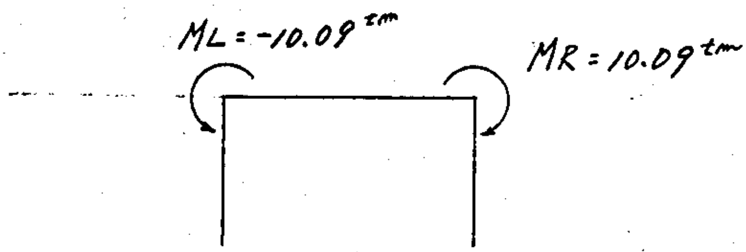
	X	D	L	I	D+L+I	SHUBARI NO BUNTAN
MT A	0.000	-10.092	13.291	5.556	8.754	
MT 1	.350	-9.386	12.360	5.167	8.141	6.924
MT 2	1.550	-6.964	9.171	3.833	6.040	4.770
MT C	5.000	0.000	0.000	0.000	0.000	0.000

R BARI

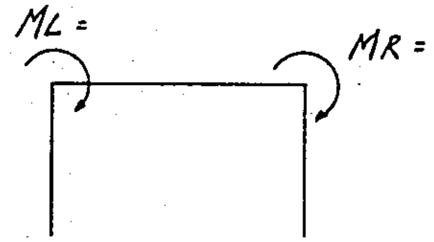
	X	D	L	I	D+L+I	SHUBARI NO BUNTAN
MT A	0.000	10.092	5.830	2.635	18.557	
MT 1	.350	9.386	5.422	2.450	17.258	14.677
MT 2	1.550	6.964	4.023	1.818	12.804	10.111
MT C	5.000	0.000	0.000	0.000	0.000	0.000

3. Rigid frame analysis on transverse section ①-① of viaduct
(AT END of viaduct)

a) Dead Load



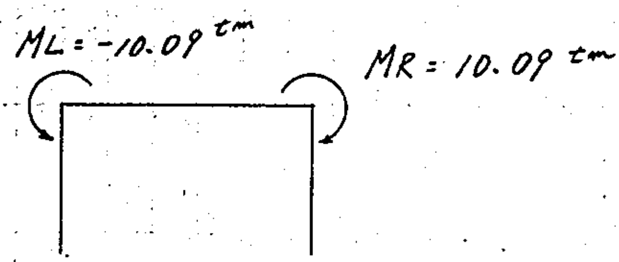
b) Train Load and Impact Load



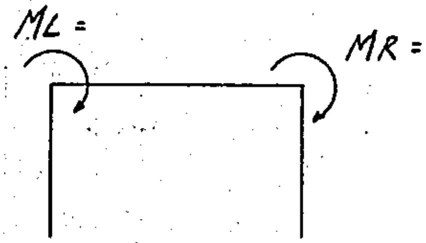
	single track	double track
ML	(12.295 + 5.183) = 17.48 tm	(7.129 + 2.780) = 9.91 tm
MR	(5.166 + 2.403) = 7.57 tm	(-7.129 - 2.780) = -9.91 tm

4. Rigid frame analysis on transverse Section ②-② of viaduct (AT Intermediate of viaduct)

a) Dead Load



b) Train Load and Impact Load

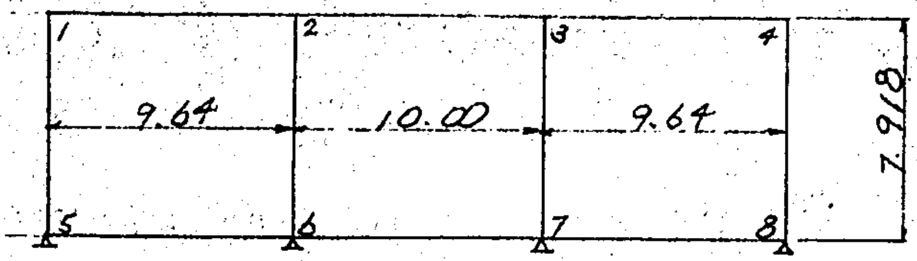


	single track	double track
ML	(13.291+5.556)×2 = 37.69 tm	(7.461+2.921)×2 = 20.76 tm
MR	(5.830+2.635)×2 = 16.93 tm	(-7.461-2.921)×2 = -20.76 tm

§5. Rigid frame analysis on longitndinal direction of elevated structure

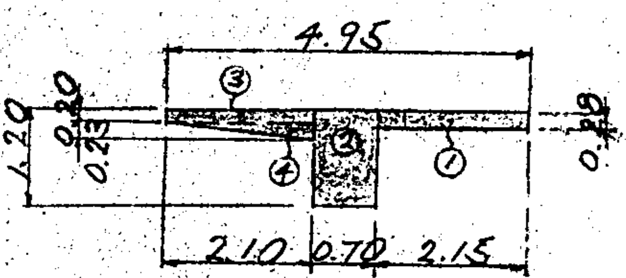
(1) Elements for rigid frame analysis

1. Conligulation and dimension



2. Cross-sectional area and moment of Inertia of the member

(1) Member (1~2 2~3. 3~4)



effective width

$be = 9.64 \times 1/2 + 0.35$

$= 5.17^m$

	b (m)	h (m)	A (m²)	y (m)	A·y (m³)
①	2.150	0.280	0.602	0.140	0.08428
②	0.700	1.200	0.840	0.600	0.50400
③	2.100	0.200	0.420	0.100	0.04200
④	2.100	1/2 × 0.230	0.242	0.278	0.06728
Σ			2.104		0.69756

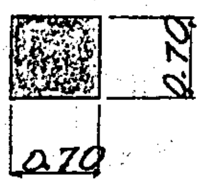
$$y = \frac{0.69756}{2.104} = 0.332^m$$

	b (m)	h (m)	A (m²)	y_0 (m)	I_0 (m⁴)	$A \cdot y_0^2$ (m⁴)	$I_0 + A \cdot y_0^2$ (m⁴)
①	2.150	0.280	0.602	0.192	0.00393	0.02219	0.02612
②	0.700	1.200	0.840	0.268	0.10080	0.06033	0.16113
③	2.100	0.200	0.420	0.232	0.00140	0.02261	0.02401
④	2.100	1/2×0.230	0.242	0.054	0.00071	0.00071	0.00142
Σ			2.104		0.10884	0.10584	0.21268

Cross-Sectional Area $A = 2.104^{m}$

Moment of Inertia $I = 0.21268^{m^4}$

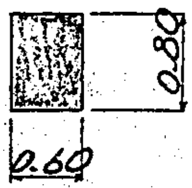
(2) Member (1~5. 2~6. 3~7. 4~8)



$A = 0.70 \times 0.70 = 0.490^{m^2}$

$I = 1/12 \times 0.70 \times 0.70^3 = 0.02001^{m^4}$

(3) Member (5~6 6~7 7~8)



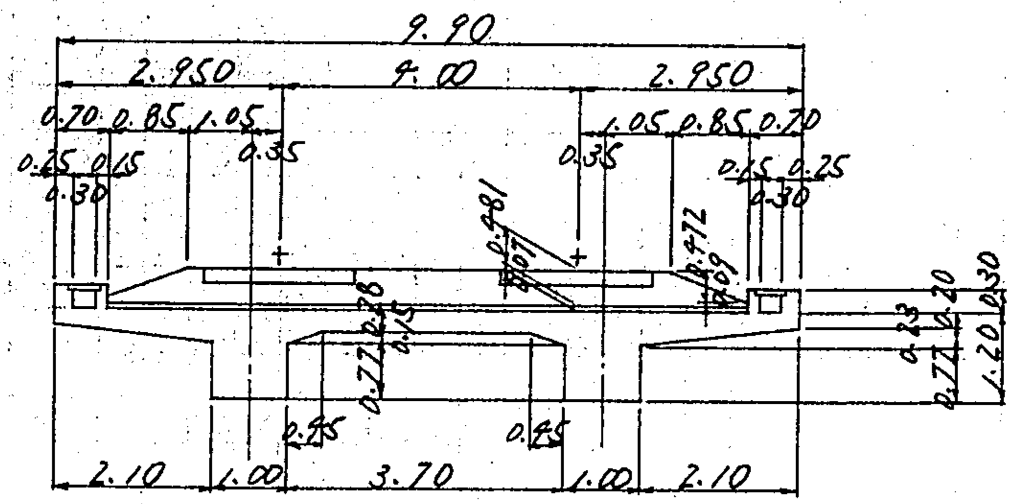
$A = 0.60 \times 0.80 = 0.480^{m^2}$

$I = 1/12 \times 0.60 \times 0.80^3 = 0.02560^{m^4}$

(4) axial height

$h_1 = 7.650 - 0.332 + 0.16 = 7.918^{m}$

3. Reaction of T-beam Saperstructure



Length of longitudinal beam

$L = 9.980^m$

Width of cross beam

$b = 0.70^m$

1) Distributed load

$0.45\ ^t/_m \times 10.00 \times 2 \quad = 9.00^t$

2) Ballast (A)

$1.9\ ^t/_{m^3} \times 0.481 \times 6.80 \times 10.00 \quad = 62.15$ "

3) Ballast (B)

1.9 " $\times 0.472 \times 0.85 \times 1/2 \times 10.00 \times 2 \quad = 7.62$ "

4) Ballast (C)

1.9 " $\times 0.85 \times 0.009 \times 10.00 \times 2 \quad = 0.29$ "

5) Crading concrete

$2.35\ t/m^3 \times 0.07 \times 8.50 \times 10.00 = 13.98\ t$

6) Handreil

$0.20\ t/m \times 10.00 \times 2 = 4.00$ "

7) curb

$2.5\ t/m^3 \times 0.25 \times 0.30 \times 9.98 \times 2 = 3.74$ "

8) ballast stopper

2.5 " $\times 0.15 \times 0.30 \times 9.98 \times 2 = 2.25$ "

9) Duct cover

2.5 " $\times 0.05 \times 0.30 \times 9.98 \times 2 = 0.75$ "

10) Cable

$0.06\ t/m \times 9.980 \times 2 = 1.20$ "

11) Slab

$2.5\ t/m^3 \times 5.70 \times 0.28 \times 9.98 = 39.82$ "

12) Slab Haunch

2.5 " $\times 0.45 \times 0.15 \times 1/2 \times (8.58 + 2.80) \times 2 = 1.92$ "

13) Cantilever Slab

2.5 " $\times (0.20 + 0.43) \times 1/2 \times 2.10 \times 9.980 \times 2 = 33.01$ "

14) Longitndinal beam

2.5 " $\times 1.00 \times 0.92 \times 9.98 \times 2 = 45.91$ "

(5) Cross beam

$2.5\ t/m^3 \times 0.70 \times 0.92 \times 3.70 \times 2 \qquad = 11.91^t$

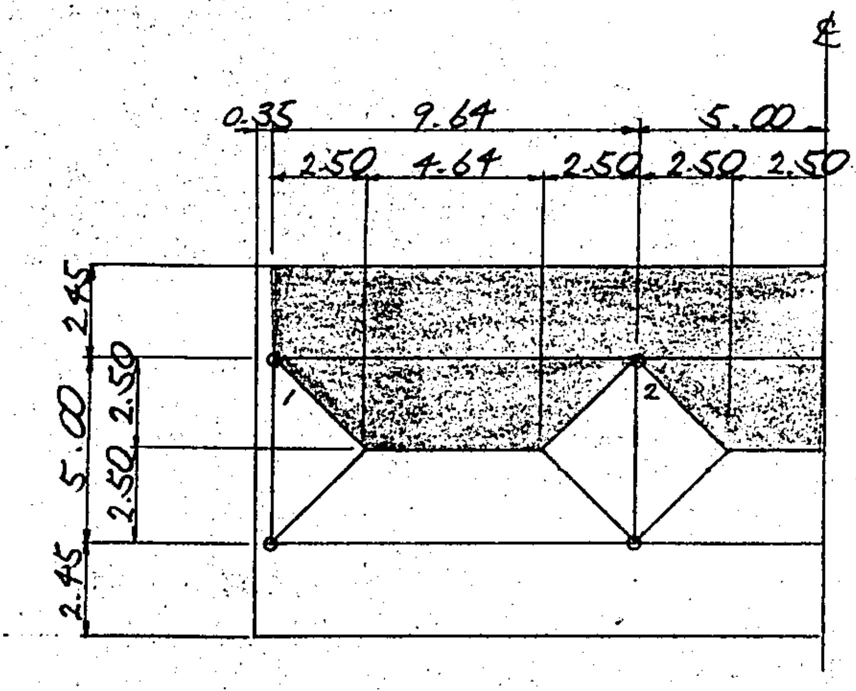
$\Sigma Rd = 237.55^t$

Reaction $Rd = 237.55 \times 1/2 = 118.78^t$

(2) Calculation of loads

1. Dead Load

(1) Member (1 ~ 2 ~ 3 ~ 4)



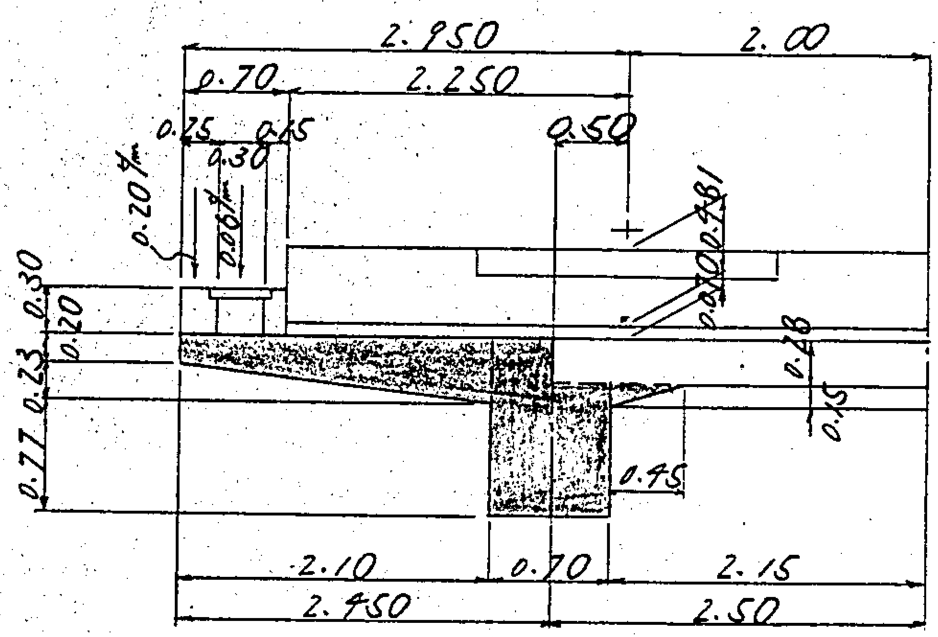
(a) Distributed Load (A)

Weight of slab, grading Concrete and Ballast

Slab	2.5 t/m³ × 0.28	=	0.700 t/m²
grading concrete	2.35 " × 0.07	=	0.165 "
Ballast	1.9 " × 0.481	=	0.914 "
	Wd	=	1.78 t/m²

Wd1 = 1.78 t/m² × 2.50 = 4.45 t/m

(b) Distributed load



1) handrail		= 0.20 t/m
2) curb	2.5 t/m³ × 0.25 × 0.30	= 0.19 "
3) ballast stopper	2.5 " × 0.15 × 0.30	= 0.11 "
4) Duct cover	2.5 " × 0.05 × 0.30	= 0.04 "
5) Cable		= 0.06 "
6) Track weight		= 0.45 "
7) ballast	1.9 t/m³ × 0.481 × 1.75	= 1.60 "
8) grading concrete	2.35 " × 0.07 × 1.75	= 0.29 "
9) Slab	2.5 " × (0.20 + 0.43) × 1/2 × 2.10	= 1.65 "
10) Slab Haunch	2.5 " × 0.45 × 0.15 × 1/2	= 0.08 "
11) Longitndinal beam	2.5 " × (1.20 × 0.70 − 0.28 × 0.35)	= 1.86 "
	Wd2	= 6.53 t/m

(c) Concentrated load of elements acting at joint, P1 as shown below

1) Distributed load (A)

1.78 t/m² × 1/2 × 2.50 × 2.50 = 5.56 t

2) Distributed load (B)

1.78 " × 0.35 × 2.50 = 1.56 t

3) Distributed load (c)

(6.53 t/m − 1.86 − 0.08) × 0.35 = 1.61 t

4) Slab Haunch

2.5 t/m³ × 0.45 × 0.15 × 1/2 × 1.70 = 0.14 t

5) Longitndinal beam Haunch

2.5 " × 1.20 × 0.40 × 1/2 × 0.70 = 0.42 t

6) Cross beam

2.5 " × 0.70 × 1.72 × 2.15 = 6.47 t

7) Beam for Bridge support

2.5 " × (0.45 + 0.75) × 1/2 × 0.70 × 1.40 = 1.47 t

8) Deficit of column weight

−2.5 " × 0.70 × 0.70 × (2.00 − 0.332) = −2.04 t

9) Deficit of Longitndinal beam weight

−2.5 " × 0.70 × 0.92 × 0.35 = −0.56 t

10) Reaction of T beam Superstructure

118.90 × 1/2 = 59.45 t

P_1 = 74.08 t

Joint P_2

1) Distributed load

1.78 t/m² × 2.50 × 2.50 × 1/2 × 2 = 11.13 t

2) Transversal beam

2.5 t/m³ × 0.70 × 0.82 × 2.15 = 3.09 "

3) Slab Haunch

2.5 " × 0.45 × 0.15 × 1/2 × 1.70 × 2 = 0.29 "

4) Longitudinal beam haunch

2.5 " × 1.20 × 0.40 × 1/2 × 0.70 × 2 = 0.84 "

5) Deficit of column weight

2.5 " × 0.70 × 0.70 × (0.332 − 0.28) = 0.06 "

6) Deficit of Longitudinal beam weight

−(1.86 + 0.08) t/m × 0.70 = −1.36 "

P_2 = 14.05 t

(d) moment at Joint caused by beam of Bridge support and T-beam bridge

$M = 59.45 \times 0.71 + 2.5\,t/m^3 \times (0.45 \times 0.70 \times 0.70$

$+ 0.30 \times 0.70 \times 1/2 \times 0.583) \times 1.40 = 43.20\,tm$

(2) Member (5~6~7~8)

1) Distributed load

Bracing beam $2.5\,t/m^3 \times 0.60 \times 0.80 = 1.20\,t/m$

Earth pressure $1.8\,'' \times 0.60 \times 1.20 = 1.30\,''$

$w = 2.50\,t/m$

Column weight

$q = 2.5\,t/m^3 \times 0.70 \times 0.70 = 1.23\,t/m$

2. Train Load and Impact

(1) Train Load (Single track)

KS - 16

(a) Distributed load acting on rigid-frame

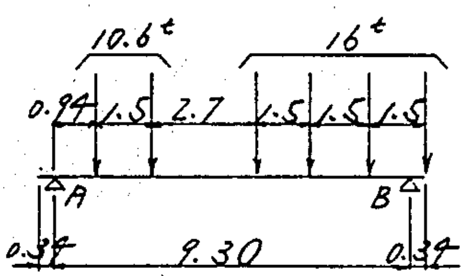
Span $l = 9.73^m$

$W_{M1} = 5.10 \times 2 = 10.20$ t/m

$W_{M2} = 4.20 \times 2 = 8.40$ "

$W_S = 5.60 \times 2 = 11.20$ "

(b) Reaction of T-beam Superstructure



$$R_B = \frac{1}{9.30} \times \{10.6 \times (0.94 + 2.44) + 16 \times (5.14 + 6.64 + 8.14 + 9.30)\} = 54.12^t$$

(2) Impact coefficient

(a) Within rigid frame Section

$l = 9.73^{m} \longrightarrow i_0 = 0.433$

For the case of double track reduction is made follwed formula.

· Reduction of impact coefficient

$i = 0.433 \times (1 - \frac{9.73}{200}) = 0.412$

(b) Within T-beam bridge section

$l = 9.30^{m} \longrightarrow i_0 = 0.437$

· Reduction of impact coefficient

$i = 0.437 \times (1 - \frac{9.30}{200}) = 0.417$

(3) Train Load + Impact Load

(a) Within rigid frame Section

$W_{M1} = 10.20 \times (1 + 0.412) = 14.40\ t/m$

$W_{M2} = 8.40 \times (\quad " \quad) = 11.86\ "$

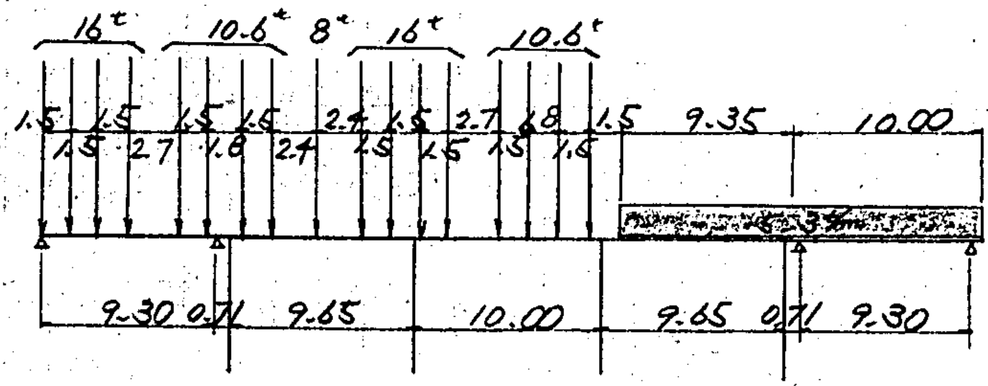
$W_S = 11.20 \times (\quad " \quad) = 15.81\ "$

(b) Reaction of T-beam bridge and joint moment

$R(l+i) = 54.12 \times (1 + 0.417) = 76.69^{t}$

$M(l+i) = 76.69 \times 0.71 = 54.45^{tm}$

3. Brake load



15% of the train load

(a) Within elevated structure Section

$T = H_1 = (10.6 \times 6 + 8 + 16 \times 4 + 5.3^{t/m} \times 9.35)$
$\times 0.15 = 27.77^t$

(b) Within T-beam bridge Section

at Supporting Point A.

$T_2 = (16 \times 4 + 10.6 \times 2) \times 0.15 = 12.78^t$

$H_2 = 0.5 \cdot T_2 = 0.5 \times 12.78 = 6.39^t$

at Supporting Point B

$T_3 = 5.3^{t/m} \times 10.00 \times 0.15 = 7.95^t$

$H_3 = 0.5 \times 7.95 = 3.98^t$

(c) Total brake load acting within elevated structure

$\Sigma H = 27.77 + 6.39 + 3.98 = 38.14^t$

$\Sigma H = 38.14 \times 1/2 = 19.07^t$

Brake load acting at the supporting point

$H = 19.07 \times 1/4 = 4.77^t$

4. Force of temperature change and/or Drying contraction

· Temperature rise

+10°C

· Temperature drop + Drying contraction

−15°C

5. Dead load + Seismic force

$Kh = 0.1$

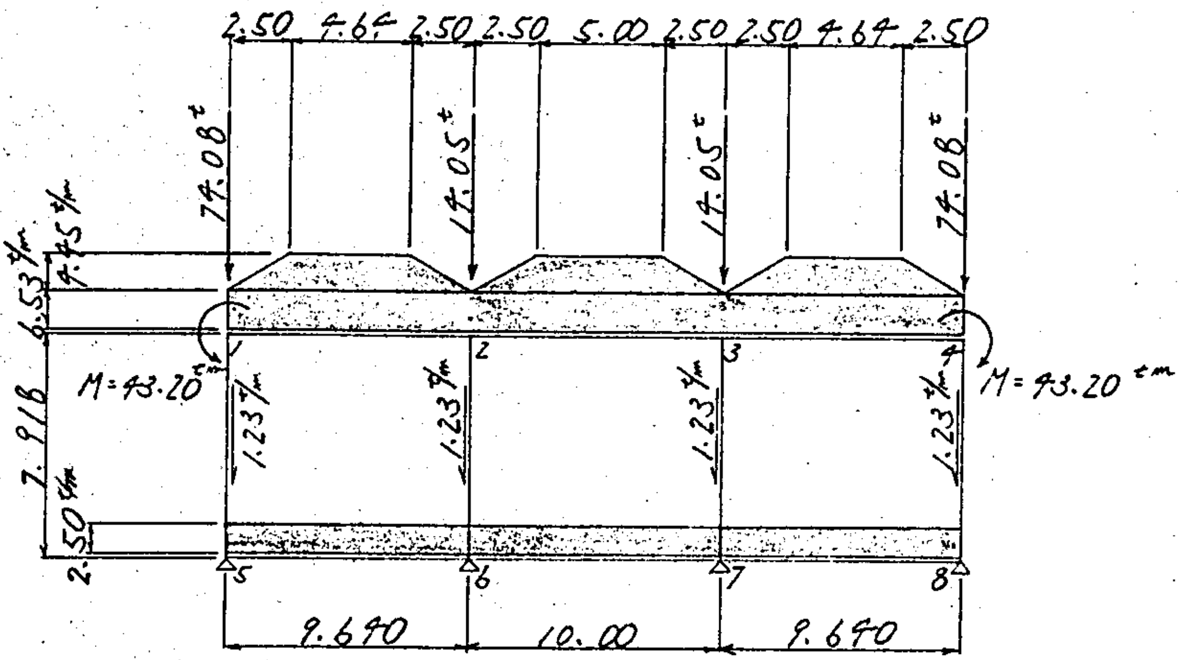
$$H = \{6.53^{t/m} \times 29.28 + (4.64 + 9.64) \times 1/2 \times 4.45^{t/m} \times 2$$
$$+ (5.00 + 10.00) \times 1/2 \times 4.45^{t/m} + 74.08^{t} \times 2$$
$$+ 14.05^{t} \times 2 + 1.23^{t/m} \times 7.918 \times 1/2 \times 4\} \times 0.10$$
$$= 48.39^{t}$$

Seismic force acting at The Supporting point

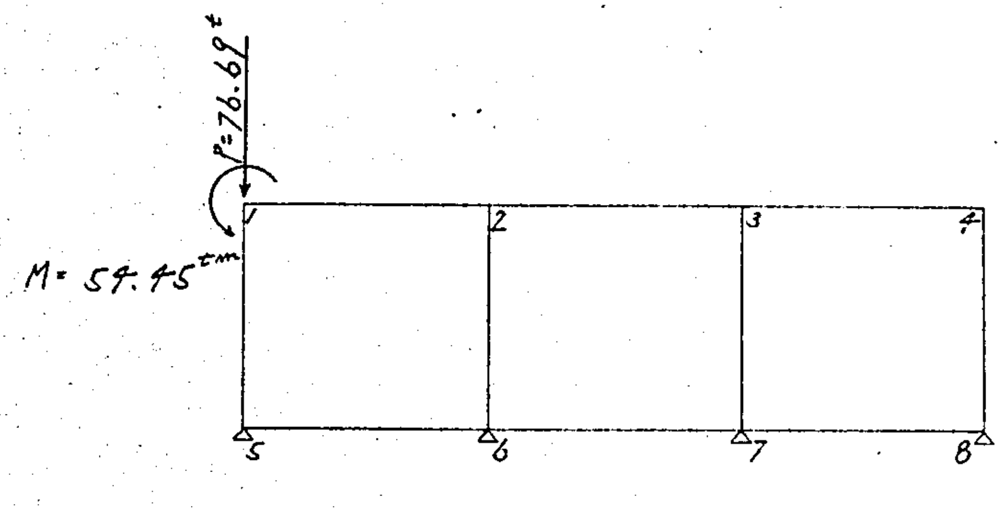
$$H = 48.39 \times 1/4 = 12.10^{t}$$

(3) Loading diagram

1. case 1. Dead load



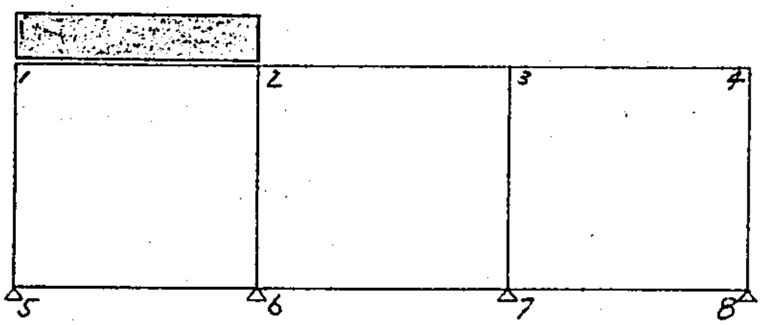
2. case 2 Train load + Impact



3. case 3. Train load + Impact

w'_{M1} = 14.40 t/m

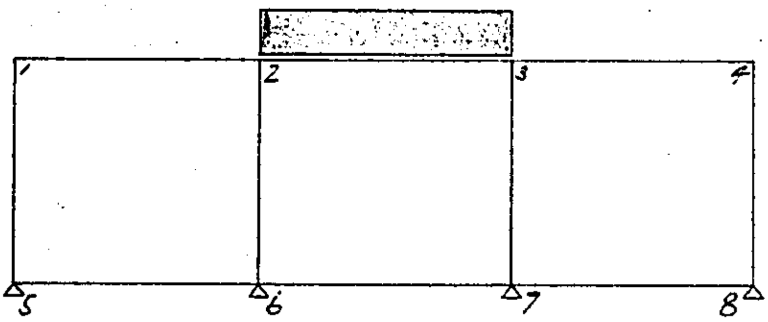
w'_{S} = 15.81 "



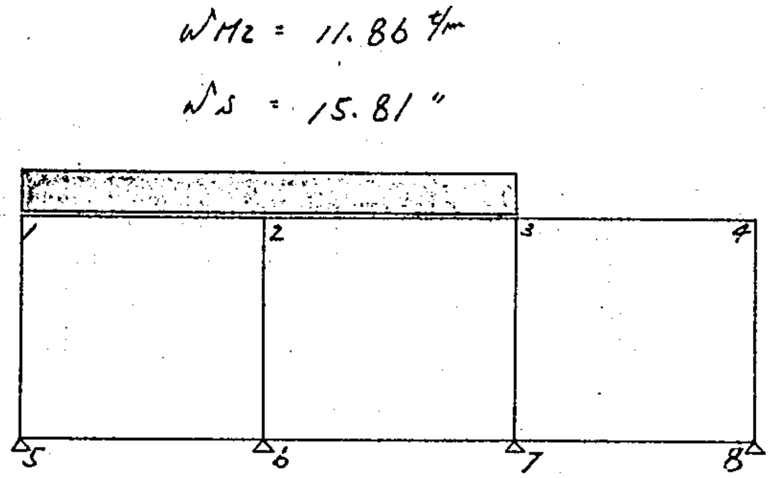
4. case 4. Train load + Impact

w_{M1} = 14.40 t/m

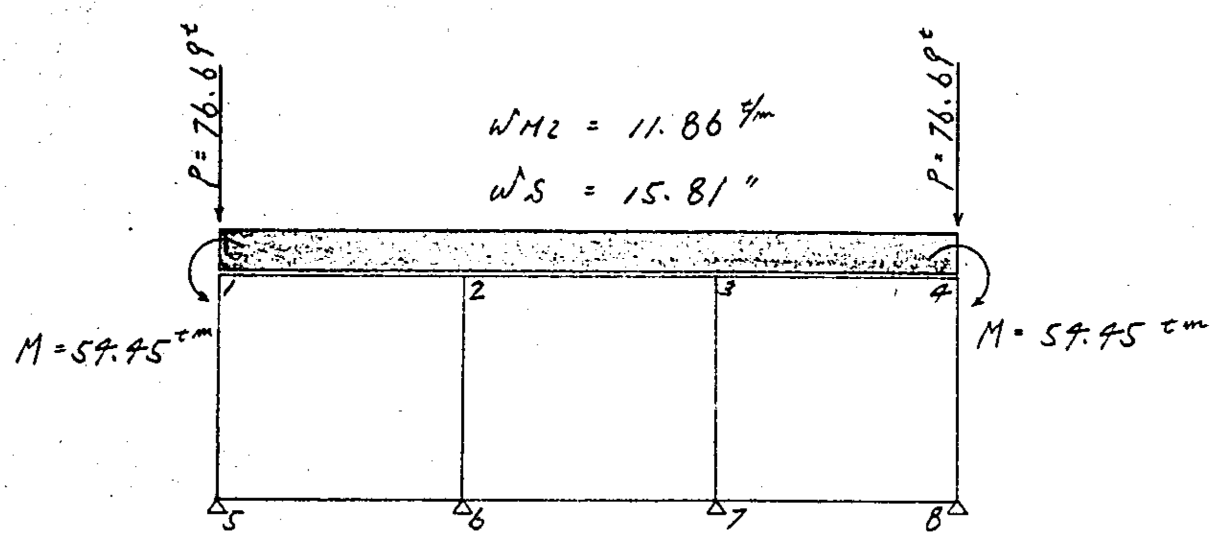
w_{S} = 15.81 "



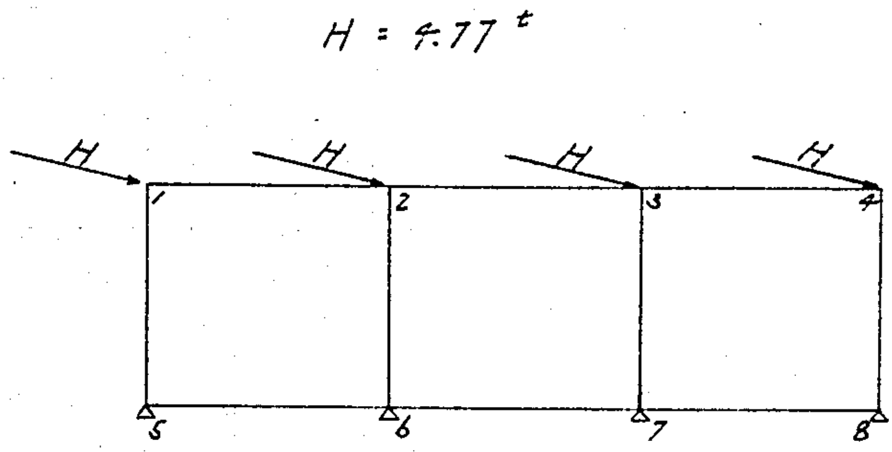
5. case 5 Train load + Impact



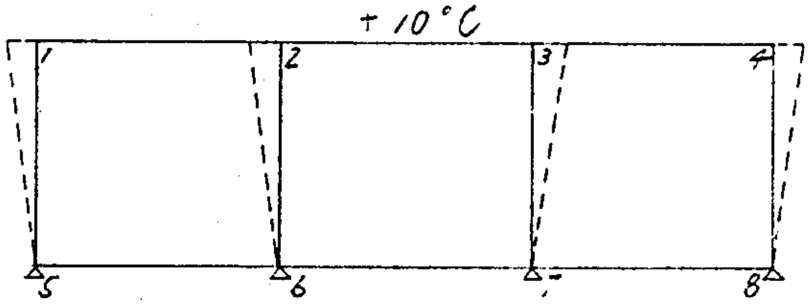
6. case 6 Train load + Impact



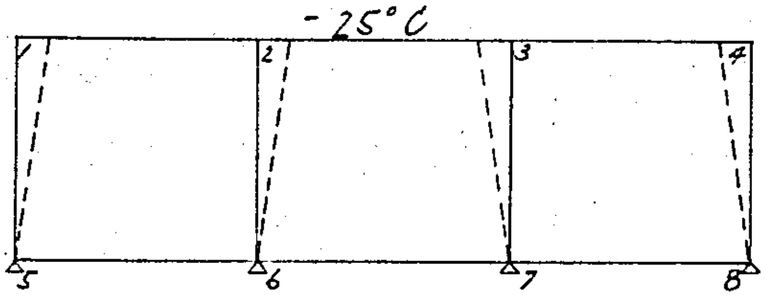
7. case 7 Brake load



8. case 8 Temperature rise

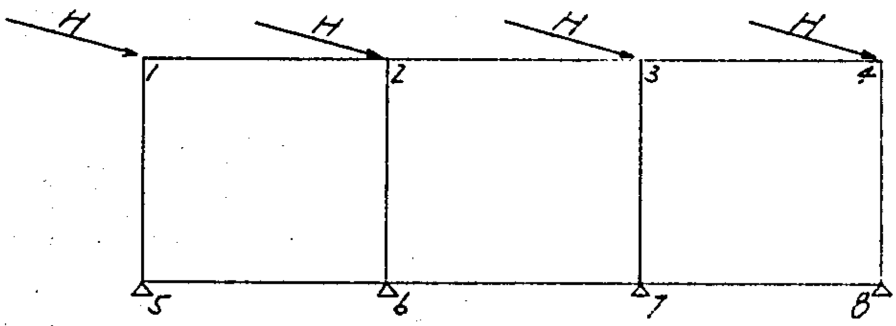


9. Case 9 Temperature drop + drying contraction



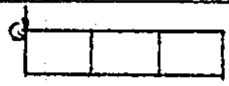
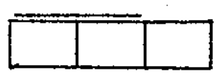
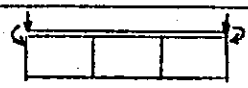
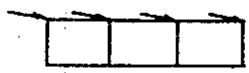
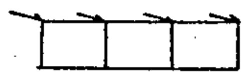
10. Case 10 Seismic load

H = 12.10 t



(4) Combination of loads

1. Basic load

Case No.	Kind of load	Loading Pattern
1	Dead load	
2	Train load + Impact	
3	Train load + Impact	
4	Train load + Impact	
5	Train load + Impact	
6	Train load + Impact	
7	Brake load	
8	Temperature	+10°C
9	Temperature + Contraction	−25°C
10	Seismic load	

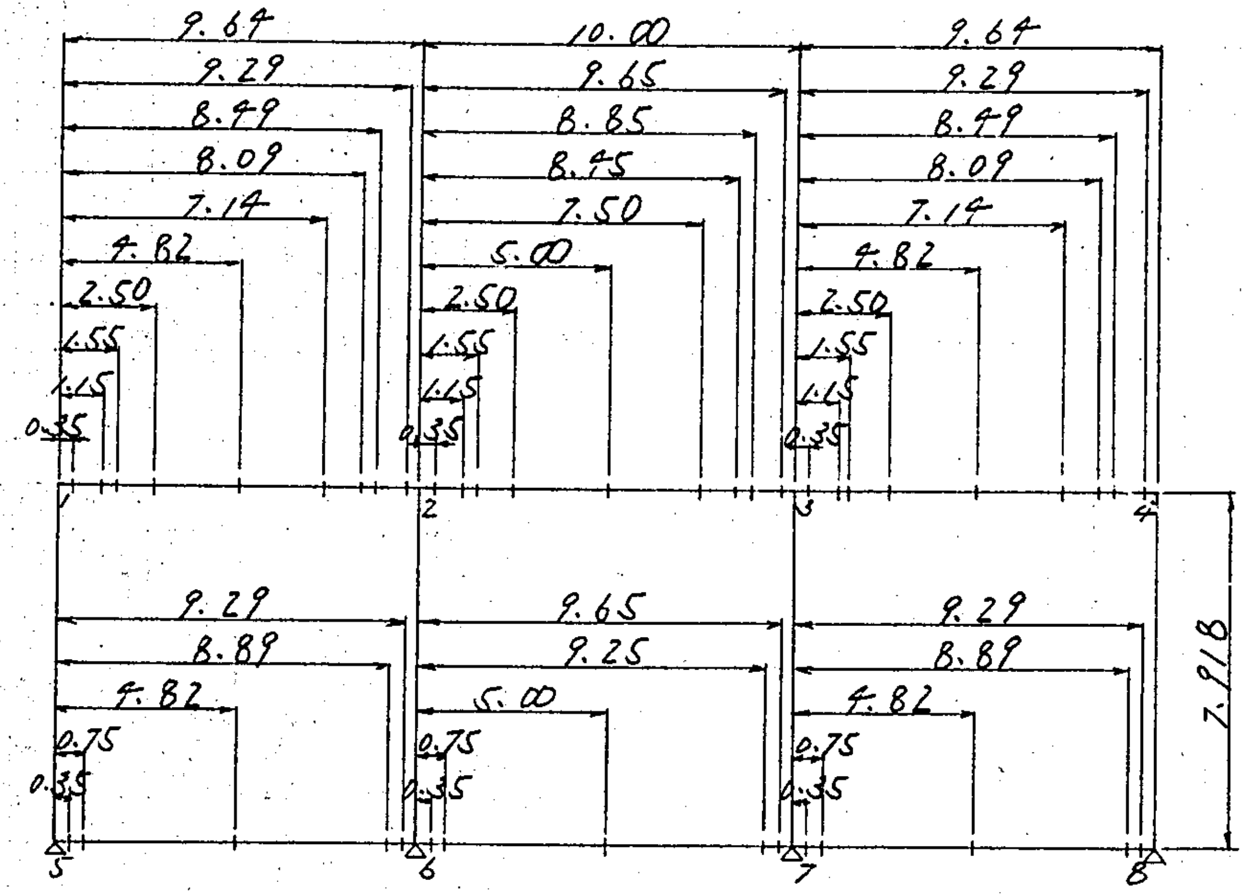
2. Combined loads

Case No.	Combination of loads	α
11	1	1.0000
12	1 + 2 + 3	1.0000
13	1 + 3	〃
14	1 + 4	〃
15	1 + 5	〃
16	1 + 6 + 7	0.8696
17	1 + 6 − 7	〃
18	1 + 8	〃
19	1 + 9	〃
20	1 + 10	0.6667
21	1 − 10	〃

3. Critical cases

No. 1	case 11	Crack
No. 2	case 12 ~ 21	synthetic
No. 3	case 12 ~ 17	footing
No. 4	case 18 ~ 19	〃
No. 5	case 20 ~ 21	〃

4. Point of computing stresses

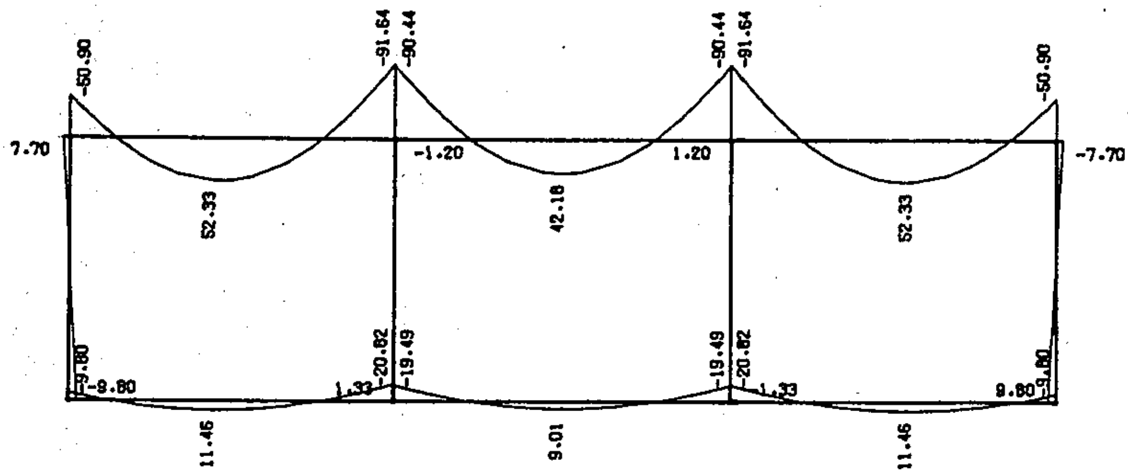


(5) stress diagram

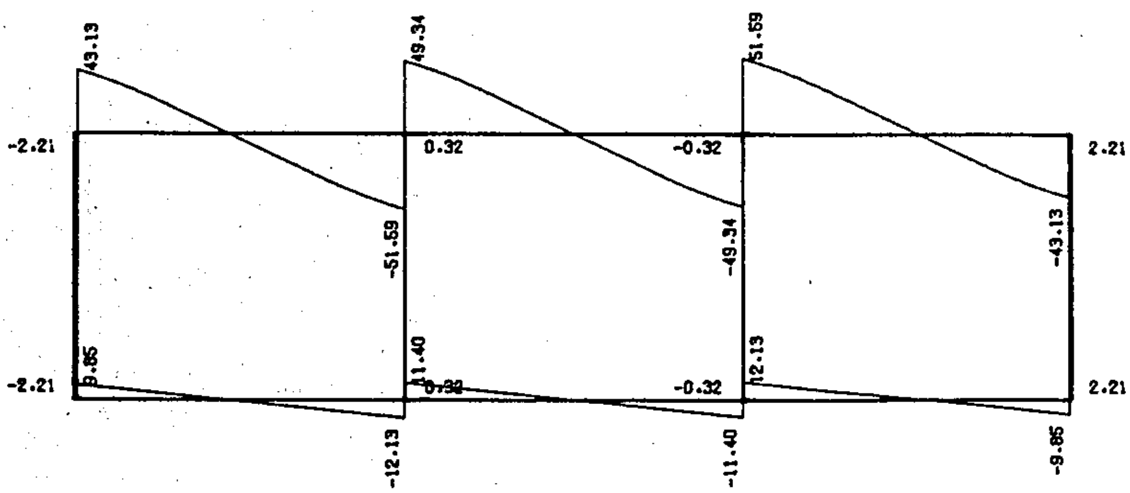
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) L1

CASE 1 (DEAD LOAD)

BENDING MOMENT



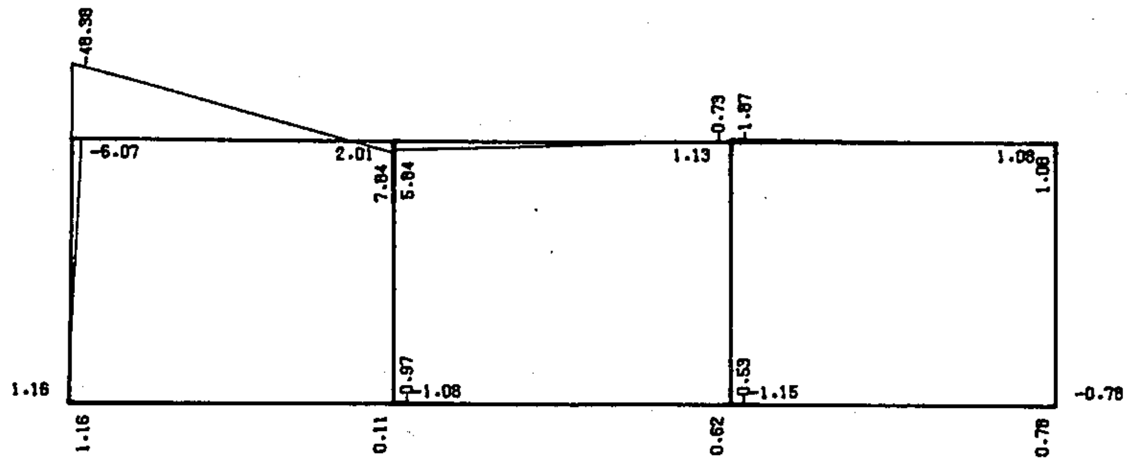
SHEARING FORCE



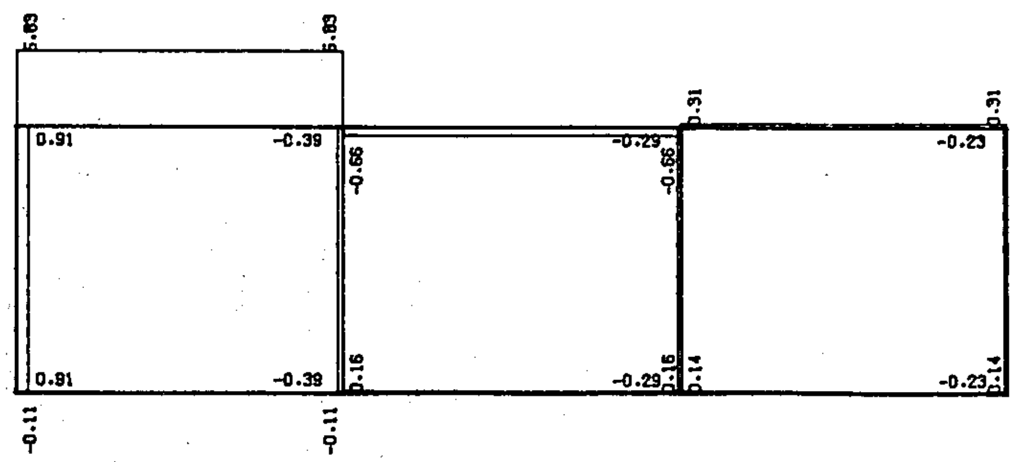
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) L1

CASE 2 (TRAIN LOAD + IMPACT LOAD 1)

BENDING MOMENT



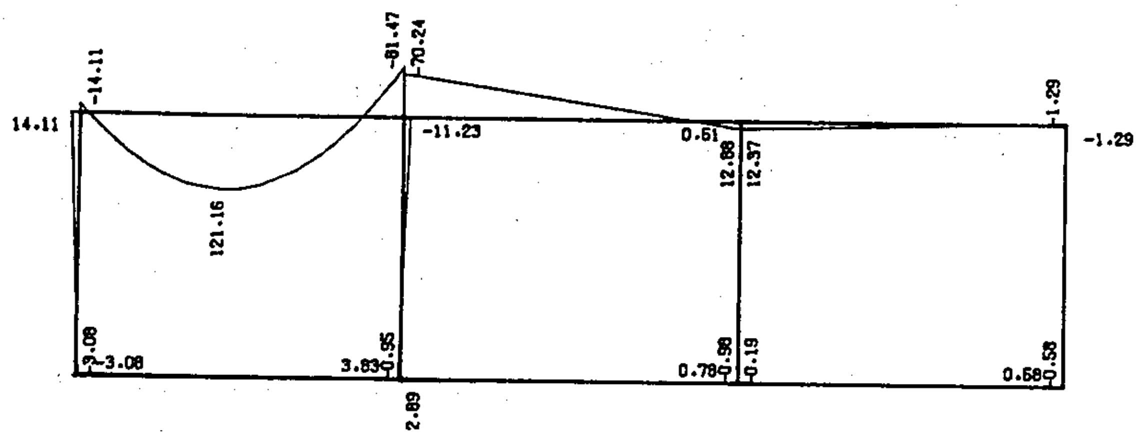
SHEARING FORCE



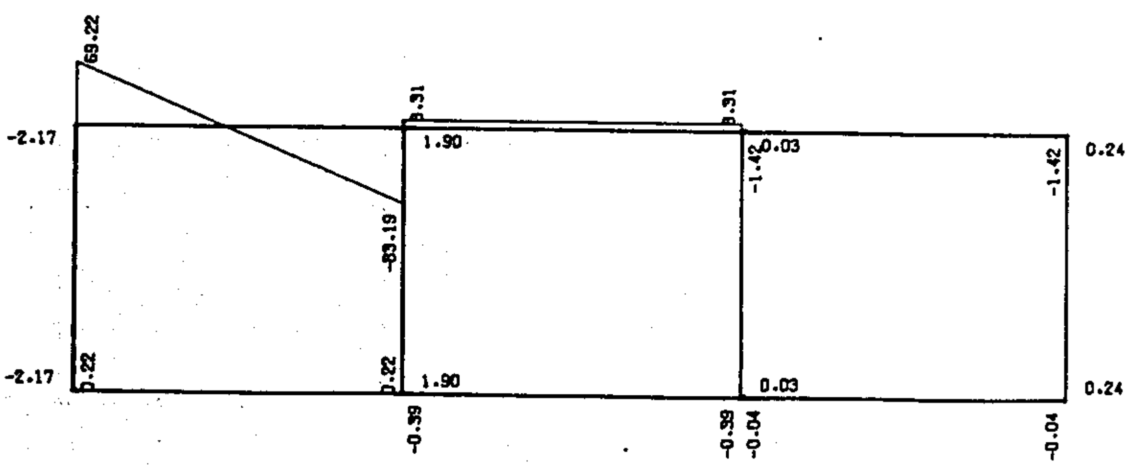
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) L1

CASE 3 (TRAIN LOAD + IMPACT LOAD 2)

BENDING MOMENT



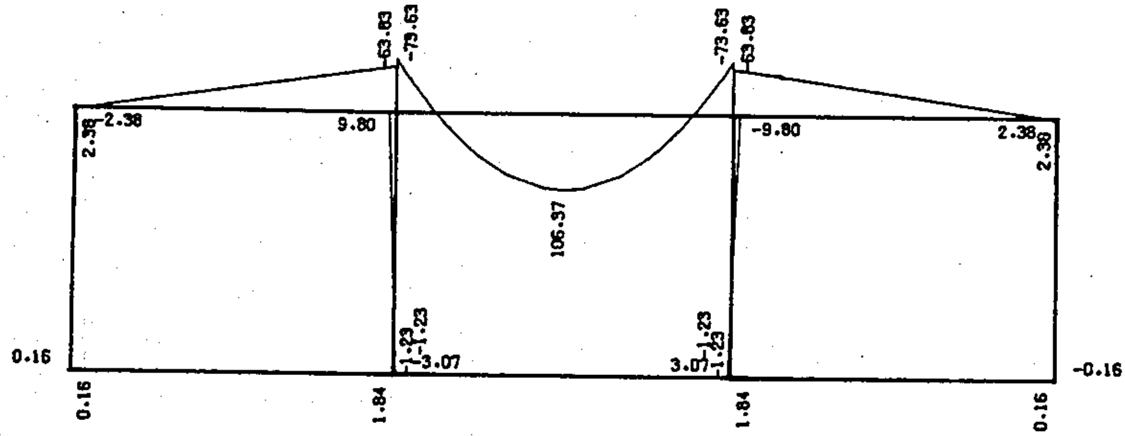
SHEARING FORCE



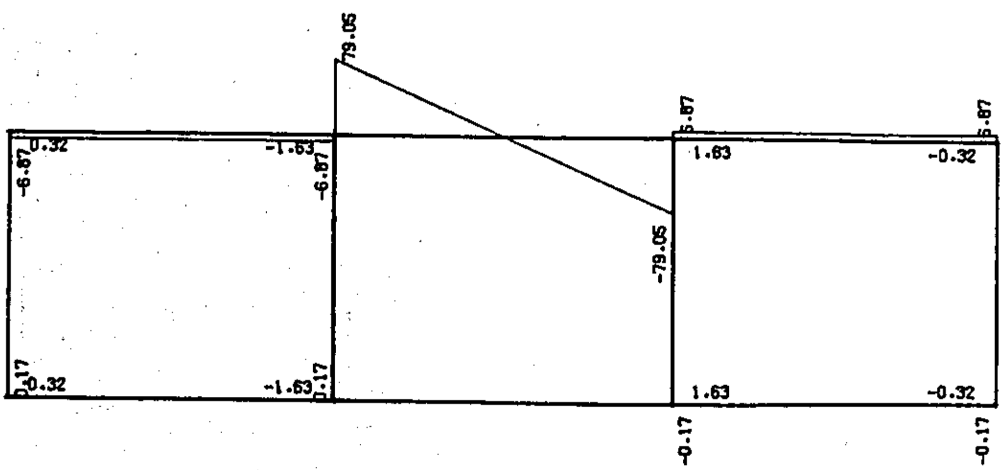
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) L1

CASE 4 (TRAIN LOAD + IMPACT LOAD 3)

BENDING MOMENT



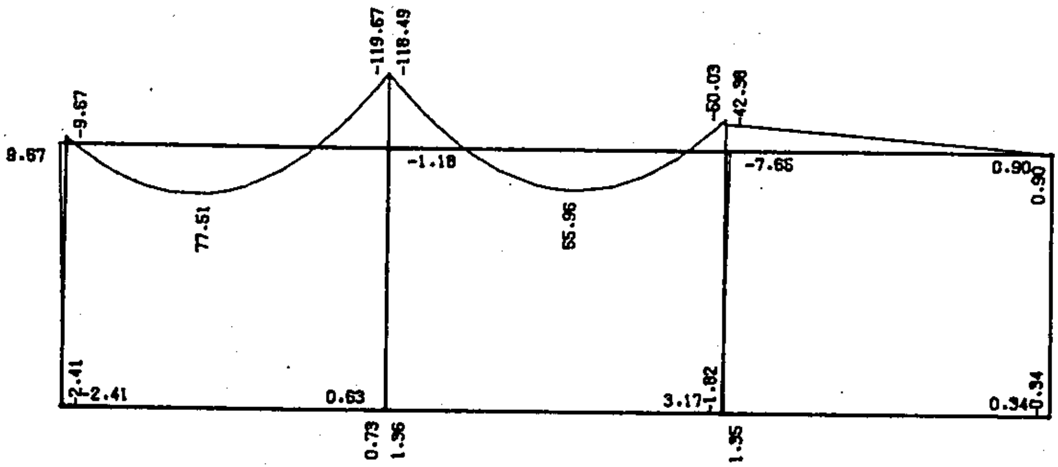
SHEARING FORCE



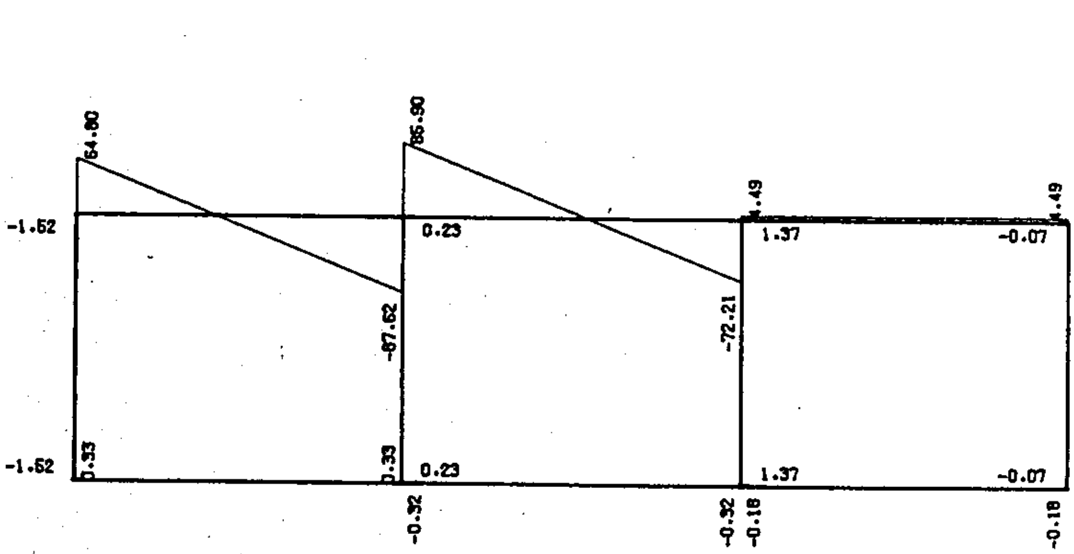
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) L1

CASE 5 (TRAIN LOAD + IMPACT LOAD 4)

BENDING MOMENT



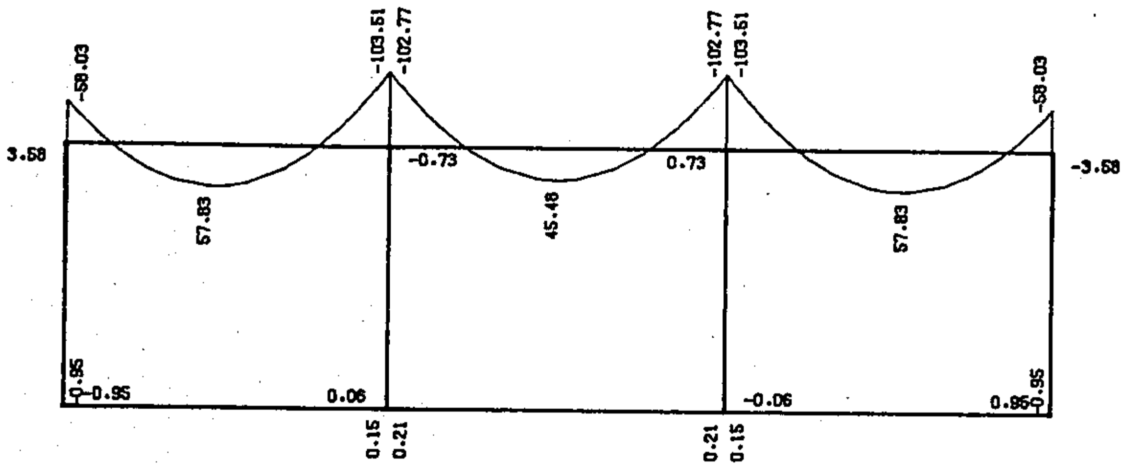
SHEARING FORCE



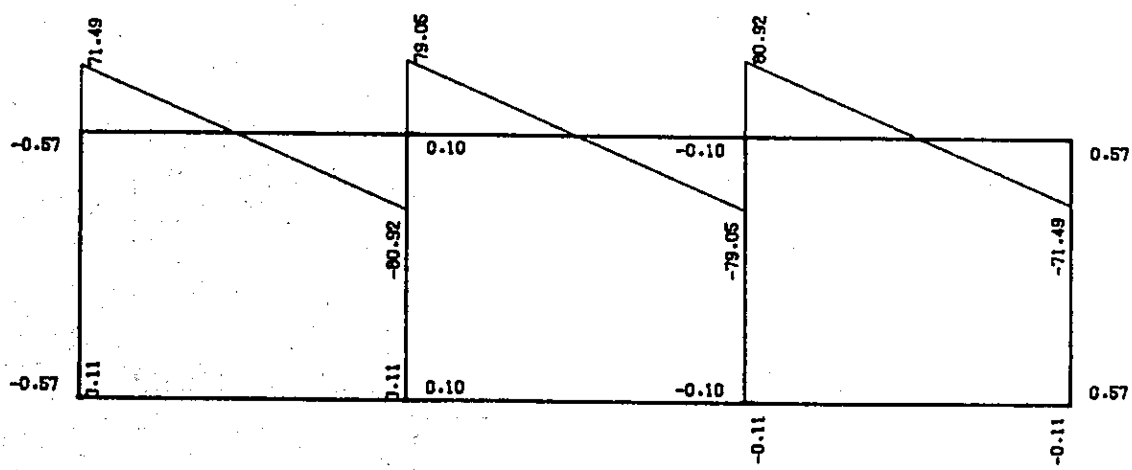
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) L1

CASE 6 (TRAIN LOAD + IMPACT LOADS)

BENDING MOMENT



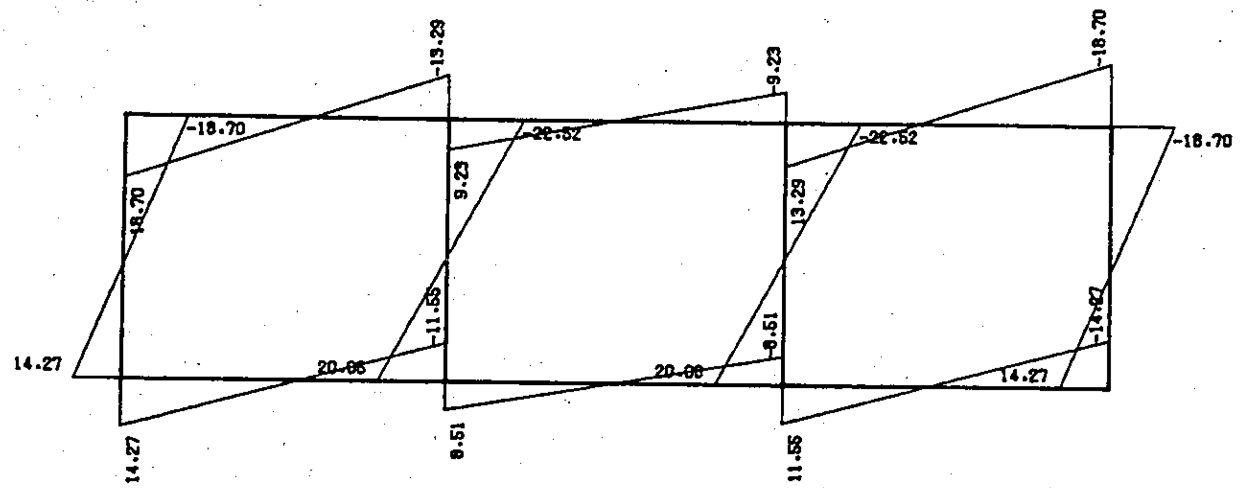
SHEARING FORCE



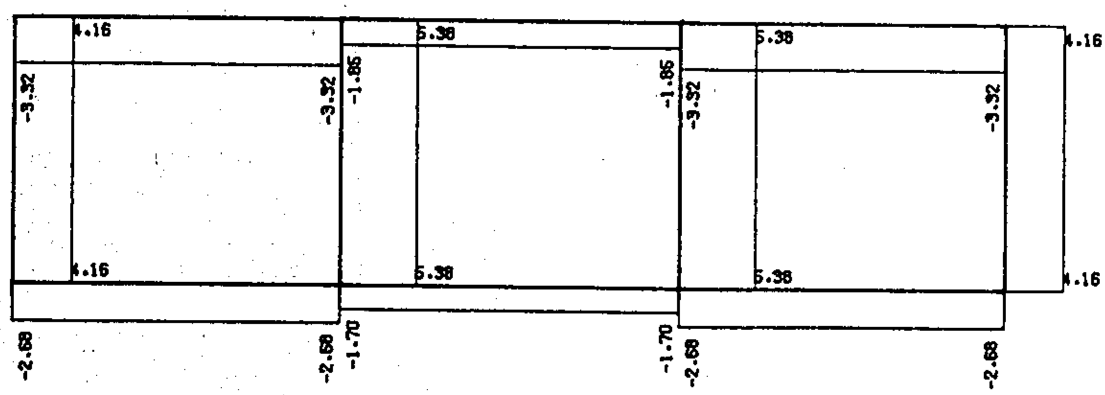
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) L1

CASE 7 (BRAKE LOAD)

BENDING MOMENT



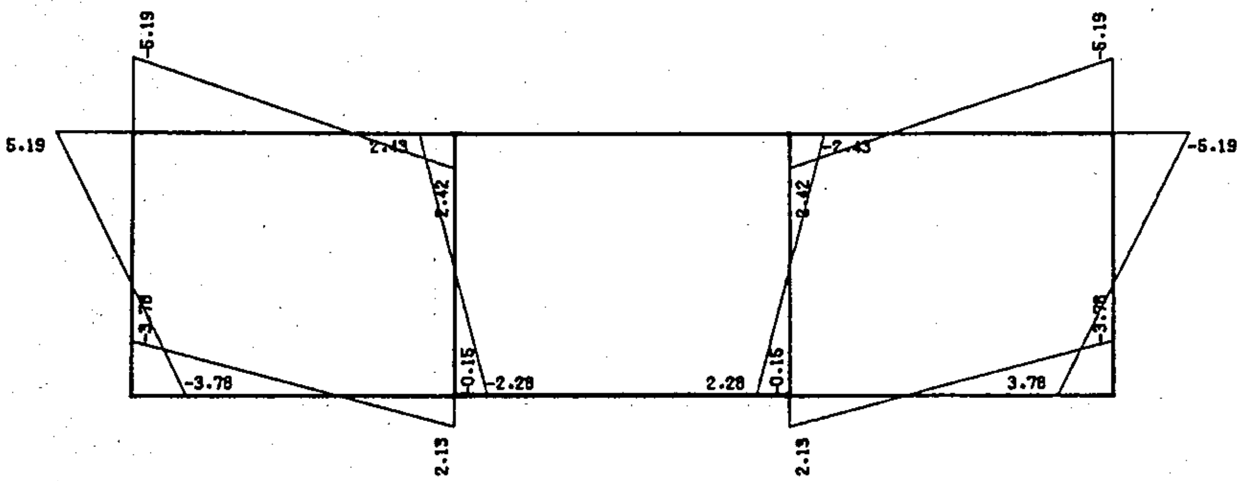
SHEARING FORCE



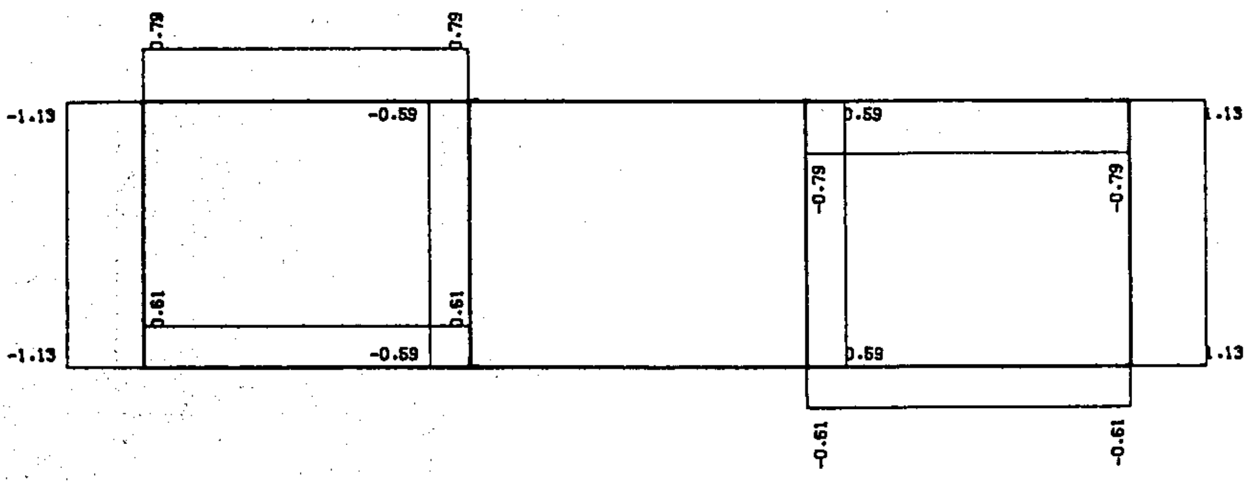
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) L1

CASE 8 (TEMPERERATURE RISE)

BENDING MOMENT



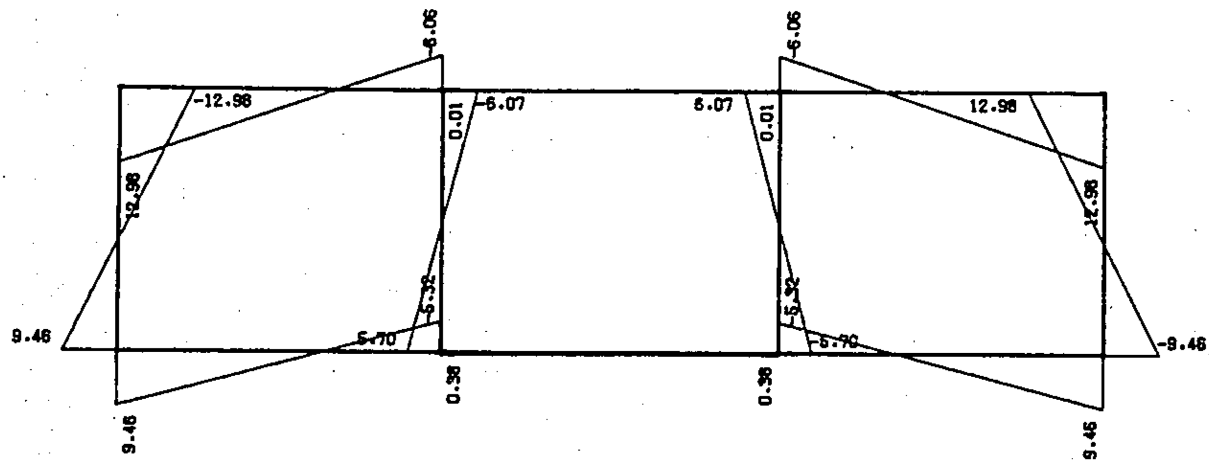
SHEARING FORCE



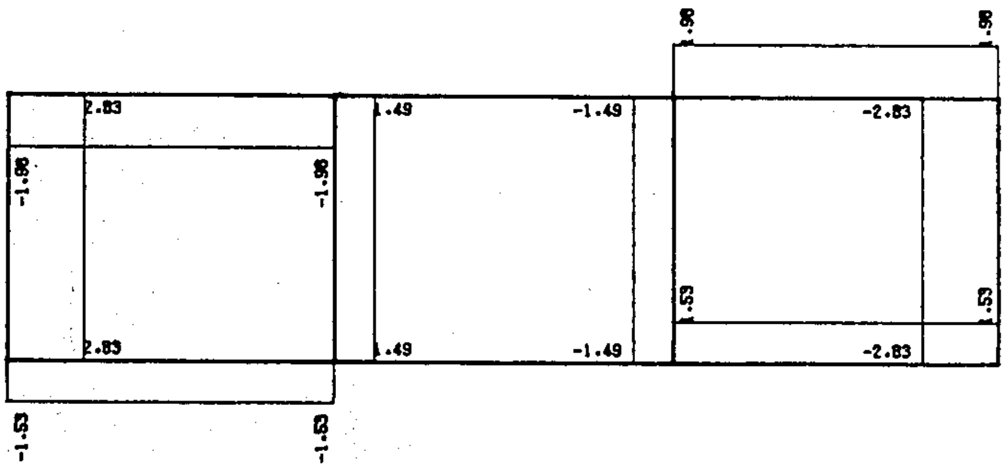
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) L1

CASE 9 (TEMPERATURE DROP + DRYING CONTRACTION)

BENDING MOMENT



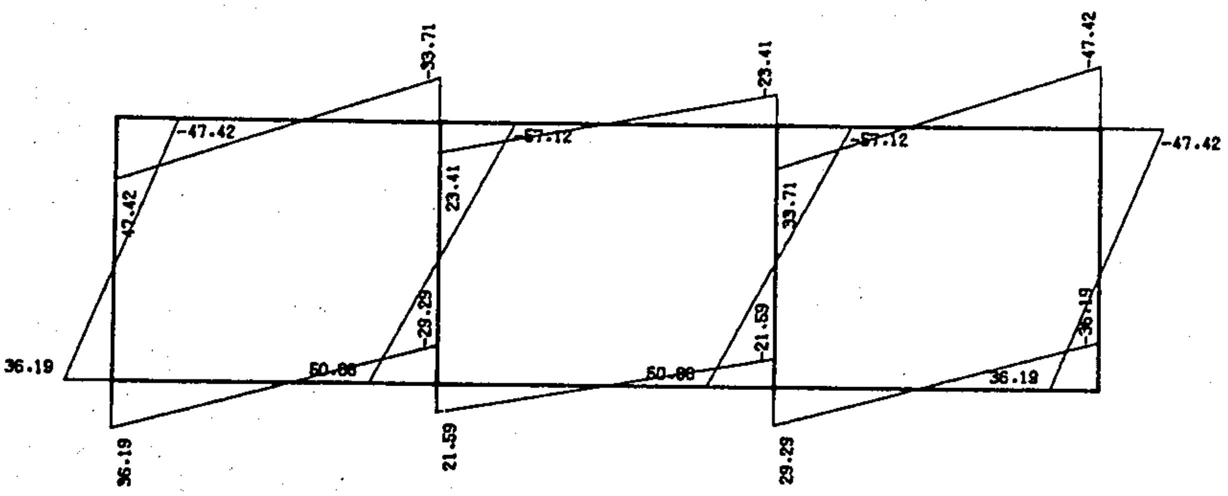
SHEARING FORCE



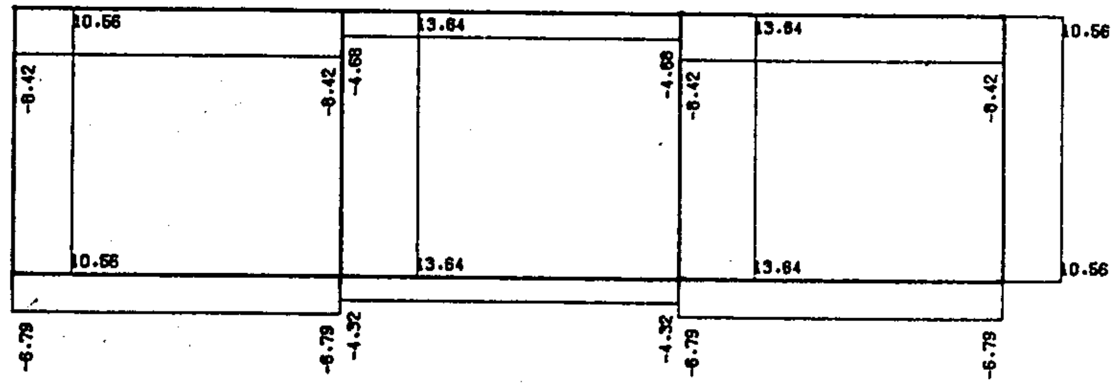
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) L1

CASE 10 (SEISMIC LOAD)

BENDING MOMENT



SHEARING FORCE



INPUT DATA

No. 87

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=== INPUT DATA ===                                                              CRC-FANSY   V6.3
       5  10        20        30        40        50        60        70        80   CARD NUMBER
   .............................................................................
TITLE                                                                                      1
CONTROL     10                                                                             2
SHEAR        1    3    1    2    3                                                         3
PLOT                   2                                                                   4
TYPE5-3-1 L=9.64,10.0,9.64    H=7.918   M1-3=2.104,0.21268               S=1               5
          M4-6=0.48,0.0256    M7-10=0.49,0.02001         P=2.7E+6,1.0E-5                   6
POINT     1 0.35       1.15      1.55      2.5       4.82      7.14      8.09              7
            8.49       9.29      =         3                                               8
          2 0.35       1.15      1.55      2.5       5.0       7.5       8.45              9
            8.85       9.65                                                               10
          4 0.35       0.75      4.82      8.89      9.29      =         6                11
          5 0.35       0.75      5.0       9.25      9.65                                 12
PICKUP       1    1   11                                                                  13
             2    1   12   21                                                             14
             3    1   12   17                                                             15
             4    1   18   19                                                             16
             5    1   20   21                                                             17
LOAD        10                                                                            18
J            1                 -74.08    43.2                                             19
             2                 -14.05                        3                            20
             4                 -74.08    -43.2                                            21
DL           1    2-4.45       2.5       2.5                 2    3                       22
             1    2-6.53                                     2    3                       23
             4    2-2.28                                     5    6                       24
             7    2-1.23                                     8    9    10                 25
END                                                                                       26
LOAD        2RI   1                                                                       27
J            1                 -76.69    54.45                                            28
END                                                                                       29
LOAD        3RI   2                                               1.0979                  30
DL           1    2-14.4                                                                  31
END                                                                                       32
LOAD        4RI   3                                               1.0979                  33
DL           2    2-14.4                                                                  34
END                                                                                       35
LOAD        5RI   4                                               1.3331                  36
DL           1    2-11.86                                    2                            37
END                                                                                       38
LOAD        6RI   5                                               1.3331                  39
J            1                 -76.69    54.45                                            40
             4                 -76.69    -54.45                                           41
LL           1  3 2-11.86      -11.86                                                     42
END                                                                                       43
LOAD        7B                                                                            44
J            1      4.77                                     2    3    4                  45
END                                                                                       46
LOAD        8TU                                                                           47
T            1    3 10.0                                                                  48
END                                                                                       49
LOAD        9TC                                                                           50
T            1    3-25.0                                                                  51
END                                                                                       52
LOAD        10ED                                                                          53
J            1      12.1                                     2    3    4                  54
END                                                                                       55
MT2     11             1                                                                  56
        12             1    2    3                                                        57
```

No. 88

```
=== INPUT DATA ===
                                                                          CRC-FANSY   V6.3
        5   10       20        30        40        50        60        70        80    CARD NUMBER
.................................................................................
            13                1   3                                                      58
            14                1   4                                                      59
            15                1   5                                                      60
            160.8696          1   6   7                                                  61
            170.8696          1   6  -7                                                  62
            180.8696          1   8                                                      63
            190.8696          1   9                                                      64
            200.6667          1  10                                                      65
            210.6667          1 -10                                                      66
       FINISH                                                                            67
```

No. 89

CONTROL DATA

METHOD	STRUCTURE	J.RENUMBER	M.RENUMBER	S.F. DIS.	UNI.SPRING	STAN.STIF.	BARA	SKEW MEM.
DIS	*RAHMEN*	*OFF*	*OFF*	*OFF*	*OFF*	*OFF*	*OFF*	*OFF*

LOAD TITLE

LOAD 1	CASE 1	LOAD 2	CASE 2
LOAD 3	CASE 3	LOAD 4	CASE 4
LOAD 5	CASE 5	LOAD 6	CASE 6
LOAD 7	CASE 7	LOAD 8	CASE 8
LOAD 9	CASE 9	LOAD 10	CASE 10
MIX 11	CASE 11 (1.0000 * 1)	MIX 12	CASE 12 (1+2+3)
MIX 13	CASE 13 (1+3)	MIX 14	CASE 14 (1+4)
MIX 15	CASE 15 (1+5)	MIX 16	CASE 16 (1+6+7)
MIX 17	CASE 17 (1+6-7)	MIX 18	CASE 18 (1+8)
MIX 19	CASE 19 (1+9)	MIX 20	CASE 20 (1+10)
MIX 21	CASE 21 (1-10)		

PICK UP LOAD CASE

PICK 1	11									
PICK 2	12	13	14	15	16	17	18	19	20	21
PICK 3	12	13	14	15	16	17				
PICK 4	18	19								
PICK 5	20	21								

No. 90

JOINT DATA

JOINT NUMBER 8

ZAHYO(M) JOINT	X	Y
1	0.0000	7.9180
2	9.6400	7.9180
3	19.6400	7.9180
4	29.2800	7.9180
5	0.0000	0.0000
6	9.6400	0.0000
7	19.6400	0.0000
8	29.2800	0.0000

MEMBER DATA

MEMBER NUMBER 10

MEMBER	ITAN	JTAN	CONNECT. ITAN	JTAN	LENGTH	A	I	PRO.NUM
1	1	2	FIX	FIX	9.6400	2.10400	.2126800	1
2	2	3	FIX	FIX	10.0000	2.10400	.2126800	1
3	3	4	FIX	FIX	9.6400	2.10400	.2126800	1
4	5	6	FIX	FIX	9.6400	.48000	.0256000	1
5	6	7	FIX	FIX	10.0000	.48000	.0256000	1
6	7	8	FIX	FIX	9.6400	.48000	.0256000	1
7	1	5	FIX	FIX	7.9180	.49000	.0200100	1
8	2	6	FIX	FIX	7.9180	.49000	.0200100	1
9	3	7	FIX	FIX	7.9180	.49000	.0200100	1
10	4	8	FIX	FIX	7.9180	.49000	.0200100	1

PROPERTY DATA

PROPERTY NUMBER 1

PROPERTY	E	G	EPS
1	2.700E+06	0.	1.000E-05

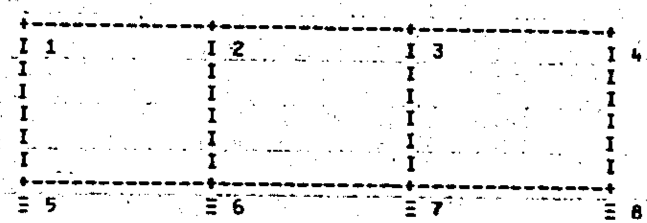
SUPPORT DATA

SUPPORT NUMBER 4

SUPPORT	X	Y	THET Z
5	FIX	FIX	FREE
6	FIX	FIX	FREE
7	FIX	FIX	FREE
8	FIX	FIX	FREE

CRC-FANSY V6.3

STRUCTURAL FIGURE



No. 92

MOVE DATA

MEMBER	ITAN	JTAN	POINT 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	......	......	.350	1.150	1.550	2.500	4.820	7.140	8.090	8.490	9.290					
2	......	......	.350	1.150	1.550	2.500	5.000	7.500	8.450	8.850	9.650					
3	......	......	.350	1.150	1.550	2.500	4.820	7.140	8.090	8.490	9.290					
4	......	......	.350	.750	4.820	8.890	9.290									
5	......	......	.350	.750	5.000	9.250	9.650									
6	......	......	.350	.750	4.820	8.890	9.290									
7	......	......														
8	......	......														
9	......	......														
10	......	......														

No. 93

LOAD DATA

	M/J	NAME	D	W1	W2	L1	L2
	2	LINEAR	Y	-11.860	-11.860	0.000	0.000
LOAD - 6		CASE 6					
MEMBER	1	SHEAR		1.33310(S/M)			
	2	SHEAR		1.33310(S/M)			
	3	SHEAR		1.33310(S/M)			
MEMBER	1	LINEAR	Y	-11.860	-11.860	0.000	0.000
	2	LINEAR	Y	-11.860	-11.860	0.000	0.000
	3	LINEAR	Y	-11.860	-11.860	0.000	0.000
JOINT	1	JOINTLOAD	Y	-76.690			
		JOINTLOAD	Z	54.450			
	4	JOINTLOAD	Y	-76.690			
		JOINTLOAD	Z	-54.450			
LOAD - 7		CASE 7					
JOINT	1	JOINTLOAD	X	4.770			
	2	JOINTLOAD	X	4.770			
	3	JOINTLOAD	X	4.770			
	4	JOINTLOAD	X	4.770			
LOAD - 8		CASE 8 (ONDO JYOUSYOU)					
MEMBER	1	TEMP		10.0(DO)			
	2	TEMP		10.0(DO)			
	3	TEMP		10.0(DO)			
LOAD - 9		CASE 9					
MEMBER	1	TEMP		-25.0(DO)			
	2	TEMP		-25.0(DO)			
	3	TEMP		-25.0(DO)			
LOAD - 10		CASE 10					
JOINT	1	JOINTLOAD	X	12.100			
	2	JOINTLOAD	X	12.100			
	3	JOINTLOAD	X	12.100			
	4	JOINTLOAD	X	12.100			

MIX DATA

MIX NUMBER 11

LOAD	SS	N	S1	K1	S2	K2	S3	K3	S4	K4	S5	K5	S6	K6	S7	K7	S8	K8
11	1.0000	1	1.0000	1														
12	1.0000	3	1.0000	1	1.0000	2	1.0000	3										
13	1.0000	2	1.0000	1	1.0000	3												
14	1.0000	2	1.0000	1	1.0000	4												
15	1.0000	2	1.0000	1	1.0000	5												
16	.8696	3	1.0000	1	1.0000	6	1.0000	7										
17	.8696	3	1.0000	1	1.0000	6	-1.0000	7										
18	.8696	2	1.0000	1	1.0000	8												
19	.8696	2	1.0000	1	1.0000	9												
20	.6667	2	1.0000	1	1.0000	10												
21	.6667	2	1.0000	1	-1.0000	10												

No. 94

PICK UP

CRC-FANSY V6.3

PICK UP 1

MOMENT MAXIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-50.897	43.135	-2.210
1	.350	(11)	-36.213	40.740	-2.210
2	1.150	(11)	-6.061	34.448	-2.210
3	1.550	(11)	7.013	30.875	-2.210
4	2.500	(11)	31.898	21.247	-2.210
5	4.820	(11)	51.642	-4.226	-2.210
6	7.140	(11)	12.288	-29.700	-2.210
7	8.090	(11)	-20.627	-39.328	-2.210
8	8.490	(11)	-37.083	-42.901	-2.210
9	9.290	(11)	-73.996	-49.193	-2.210
JTAN	9.640	(11)	-91.639	-51.587	-2.210
MAX	4.284	(11)	52.331	1.654	-2.210

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-90.436	49.338	-1.890
1	.350	(11)	-73.580	46.943	-1.890
2	1.150	(11)	-38.467	40.651	-1.890
3	1.550	(11)	-22.912	37.078	-1.890
4	2.500	(11)	7.866	27.450	-1.890
5	5.000	(11)	42.179	-.000	-1.890
6	7.500	(11)	7.866	-27.450	-1.890
7	8.450	(11)	-22.912	-37.078	-1.890
8	8.850	(11)	-38.467	-40.651	-1.890
9	9.650	(11)	-73.580	-46.943	-1.890
JTAN	10.000	(11)	-90.436	-49.337	-1.890
MAX	5.000	(11)	42.179	-.000	-1.890

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-91.639	51.587	-2.210
1	.350	(11)	-73.996	49.193	-2.210
2	1.150	(11)	-37.083	42.901	-2.210
3	1.550	(11)	-20.627	39.328	-2.210
4	2.500	(11)	12.288	29.700	-2.210
5	4.820	(11)	51.642	4.226	-2.210
6	7.140	(11)	31.898	-21.247	-2.210
7	8.090	(11)	7.013	-30.875	-2.210
8	8.490	(11)	-6.061	-34.448	-2.210
9	9.290	(11)	-36.213	-40.740	-2.210
JTAN	9.640	(11)	-50.897	-43.135	-2.210
MAX	5.356	(11)	52.331	-1.654	-2.210

MOMENT MINIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-50.897	43.135	-2.210
1	.350	(11)	-36.213	40.740	-2.210
2	1.150	(11)	-6.061	34.448	-2.210
3	1.550	(11)	7.013	30.875	-2.210
4	2.500	(11)	31.898	21.247	-2.210
5	4.820	(11)	51.642	-4.226	-2.210
6	7.140	(11)	12.288	-29.700	-2.210
7	8.090	(11)	-20.627	-39.328	-2.210
8	8.490	(11)	-37.083	-42.901	-2.210
9	9.290	(11)	-73.996	-49.193	-2.210
JTAN	9.640	(11)	-91.639	-51.587	-2.210
MAX	4.284	(11)	52.331	1.654	-2.210

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-90.436	49.338	-1.890
1	.350	(11)	-73.580	46.943	-1.890
2	1.150	(11)	-38.467	40.651	-1.890
3	1.550	(11)	-22.912	37.078	-1.890
4	2.500	(11)	7.866	27.450	-1.890
5	5.000	(11)	42.179	-.000	-1.890
6	7.500	(11)	7.866	-27.450	-1.890
7	8.450	(11)	-22.912	-37.078	-1.890
8	8.850	(11)	-38.467	-40.651	-1.890
9	9.650	(11)	-73.580	-46.943	-1.890
JTAN	10.000	(11)	-90.436	-49.337	-1.890
MAX	5.000	(11)	42.179	-.000	-1.890

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-91.639	51.587	-2.210
1	.350	(11)	-73.996	49.193	-2.210
2	1.150	(11)	-37.083	42.901	-2.210
3	1.550	(11)	-20.627	39.328	-2.210
4	2.500	(11)	12.288	29.700	-2.210
5	4.820	(11)	51.642	4.226	-2.210
6	7.140	(11)	31.898	-21.247	-2.210
7	8.090	(11)	7.013	-30.875	-2.210
8	8.490	(11)	-6.061	-34.448	-2.210
9	9.290	(11)	-36.213	-40.740	-2.210
JTAN	9.640	(11)	-50.897	-43.135	-2.210
MAX	5.356	(11)	52.331	-1.654	-2.210

No. 95

No. 96

PICK UP 1

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(11)	-9.803	9.847	0.000
1	.350	(11)	-6.496	9.049	0.000
2	.750	(11)	-3.059	8.137	0.000
3	4.820	(11)	11.173	-1.143	0.000
4	8.890	(11)	-12.363	-10.423	0.000
5	9.290	(11)	-16.714	-11.335	0.000
JTAN	9.640	(11)	-20.821	-12.133	0.000
MAX	4.284	(11)	11.458	.078	0.000
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(11)	-19.490	11.400	0.000
1	.350	(11)	-15.640	10.602	0.000
2	.750	(11)	-11.581	9.690	0.000
3	5.000	(11)	9.010	0.000	0.000
4	9.250	(11)	-11.581	-9.690	0.000
5	9.650	(11)	-15.640	-10.602	0.000
JTAN	10.000	(11)	-19.490	-11.400	0.000
MAX	5.000	(11)	9.010	0.000	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(11)	-20.821	12.133	0.000
1	.350	(11)	-16.714	11.335	0.000
2	.750	(11)	-12.363	10.423	0.000
3	4.820	(11)	11.173	1.143	0.000
4	8.890	(11)	-3.059	-8.137	0.000
5	9.290	(11)	-6.496	-9.049	0.000
JTAN	9.640	(11)	-9.803	-9.847	0.000
MAX	5.356	(11)	11.458	-.078	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(11)	7.697	-2.210	-117.215
JTAN	7.918	(11)	-9.803	-2.210	-126.954
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(11)	-1.203	.320	-114.975
JTAN	7.918	(11)	1.331	.320	-124.714

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(11)	-9.803	9.847	0.000
1	.350	(11)	-6.496	9.049	0.000
2	.750	(11)	-3.059	8.137	0.000
3	4.820	(11)	11.173	-1.143	0.000
4	8.890	(11)	-12.363	-10.423	0.000
5	9.290	(11)	-16.714	-11.335	0.000
JTAN	9.640	(11)	-20.821	-12.133	0.000
MAX	4.284	(11)	11.458	.078	0.000
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(11)	-19.490	11.400	0.000
1	.350	(11)	-15.640	10.602	0.000
2	.750	(11)	-11.581	9.690	0.000
3	5.000	(11)	9.010	0.000	0.000
4	9.250	(11)	-11.581	-9.690	0.000
5	9.650	(11)	-15.640	-10.602	0.000
JTAN	10.000	(11)	-19.490	-11.400	0.000
MAX	5.000	(11)	9.010	0.000	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(11)	-20.821	12.133	0.000
1	.350	(11)	-16.714	11.335	0.000
2	.750	(11)	-12.363	10.423	0.000
3	4.820	(11)	11.173	1.143	0.000
4	8.890	(11)	-3.059	-8.137	0.000
5	9.290	(11)	-6.496	-9.049	0.000
JTAN	9.640	(11)	-9.803	-9.847	0.000
MAX	5.356	(11)	11.458	-.078	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(11)	7.697	-2.210	-117.215
JTAN	7.918	(11)	-9.803	-2.210	-126.954
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(11)	-1.203	.320	-114.975
JTAN	7.918	(11)	1.331	.320	-124.714

No. 97

PICK UP 1

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(11)	1.203	-.320	-114.975
JTAN	7.918	(11)	-1.331	-.320	-124.714
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(11)	-7.697	2.210	-117.215
JTAN	7.918	(11)	9.803	2.210	-126.954

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(11)	1.203	-.320	-114.975
JTAN	7.918	(11)	-1.331	-.320	-124.714
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(11)	-7.697	2.210	-117.215
JTAN	7.918	(11)	9.803	2.210	-126.954

No. 98

PICK UP 1

SHEAR MAXIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-50.897	43.135	-2.210
1	.350	(11)	-36.213	40.740	-2.210
2	1.150	(11)	-6.061	34.448	-2.210
3	1.550	(11)	7.013	30.875	-2.210
4	2.500	(11)	31.898	21.247	-2.210
5	4.820	(11)	51.642	-4.226	-2.210
6	7.140	(11)	12.288	-29.700	-2.210
7	8.090	(11)	-20.627	-39.328	-2.210
8	8.490	(11)	-37.083	-42.901	-2.210
9	9.290	(11)	-73.996	-49.193	-2.210
JTAN	9.640	(11)	-91.639	-51.587	-2.210

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-90.436	49.338	-1.890
1	.350	(11)	-73.580	46.943	-1.890
2	1.150	(11)	-38.467	40.651	-1.890
3	1.550	(11)	-22.912	37.078	-1.890
4	2.500	(11)	7.866	27.450	-1.890
5	5.000	(11)	42.179	-.000	-1.890
6	7.500	(11)	7.866	-27.450	-1.890
7	8.450	(11)	-22.912	-37.078	-1.890
8	8.850	(11)	-38.467	-40.651	-1.890
9	9.650	(11)	-73.580	-46.943	-1.890
JTAN	10.000	(11)	-90.436	-49.337	-1.890

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-91.639	51.587	-2.210
1	.350	(11)	-73.996	49.193	-2.210
2	1.150	(11)	-37.083	42.901	-2.210
3	1.550	(11)	-20.627	39.328	-2.210
4	2.500	(11)	12.288	29.700	-2.210
5	4.820	(11)	51.642	4.226	-2.210
6	7.140	(11)	31.898	-21.247	-2.210
7	8.090	(11)	7.013	-30.875	-2.210
8	8.490	(11)	-6.061	-34.448	-2.210
9	9.290	(11)	-36.213	-40.740	-2.210
JTAN	9.640	(11)	-50.897	-43.135	-2.210

= = MEMBER 4 (5 - 6) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-9.803	9.847	0.000
1	.350	(11)	-6.496	9.049	0.000
2	.750	(11)	-3.059	8.137	0.000
3	4.820	(11)	11.173	-1.143	0.000
4	8.890	(11)	-12.363	-10.423	0.000
5	9.290	(11)	-16.714	-11.335	0.000
JTAN	9.640	(11)	-20.821	-12.133	0.000

SHEAR MINIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-50.897	43.135	-2.210
1	.350	(11)	-36.213	40.740	-2.210
2	1.150	(11)	-6.061	34.448	-2.210
3	1.550	(11)	7.013	30.875	-2.210
4	2.500	(11)	31.898	21.247	-2.210
5	4.820	(11)	51.642	-4.226	-2.210
6	7.140	(11)	12.288	-29.700	-2.210
7	8.090	(11)	-20.627	-39.328	-2.210
8	8.490	(11)	-37.083	-42.901	-2.210
9	9.290	(11)	-73.996	-49.193	-2.210
JTAN	9.640	(11)	-91.639	-51.587	-2.210

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-90.436	49.338	-1.890
1	.350	(11)	-73.580	46.943	-1.890
2	1.150	(11)	-38.467	40.651	-1.890
3	1.550	(11)	-22.912	37.078	-1.890
4	2.500	(11)	7.865	27.450	-1.890
5	5.000	(11)	42.179	-.000	-1.890
6	7.500	(11)	7.866	-27.450	-1.890
7	8.450	(11)	-22.912	-37.078	-1.890
8	8.850	(11)	-38.467	-40.651	-1.890
9	9.650	(11)	-73.580	-46.943	-1.890
JTAN	10.000	(11)	-90.436	-49.337	-1.890

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-91.639	51.587	-2.210
1	.350	(11)	-73.996	49.193	-2.210
2	1.150	(11)	-37.083	42.901	-2.210
3	1.550	(11)	-20.627	39.328	-2.210
4	2.500	(11)	12.288	29.700	-2.210
5	4.820	(11)	51.642	4.226	-2.210
6	7.140	(11)	31.898	-21.247	-2.210
7	8.090	(11)	7.013	-30.875	-2.210
8	8.490	(11)	-6.061	-34.448	-2.210
9	9.290	(11)	-36.213	-40.740	-2.210
JTAN	9.640	(11)	-50.897	-43.135	-2.210

= = MEMBER 4 (5 - 6) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-9.803	9.847	0.000
1	.350	(11)	-6.496	9.049	0.000
2	.750	(11)	-3.059	8.137	0.000
3	4.820	(11)	11.173	-1.143	0.000
4	8.890	(11)	-12.363	-10.423	0.000
5	9.290	(11)	-16.714	-11.335	0.000
JTAN	9.640	(11)	-20.821	-12.133	0.000

No. 99

PICK UP 1

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(11)	-19.490	11.400	0.000
1	.350	(11)	-15.640	10.602	0.000
2	.750	(11)	-11.581	9.690	0.000
3	5.000	(11)	9.010	0.000	0.000
4	9.250	(11)	-11.581	-9.690	0.000
5	9.650	(11)	-15.640	-10.602	0.000
JTAN	10.000	(11)	-19.490	-11.400	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(11)	-20.821	12.133	0.000
1	.350	(11)	-16.714	11.335	0.000
2	.750	(11)	-12.363	10.423	0.000
3	4.820	(11)	11.173	1.143	0.000
4	8.890	(11)	-3.059	-8.137	0.000
5	9.290	(11)	-6.496	-9.049	0.000
JTAN	9.640	(11)	-9.803	-9.847	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(11)	7.697	-2.210	-117.215
JTAN	7.918	(11)	-9.803	-2.210	-126.954
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(11)	-1.203	.320	-114.975
JTAN	7.918	(11)	1.331	.320	-124.714
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(11)	1.203	-.320	-114.975
JTAN	7.918	(11)	-1.331	-.320	-124.714
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(11)	-7.697	2.210	-117.215
JTAN	7.918	(11)	9.803	2.210	-126.954

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(11)	-19.490	11.400	0.000
1	.350	(11)	-15.640	10.602	0.000
2	.750	(11)	-11.581	9.690	0.000
3	5.000	(11)	9.010	0.000	0.000
4	9.250	(11)	-11.581	-9.690	0.000
5	9.650	(11)	-15.640	-10.602	0.000
JTAN	10.000	(11)	-19.490	-11.400	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(11)	-20.821	12.133	0.000
1	.350	(11)	-16.714	11.335	0.000
2	.750	(11)	-12.363	10.423	0.000
3	4.820	(11)	11.173	1.143	0.000
4	8.890	(11)	-3.059	-8.137	0.000
5	9.290	(11)	-6.496	-9.049	0.000
JTAN	9.640	(11)	-9.803	-9.847	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(11)	7.697	-2.210	-117.215
JTAN	7.918	(11)	-9.803	-2.210	-126.954
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(11)	-1.203	.320	-114.975
JTAN	7.918	(11)	1.331	.320	-124.714
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(11)	1.203	-.320	-114.975
JTAN	7.918	(11)	-1.331	-.320	-124.714
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(11)	-7.697	2.210	-117.215
JTAN	7.918	(11)	9.803	2.210	-126.954

No. 100

PICK UP 1

AXIAL MAXIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-50.897	43.135	-2.210
1	.350	(11)	-36.213	40.740	-2.210
2	1.150	(11)	-6.061	34.448	-2.210
3	1.550	(11)	7.013	30.875	-2.210
4	2.500	(11)	31.898	21.247	-2.210
5	4.820	(11)	51.642	-4.226	-2.210
6	7.140	(11)	12.288	-29.700	-2.210
7	8.090	(11)	-20.627	-39.328	-2.210
8	8.490	(11)	-37.083	-42.901	-2.210
9	9.290	(11)	-73.996	-49.193	-2.210
JTAN	9.640	(11)	-91.639	-51.587	-2.210

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-90.436	49.338	-1.890
1	.350	(11)	-73.580	46.943	-1.890
2	1.150	(11)	-38.467	40.651	-1.890
3	1.550	(11)	-22.912	37.078	-1.890
4	2.500	(11)	7.866	27.450	-1.890
5	5.000	(11)	42.179	-.000	-1.890
6	7.500	(11)	7.866	-27.450	-1.890
7	8.450	(11)	-22.912	-37.078	-1.890
8	8.850	(11)	-38.467	-40.651	-1.890
9	9.650	(11)	-73.580	-46.943	-1.890
JTAN	10.000	(11)	-90.436	-49.337	-1.890

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-91.639	51.587	-2.210
1	.350	(11)	-73.996	49.193	-2.210
2	1.150	(11)	-37.083	42.901	-2.210
3	1.550	(11)	-20.627	39.328	-2.210
4	2.500	(11)	12.288	29.700	-2.210
5	4.820	(11)	51.642	4.226	-2.210
6	7.140	(11)	31.898	-21.247	-2.210
7	8.090	(11)	7.013	-30.875	-2.210
8	8.490	(11)	-6.061	-34.448	-2.210
9	9.290	(11)	-36.213	-40.740	-2.210
JTAN	9.640	(11)	-50.897	-43.135	-2.210

= = MEMBER 4 (5 - 6) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-9.803	9.847	0.000
1	.350	(11)	-6.496	9.049	0.000
2	.750	(11)	-3.059	8.137	0.000
3	4.820	(11)	11.173	-1.143	0.000
4	8.890	(11)	-12.363	-10.423	0.000
5	9.290	(11)	-16.714	-11.335	0.000
JTAN	9.640	(11)	-20.821	-12.133	0.000

AXIAL MINIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-50.897	43.135	-2.210
1	.350	(11)	-36.213	40.740	-2.210
2	1.150	(11)	-6.061	34.448	-2.210
3	1.550	(11)	7.013	30.875	-2.210
4	2.500	(11)	31.898	21.247	-2.210
5	4.820	(11)	51.642	-4.226	-2.210
6	7.140	(11)	12.288	-29.700	-2.210
7	8.090	(11)	-20.627	-39.328	-2.210
8	8.490	(11)	-37.083	-42.901	-2.210
9	9.290	(11)	-73.996	-49.193	-2.210
JTAN	9.640	(11)	-91.639	-51.587	-2.210

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-90.436	49.338	-1.890
1	.350	(11)	-73.580	46.943	-1.890
2	1.150	(11)	-38.467	40.651	-1.890
3	1.550	(11)	-22.912	37.078	-1.890
4	2.500	(11)	7.866	27.450	-1.890
5	5.000	(11)	42.179	-.000	-1.890
6	7.500	(11)	7.866	-27.450	-1.890
7	8.450	(11)	-22.912	-37.078	-1.890
8	8.850	(11)	-38.467	-40.651	-1.890
9	9.650	(11)	-73.580	-46.943	-1.890
JTAN	10.000	(11)	-90.436	-49.337	-1.890

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-91.639	51.587	-2.210
1	.350	(11)	-73.996	49.193	-2.210
2	1.150	(11)	-37.083	42.901	-2.210
3	1.550	(11)	-20.627	39.328	-2.210
4	2.500	(11)	12.288	29.700	-2.210
5	4.820	(11)	51.642	4.226	-2.210
6	7.140	(11)	31.898	-21.247	-2.210
7	8.090	(11)	7.013	-30.875	-2.210
8	8.490	(11)	-6.061	-34.448	-2.210
9	9.290	(11)	-36.213	-40.740	-2.210
JTAN	9.640	(11)	-50.897	-43.135	-2.210

= = MEMBER 4 (5 - 6) G = =

	L	CASE	M	Q	N
ITAN	0.000	(11)	-9.803	9.847	0.000
1	.350	(11)	-6.496	9.049	0.000
2	.750	(11)	-3.059	8.137	0.000
3	4.820	(11)	11.173	-1.143	0.000
4	8.890	(11)	-12.363	-10.423	0.000
5	9.290	(11)	-16.714	-11.335	0.000
JTAN	9.640	(11)	-20.821	-12.133	0.000

No.101

PICK UP 1

AXIAL MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(11)	-19.490	11.400	0.000
1	.350	(11)	-15.640	10.602	0.000
2	.750	(11)	-11.581	9.690	0.000
3	5.000	(11)	9.010	0.000	0.000
4	9.250	(11)	-11.581	-9.690	0.000
5	9.650	(11)	-15.640	-10.602	0.000
JTAN	10.000	(11)	-19.490	-11.400	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(11)	-20.821	12.133	0.000
1	.350	(11)	-16.714	11.335	0.000
2	.750	(11)	-12.363	10.423	0.000
3	4.820	(11)	11.173	1.143	0.000
4	8.890	(11)	-3.059	-8.137	0.000
5	9.290	(11)	-6.496	-9.049	0.000
JTAN	9.640	(11)	-9.803	-9.847	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(11)	7.697	-2.210	-117.215
JTAN	7.918	(11)	-9.803	-2.210	-126.954
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(11)	-1.203	.320	-114.975
JTAN	7.918	(11)	1.331	.320	-124.714
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(11)	1.203	-.320	-114.975
JTAN	7.918	(11)	-1.331	-.320	-124.714
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(11)	-7.697	2.210	-117.215
JTAN	7.918	(11)	9.803	2.210	-126.954

AXIAL MINIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(11)	-19.490	11.400	0.000
1	.350	(11)	-15.640	10.602	0.000
2	.750	(11)	-11.581	9.690	0.000
3	5.000	(11)	9.010	0.000	0.000
4	9.250	(11)	-11.581	-9.690	0.000
5	9.650	(11)	-15.640	-10.602	0.000
JTAN	10.000	(11)	-19.490	-11.400	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(11)	-20.821	12.133	0.000
1	.350	(11)	-16.714	11.335	0.000
2	.750	(11)	-12.363	10.423	0.000
3	4.820	(11)	11.173	1.143	0.000
4	8.890	(11)	-3.059	-8.137	0.000
5	9.290	(11)	-6.496	-9.049	0.000
JTAN	9.640	(11)	-9.803	-9.847	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(11)	7.697	-2.210	-117.215
JTAN	7.918	(11)	-9.803	-2.210	-126.954
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(11)	-1.203	.320	-114.975
JTAN	7.918	(11)	1.331	.320	-124.714
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(11)	1.203	-.320	-114.975
JTAN	7.918	(11)	-1.331	-.320	-124.714
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(11)	-7.697	2.210	-117.215
JTAN	7.918	(11)	9.803	2.210	-126.954

No. 102

PICK UP 2

MOMENT MAXIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(20)	-2.316	23.147	-2.500
1	.350	(20)	5.511	21.550	-2.500
2	1.150	(13)	42.088	85.483	-4.382
3	1.550	(13)	72.354	75.586	-4.382
4	2.500	(13)	128.838	50.939	-4.382
5	4.820	(13)	171.125	-11.213	-4.382
6	7.140	(13)	76.807	-73.366	-4.382
7	8.090	(21)	.024	-20.609	-.447
8	8.490	(21)	-8.703	-22.991	-.447
9	9.290	(21)	-28.824	-27.186	-.447
JTAN	9.640	(21)	-38.623	-28.782	-.447
MAX	4.284	(13)	173.491	3.134	-4.382

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(20)	-44.686	29.772	-1.260
1	.350	(20)	-34.541	28.175	-1.260
2	1.150	(20)	-13.628	23.980	-1.260
3	1.550	(14)	-2.238	91.621	-3.195
4	2.500	(14)	69.238	66.974	-3.195
5	5.000	(14)	148.550	-.000	-3.195
6	7.500	(14)	69.238	-66.974	-3.195
7	8.450	(14)	-2.238	-91.621	-3.195
8	8.850	(21)	-13.628	-23.980	-1.260
9	9.650	(21)	-34.541	-28.175	-1.260
JTAN	10.000	(21)	-44.686	-29.772	-1.260
MAX	5.000	(14)	148.550	-.000	-3.195

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(20)	-38.623	28.782	-.447
1	.350	(20)	-28.824	27.186	-.447
2	1.150	(20)	-8.703	22.991	-.447
3	1.550	(20)	.024	20.609	-.447
4	2.500	(16)	27.323	58.942	-1.891
5	4.820	(17)	96.828	10.663	-2.947
6	7.140	(17)	68.114	-43.386	-2.947
7	8.090	(21)	27.596	-14.973	-2.500
8	8.490	(21)	21.124	-17.356	-2.500
9	9.290	(21)	5.511	-21.550	-2.500
JTAN	9.640	(21)	-2.316	-23.147	-2.500
MAX	5.356	(17)	93.690	-1.814	-2.947

MOMENT MINIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(12)	-113.389	118.183	-3.469
1	.350	(17)	-81.867	95.668	-1.891
2	1.150	(21)	-29.206	28.578	-.447
3	1.550	(21)	-18.245	26.195	-.447
4	2.500	(21)	3.677	19.777	-.447
5	4.820	(14)	20.915	-11.094	-1.890
6	7.140	(14)	-34.373	-36.568	-1.890
7	8.090	(14)	-73.813	-46.196	-1.890
8	8.490	(14)	-93.016	-49.769	-1.890
9	9.290	(15)	-170.391	-131.277	-3.735
JTAN	9.640	(15)	-211.309	-139.206	-3.735
MAX	4.284	(14)	25.282	-5.214	-1.890

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(15)	-208.924	135.236	-3.186
1	.350	(15)	-169.644	127.308	-3.186
2	1.150	(13)	-99.144	48.963	-2.159
3	1.550	(13)	-80.264	45.390	-2.159
4	2.500	(13)	-41.589	35.762	-2.159
5	5.000	(13)	13.503	8.312	-2.159
6	7.500	(20)	-2.559	-21.422	-1.260
7	8.450	(16)	-47.293	-81.282	-2.054
8	8.850	(16)	-76.520	-89.888	-2.054
9	9.650	(16)	-143.404	-106.359	-2.054
JTAN	10.000	(15)	-176.040	-113.253	-2.054
MAX	5.556	(13)	16.427	2.212	-2.159

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(17)	-181.253	118.118	-2.947
1	.350	(17)	-146.698	111.223	-2.947
2	1.150	(14)	-93.016	49.769	-1.890
3	1.550	(14)	-73.813	46.196	-1.890
4	2.500	(14)	-34.373	36.568	-1.890
5	4.820	(14)	20.915	11.094	-1.890
6	7.140	(20)	3.677	-19.777	-.447
7	8.090	(20)	-18.245	-26.195	-.447
8	8.490	(20)	-29.206	-28.578	-.447
9	9.290	(16)	-81.867	-95.668	-1.891
JTAN	9.640	(16)	-110.978	-102.562	-1.891
MAX	5.356	(14)	25.282	5.214	-1.890

No. 103

PICK UP 2

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(20)	17.594	2.036	0.000
1	.350	(20)	18.213	1.504	0.000
2	.750	(20)	18.693	.896	0.000
3	4.820	(14)	12.172	-.969	0.000
4	8.890	(21)	7.891	-2.420	0.000
5	9.290	(21)	6.801	-3.028	0.000
JTAN	9.640	(21)	5.648	-3.560	0.000
MAX	1.071	(20)	18.902	.408	0.000
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(20)	1.399	4.722	0.000
1	.350	(20)	2.958	4.190	0.000
2	.750	(20)	4.513	3.582	0.000
3	5.000	(13)	9.965	-.386	0.000
4	9.250	(21)	4.513	-3.582	0.000
5	9.650	(21)	2.958	-4.190	0.000
JTAN	10.000	(21)	1.399	-4.722	0.000
MAX	5.000	(13)	9.965	-.386	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(20)	5.648	3.560	0.000
1	.350	(20)	6.801	3.028	0.000
2	.750	(20)	7.891	2.420	0.000
3	4.820	(14)	12.172	.969	0.000
4	8.890	(21)	18.693	-.896	0.000
5	9.290	(21)	18.213	-1.504	0.000
JTAN	9.640	(21)	17.594	-2.036	0.000
MAX	8.569	(21)	18.902	-.408	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(21)	36.749	-8.514	-83.758
JTAN	7.918	(20)	17.594	5.567	-79.029
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(21)	37.279	-8.880	-74.164
JTAN	7.918	(20)	34.810	9.307	-85.636

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(21)	-30.665	11.094	0.000
1	.350	(21)	-26.875	10.562	0.000
2	.750	(21)	-22.772	9.954	0.000
3	4.820	(21)	5.149	3.767	0.000
4	8.890	(20)	-24.375	-11.478	0.000
5	9.290	(20)	-29.088	-12.086	0.000
JTAN	9.640	(20)	-33.411	-12.618	0.000
MAX	5.356	(20)	6.697	-6.105	0.000
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(21)	-27.387	10.479	0.000
1	.350	(21)	-23.812	9.947	0.000
2	.750	(21)	-19.955	9.339	0.000
3	5.000	(21)	6.007	2.879	0.000
4	9.250	(20)	-19.955	-9.339	0.000
5	9.650	(20)	-23.812	-9.947	0.000
JTAN	10.000	(20)	-27.387	-10.479	0.000
MAX	5.000	(21)	6.007	2.879	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(21)	-33.411	12.618	0.000
1	.350	(21)	-29.088	12.086	0.000
2	.750	(21)	-24.375	11.478	0.000
3	4.820	(20)	5.149	-3.767	0.000
4	8.890	(20)	-22.772	-9.954	0.000
5	9.290	(20)	-26.875	-10.562	0.000
JTAN	9.640	(20)	-30.665	-11.094	0.000
MAX	4.284	(21)	6.697	6.105	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(20)	-26.486	5.567	-72.536
JTAN	7.918	(21)	-30.665	-8.514	-90.251
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(20)	-38.883	9.307	-79.143
JTAN	7.918	(21)	-33.035	-8.880	-80.657

PICK UP 2

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(21)	38.883	-9.307	-79.143
JTAN	7.918	(20)	33.035	8.880	-80.657
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(21)	26.486	-5.567	-72.536
JTAN	7.918	(20)	30.665	8.514	-90.251

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(20)	-37.279	8.880	-74.164
JTAN	7.918	(21)	-34.810	-9.307	-85.636
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(20)	-36.749	8.514	-83.758
JTAN	7.918	(21)	-17.594	-5.567	-79.029

PICK UP 2

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(12)	-113.389	118.183	-3.469
1	.350	(12)	-75.698	110.255	-3.469
2	1.150	(12)	.416	91.315	-3.469
3	1.550	(12)	33.015	81.418	-3.469
4	2.500	(12)	95.039	56.771	-3.469
5	4.820	(21)	29.858	2.793	-.447
6	7.140	(21)	16.638	-14.190	-.447
7	8.090	(21)	.024	-20.609	-.447
8	8.490	(21)	-8.703	-22.991	-.447
9	9.290	(21)	-28.824	-27.186	-.447
JTAN	9.640	(21)	-38.623	-28.782	-.447
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(15)	-208.924	135.236	-3.186
1	.350	(15)	-169.644	127.308	-3.186
2	1.150	(15)	-88.730	108.368	-3.186
3	1.550	(15)	-53.120	98.470	-3.186
4	2.500	(15)	17.680	73.822	-3.186
5	5.000	(13)	13.503	8.312	-2.159
6	7.500	(21)	13.048	-15.179	-1.260
7	8.450	(21)	-4.506	-21.598	-1.260
8	8.850	(21)	-13.628	-23.980	-1.260
9	9.650	(21)	-34.541	-28.175	-1.260
JTAN	10.000	(21)	-44.686	-29.772	-1.260
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(17)	-181.253	118.118	-2.947
1	.350	(17)	-146.698	111.223	-2.947
2	1.150	(17)	-75.428	94.753	-2.947
3	1.550	(17)	-44.008	86.146	-2.947
4	2.500	(17)	19.638	64.712	-2.947
5	4.820	(14)	20.915	11.094	-1.890
6	7.140	(21)	38.856	-8.555	-2.500
7	8.090	(21)	27.596	-14.973	-2.500
8	8.490	(21)	21.124	-17.356	-2.500
9	9.290	(21)	5.511	-21.550	-2.500
JTAN	9.640	(21)	-2.316	-23.147	-2.500
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(21)	-33.665	11.094	0.000
1	.350	(21)	-26.875	10.562	0.000
2	.750	(21)	-22.772	9.954	0.000
3	4.820	(21)	5.149	3.767	0.000
4	8.890	(21)	7.891	-2.420	0.000
5	9.290	(21)	6.801	-3.028	0.000
JTAN	9.640	(21)	5.648	-3.560	0.000

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(20)	-2.316	23.147	-2.500
1	.350	(20)	5.511	21.550	-2.500
2	1.150	(20)	21.124	17.356	-2.500
3	1.550	(20)	27.596	14.973	-2.500
4	2.500	(28)	38.856	8.555	-2.500
5	4.820	(15)	124.742	-15.638	-3.735
6	7.140	(15)	26.996	-77.792	-3.735
7	8.090	(15)	-48.251	-102.439	-3.735
8	8.490	(15)	-85.733	-112.337	-3.735
9	9.290	(15)	-170.391	-131.277	-3.735
JTAN	9.640	(15)	-211.309	-139.206	-3.735
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(20)	-44.686	29.772	-1.260
1	.350	(20)	-34.541	28.175	-1.260
2	1.150	(20)	-13.628	23.980	-1.260
3	1.550	(20)	-4.506	21.598	-1.260
4	2.500	(20)	13.048	15.179	-1.260
5	5.000	(20)	28.121	-3.122	-1.260
6	7.500	(14)	69.238	-66.974	-3.195
7	8.450	(14)	-2.238	-91.621	-3.195
8	8.850	(14)	-38.817	-101.519	-3.195
9	9.650	(14)	-122.891	-120.458	-3.195
JTAN	10.000	(14)	-164.064	-128.386	-3.195
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(20)	-38.623	28.782	-.447
1	.350	(20)	-28.824	27.186	-.447
2	1.150	(20)	-8.703	22.991	-.447
3	1.550	(20)	.024	20.609	-.447
4	2.500	(20)	16.638	14.190	-.447
5	4.820	(20)	29.858	-2.793	-.447
6	7.140	(16)	50.025	-49.157	-1.891
7	8.090	(16)	2.157	-70.590	-1.891
8	8.490	(16)	-23.041	-79.197	-1.891
9	9.290	(16)	-81.867	-95.668	-1.891
JTAN	9.640	(16)	-110.978	-102.562	-1.891
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(20)	17.594	2.036	0.000
1	.350	(20)	18.213	1.504	0.000
2	.750	(20)	18.693	.896	0.000
3	4.820	(20)	9.749	-5.291	0.000
4	8.890	(20)	-24.375	-11.478	0.000
5	9.290	(16)	-23.666	-12.086	0.000
JTAN	9.640	(16)	-28.017	-12.780	0.000

PICK UP 2

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(14)	-20.723	11.400	0.000
1	.350	(17)	-20.301	10.700	0.000
2	.750	(17)	-16.180	9.907	0.000
3	5.000	(21)	6.007	2.879	0.000
4	9.250	(21)	4.513	-3.582	0.000
5	9.650	(21)	2.958	-4.190	0.000
JTAN	10.000	(21)	1.399	-4.722	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(17)	-28.017	12.780	0.000
1	.350	(17)	-23.666	12.086	0.000
2	.750	(21)	-24.375	11.478	0.000
3	4.820	(21)	9.749	5.291	0.000
4	8.890	(21)	18.693	-.896	0.000
5	9.290	(21)	18.213	-1.504	0.000
JTAN	9.640	(21)	17.594	-2.036	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(20)	-26.486	5.567	-72.536
JTAN	7.918	(20)	17.594	5.567	-79.029
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(20)	-38.883	9.307	-79.143
JTAN	7.918	(20)	34.810	9.307	-85.636
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(20)	-37.279	8.880	-74.164
JTAN	7.918	(20)	33.035	8.880	-80.657
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(20)	-36.749	8.514	-83.758
JTAN	7.918	(20)	30.665	8.514	-90.251

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(20)	1.399	4.722	0.000
1	.350	(20)	2.958	4.190	0.000
2	.750	(20)	4.513	3.582	0.000
3	5.000	(20)	6.007	-2.879	0.000
4	9.250	(13)	-12.268	-10.076	0.000
5	9.650	(13)	-16.481	-10.988	0.000
JTAN	10.000	(13)	-20.466	-11.786	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(20)	5.648	3.560	0.000
1	.350	(20)	6.801	3.028	0.000
2	.750	(20)	7.891	2.420	0.000
3	4.820	(20)	5.149	-3.767	0.000
4	8.890	(20)	-22.772	-9.954	0.000
5	9.290	(20)	-26.875	-10.562	0.000
JTAN	9.640	(20)	-30.665	-11.094	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(21)	36.749	-8.514	-83.758
JTAN	7.918	(21)	-30.665	-8.514	-90.251
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(21)	37.279	-8.880	-74.164
JTAN	7.918	(21)	-33.035	-8.880	-80.657
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(21)	38.883	-9.307	-79.143
JTAN	7.918	(21)	-34.810	-9.307	-85.636
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(21)	26.486	-5.567	-72.536
JTAN	7.918	(21)	-17.594	-5.567	-79.029

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PICK UP 2

AXIAL MAXIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(19)	-32.973	35.792	.542
1	.350	(19)	-20.805	33.710	.542
2	1.150	(19)	4.041	28.239	.542
3	1.550	(19)	14.723	25.131	.542
4	2.500	(19)	34.731	16.759	.542
5	4.820	(19)	47.916	-5.393	.542
6	7.140	(19)	9.708	-27.545	.542
7	8.090	(19)	-20.547	-35.917	.542
8	8.490	(19)	-35.543	-39.024	.542
9	9.290	(19)	-69.017	-44.496	.542
JTAN	9.640	(19)	-84.961	-46.578	.542

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(19)	-78.637	42.904	2.113
1	.350	(19)	-63.980	40.822	2.113
2	1.150	(19)	-33.445	35.350	2.113
3	1.550	(19)	-19.918	32.243	2.113
4	2.500	(19)	6.846	23.871	2.113
5	5.000	(19)	36.685	.000	2.113
6	7.500	(19)	6.846	-23.871	2.113
7	8.450	(19)	-19.918	-32.243	2.113
8	8.850	(19)	-33.445	-35.350	2.113
9	9.650	(19)	-63.980	-40.822	2.113
JTAN	10.000	(19)	-78.637	-42.904	2.113

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(19)	-84.961	46.578	.542
1	.350	(19)	-69.017	44.496	.542
2	1.150	(19)	-35.543	39.024	.542
3	1.550	(19)	-20.547	35.917	.542
4	2.500	(19)	9.708	27.545	.542
5	4.820	(19)	47.916	5.393	.542
6	7.140	(19)	34.731	-16.759	.542
7	8.090	(19)	14.723	-25.131	.542
8	8.490	(19)	4.041	-28.239	.542
9	9.290	(19)	-20.805	-33.710	.542
JTAN	9.640	(19)	-32.973	-35.792	.542

= = MEMBER 4 (5 - 6) G = =

	L	CASE	M	Q	N
ITAN	0.000	(12)	-11.731	9.960	0.000
1	.350	(12)	-8.384	9.162	0.000
2	.750	(12)	-4.902	8.250	0.000
3	4.820	(12)	9.790	-1.030	0.000
4	8.890	(12)	-13.286	-10.310	0.000
5	9.290	(12)	-17.592	-11.222	0.000
JTAN	9.640	(12)	-21.560	-12.020	0.000

AXIAL MINIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(13)	-65.010	112.351	-4.382
1	.350	(13)	-29.360	104.423	-4.382
2	1.150	(13)	42.088	85.483	-4.382
3	1.550	(13)	72.354	75.586	-4.382
4	2.500	(13)	128.838	50.939	-4.382
5	4.820	(13)	171.125	-11.213	-4.382
6	7.140	(13)	76.807	-73.366	-4.382
7	8.090	(13)	-.981	-98.013	-4.382
8	8.490	(13)	-40.219	-107.910	-4.382
9	9.290	(13)	-129.608	-126.850	-4.382
JTAN	9.640	(13)	-173.107	-134.778	-4.382

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(14)	-164.064	128.386	-3.195
1	.350	(14)	-122.891	120.458	-3.195
2	1.150	(14)	-38.817	101.519	-3.195
3	1.550	(14)	-2.238	91.521	-3.195
4	2.500	(14)	69.238	66.974	-3.195
5	5.000	(14)	148.550	-.000	-3.195
6	7.500	(14)	69.238	-66.974	-3.195
7	8.450	(14)	-2.238	-91.621	-3.195
8	8.850	(14)	-38.817	-101.519	-3.195
9	9.650	(14)	-122.891	-120.458	-3.195
JTAN	10.000	(14)	-164.064	-128.386	-3.195

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(17)	-181.253	118.118	-2.947
1	.350	(17)	-146.698	111.223	-2.947
2	1.150	(17)	-75.428	94.753	-2.947
3	1.550	(17)	-44.008	86.146	-2.947
4	2.500	(17)	18.638	64.712	-2.947
5	4.820	(17)	96.828	10.663	-2.947
6	7.140	(17)	68.114	-43.386	-2.947
7	8.090	(17)	25.727	-64.820	-2.947
8	8.490	(17)	2.838	-73.427	-2.947
9	9.290	(17)	-51.372	-89.897	-2.947
JTAN	9.640	(17)	-78.463	-96.792	-2.947

= = MEMBER 4 (5 - 6) G = =

	L	CASE	M	Q	N
ITAN	0.000	(12)	-11.731	9.960	0.000
1	.350	(12)	-8.384	9.162	0.000
2	.750	(12)	-4.902	8.250	0.000
3	4.820	(12)	9.790	-1.030	0.000
4	8.890	(12)	-13.286	-10.310	0.000
5	9.290	(12)	-17.592	-11.222	0.000
JTAN	9.640	(12)	-21.660	-12.020	0.000

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PICK UP 2

AXIAL MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(12)	-17.576	11.173	0.000
1	.350	(12)	-13.805	10.375	0.000
2	.750	(12)	-9.837	9.463	0.000
3	5.000	(12)	9.791	-.227	0.000
4	9.250	(12)	-11.764	-9.917	0.000
5	9.650	(12)	-15.913	-10.829	0.000
JTAN	10.000	(12)	-19.843	-11.627	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(12)	-21.546	12.228	0.000
1	.350	(12)	-17.406	11.430	0.000
2	.750	(12)	-13.017	10.518	0.000
3	4.820	(12)	10.909	1.239	0.000
4	8.890	(12)	-2.933	-8.041	0.000
5	9.290	(12)	-6.332	-8.953	0.000
JTAN	9.640	(12)	-9.605	-9.751	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(20)	-26.486	5.567	-72.536
JTAN	7.918	(20)	17.594	5.567	-79.029
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(21)	37.279	-8.880	-74.164
JTAN	7.918	(21)	-33.035	-8.880	-80.657
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(20)	-37.279	8.880	-74.164
JTAN	7.916	(20)	33.035	8.880	-80.657
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(21)	26.486	-5.567	-72.536
JTAN	7.918	(21)	-17.594	-5.567	-79.029

AXIAL MINIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(12)	-17.576	11.173	0.000
1	.350	(12)	-13.805	10.375	0.000
2	.750	(12)	-9.837	9.463	0.000
3	5.000	(12)	9.791	-.227	0.000
4	9.250	(12)	-11.764	-9.917	0.000
5	9.650	(12)	-15.913	-10.829	0.000
JTAN	10.000	(12)	-19.843	-11.627	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(12)	-21.546	12.228	0.000
1	.350	(12)	-17.406	11.430	0.000
2	.750	(12)	-13.017	10.518	0.000
3	4.820	(12)	10.909	1.239	0.000
4	8.890	(12)	-2.933	-8.041	0.000
5	9.290	(12)	-6.332	-8.953	0.000
JTAN	9.640	(12)	-9.605	-9.751	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(12)	15.739	-3.469	-262.158
JTAN	7.918	(12)	-11.731	-3.469	-271.897
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(15)	-2.385	.548	-249.697
JTAN	7.918	(15)	1.957	.548	-259.436
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(17)	21.264	-5.041	-206.643
JTAN	7.918	(17)	-18.651	-5.041	-215.112
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(16)	-26.061	6.039	-217.113
JTAN	7.918	(16)	21.759	6.039	-225.582

PICK UP 3

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(14)	-48.521	36.267	-1.890
1	.350	(13)	-29.360	104.423	-4.382
2	1.150	(13)	42.088	85.483	-4.382
3	1.550	(13)	72.354	75.586	-4.382
4	2.500	(13)	128.838	50.939	-4.382
5	4.820	(13)	171.125	-11.213	-4.382
6	7.140	(13)	76.807	-73.366	-4.382
7	8.090	(13)	-.981	-98.013	-4.382
8	8.490	(12)	-39.083	-102.078	-3.469
9	9.290	(12)	-123.806	-121.017	-3.469
JTAN	9.640	(14)	-155.470	-58.455	-1.890
MAX	4.284	(13)	173.491	3.134	-4.382
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(12)	-154.835	56.992	-1.636
1	.350	(14)	-122.891	120.458	-3.195
2	1.150	(14)	-38.817	101.519	-3.195
3	1.550	(14)	-2.238	91.621	-3.195
4	2.500	(14)	69.238	66.974	-3.195
5	5.000	(14)	148.550	-.000	-3.195
6	7.500	(14)	69.238	-66.974	-3.195
7	8.450	(14)	-2.238	-91.621	-3.195
8	8.850	(12)	-35.119	-32.996	-1.636
9	9.650	(13)	-63.605	-38.631	-2.159
JTAN	10.000	(13)	-77.551	-41.025	-2.159
MAX	5.000	(14)	148.550	-.000	-3.195
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(13)	-79.269	50.171	-2.446
1	.350	(13)	-62.122	47.776	-2.446
2	1.150	(13)	-26.342	41.484	-2.446
3	1.550	(13)	-10.453	37.911	-2.446
4	2.500	(16)	27.323	58.942	-1.891
5	4.820	(17)	96.828	10.663	-2.947
6	7.140	(17)	68.114	-43.386	-2.947
7	8.090	(17)	25.727	-64.820	-2.947
8	8.490	(17)	2.838	-73.427	-2.947
9	9.290	(12)	-36.032	-41.851	-2.212
JTAN	9.640	(14)	-49.521	-36.267	-1.890
MAX	5.356	(17)	99.690	-1.814	-2.947

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(12)	-113.389	118.183	-3.469
1	.350	(17)	-81.867	95.668	-1.891
2	1.150	(17)	-23.041	79.197	-1.891
3	1.550	(14)	-1.256	24.007	-1.890
4	2.500	(14)	17.105	14.379	-1.890
5	4.820	(14)	20.915	-11.094	-1.890
6	7.140	(14)	-34.373	-36.568	-1.890
7	8.090	(14)	-73.813	-46.196	-1.890
8	8.490	(14)	-93.016	-49.769	-1.890
9	9.290	(15)	-170.391	-131.277	-3.735
JTAN	9.640	(15)	-211.309	-139.206	-3.735
MAX	4.284	(14)	25.282	-5.214	-1.890
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(15)	-208.924	135.236	-3.186
1	.350	(15)	-169.644	127.308	-3.186
2	1.150	(13)	-99.144	48.963	-2.159
3	1.550	(13)	-80.264	45.390	-2.159
4	2.500	(13)	-41.589	35.762	-2.159
5	5.000	(13)	13.503	8.312	-2.159
6	7.500	(13)	-.029	-19.138	-2.159
7	8.450	(16)	-47.293	-81.282	-2.054
8	8.850	(16)	-76.520	-89.888	-2.054
9	9.650	(16)	-143.404	-106.359	-2.054
JTAN	10.000	(16)	-176.040	-113.253	-2.054
MAX	5.556	(13)	16.427	2.212	-2.159
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(17)	-181.253	118.118	-2.947
1	.350	(17)	-146.698	111.223	-2.947
2	1.150	(14)	-93.016	49.769	-1.890
3	1.550	(14)	-73.813	46.196	-1.890
4	2.500	(14)	-34.373	36.568	-1.890
5	4.820	(14)	20.915	11.094	-1.890
6	7.140	(14)	17.105	-14.379	-1.890
7	8.090	(14)	-1.256	-24.007	-1.890
8	8.490	(16)	-23.041	-79.197	-1.891
9	9.290	(16)	-81.867	-95.668	-1.891
JTAN	9.640	(16)	-110.978	-102.562	-1.891
MAX	5.356	(14)	25.282	5.214	-1.890

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PICK UP 3

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(16)	3.055	6.333	0.000
1	.350	(16)	5.151	5.639	0.000
2	.750	(16)	7.248	4.846	0.000
3	4.820	(14)	12.172	-.969	0.000
4	8.890	(17)	-2.399	-6.635	0.000
5	9.290	(17)	-5.212	-7.428	0.000
JTAN	9.640	(17)	-7.933	-8.122	0.000
MAX	3.213	(16)	13.170	-.038	0.000
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(16)	-9.366	8.433	0.000
1	.350	(16)	-6.536	7.739	0.000
2	.750	(16)	-3.599	6.946	0.000
3	5.000	(13)	9.965	-.386	0.000
4	9.250	(17)	-3.599	-6.946	0.000
5	9.650	(17)	-6.536	-7.739	0.000
JTAN	10.000	(17)	-9.366	-8.433	0.000
MAX	5.000	(13)	9.965	-.386	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(16)	-7.933	8.122	0.000
1	.350	(16)	-5.212	7.428	0.000
2	.750	(16)	-2.399	6.635	0.000
3	4.820	(14)	12.172	.969	0.000
4	8.890	(17)	7.248	-4.846	0.000
5	9.290	(17)	5.151	-5.639	0.000
JTAN	9.640	(17)	3.055	-6.333	0.000
MAX	6.427	(17)	13.170	.038	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(17)	26.061	-6.039	-217.113
JTAN	7.918	(16)	3.055	1.201	-219.812
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(17)	17.897	-4.311	-204.083
JTAN	7.918	(16)	18.651	5.041	-215.112

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(17)	-21.759	10.991	0.000
1	.350	(17)	-18.033	10.297	0.000
2	.750	(17)	-14.073	9.504	0.000
3	4.820	(17)	8.185	1.434	0.000
4	8.890	(16)	-18.990	-11.293	0.000
5	9.290	(16)	-23.666	-12.086	0.000
JTAN	9.640	(16)	-28.017	-12.780	0.000
MAX	5.356	(13)	8.339	-2.142	0.000
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(17)	-24.167	11.394	0.000
1	.350	(17)	-20.301	10.700	0.000
2	.750	(17)	-16.180	9.907	0.000
3	5.000	(14)	7.777	-.000	0.000
4	9.250	(15)	-16.180	-9.907	0.000
5	9.650	(16)	-20.301	-10.700	0.000
JTAN	10.000	(16)	-24.167	-11.394	0.000
MAX	5.000	(14)	7.777	-.000	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(17)	-28.017	12.780	0.000
1	.350	(17)	-23.666	12.086	0.000
2	.750	(17)	-18.990	11.293	0.000
3	4.820	(16)	8.185	-1.434	0.000
4	8.890	(16)	-14.073	-9.504	0.000
5	9.290	(16)	-18.033	-10.297	0.000
JTAN	9.640	(16)	-21.759	-10.991	0.000
MAX	4.284	(17)	8.540	4.285	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(16)	-6.453	1.201	-211.343
JTAN	7.918	(17)	-21.759	-6.039	-225.582
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(16)	-21.264	5.041	-206.643
JTAN	7.918	(17)	-16.234	-4.311	-212.552

No. 111

PICK UP 3

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(17)	21.264	-5.041	-206.643
JTAN	7.918	(16)	16.234	4.311	-212.552
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(17)	6.453	-1.201	-211.343
JTAN	7.918	(16)	21.759	6.039	-225.582

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(16)	-17.897	4.311	-204.083
JTAN	7.918	(17)	-18.651	-5.041	-215.112
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(16)	-26.061	6.039	-217.113
JTAN	7.918	(17)	-3.055	-1.201	-219.812

No. 112

PICK UP 3

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(12)	-113.389	118.183	-3.469
1	.350	(12)	-75.698	110.255	-3.469
2	1.150	(12)	.416	91.315	-3.469
3	1.550	(12)	33.015	81.418	-3.469
4	2.500	(12)	95.039	56.771	-3.469
5	4.820	(17)	92.126	-4.893	-1.891
6	7.140	(14)	-34.373	-36.568	-1.890
7	8.090	(14)	-73.813	-46.196	-1.890
8	8.490	(14)	-93.016	-49.769	-1.890
9	9.290	(14)	-135.423	-56.061	-1.890
JTAN	9.640	(14)	-155.470	-58.455	-1.890
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(15)	-208.924	135.236	-3.186
1	.350	(15)	-169.644	127.308	-3.186
2	1.150	(15)	-88.730	108.368	-3.186
3	1.550	(15)	-53.120	98.470	-3.186
4	2.500	(15)	17.680	73.822	-3.186
5	5.000	(13)	13.503	8.312	-2.159
6	7.500	(13)	-.029	-19.138	-2.159
7	8.450	(13)	-22.910	-28.766	-2.159
8	8.850	(13)	-35.141	-32.339	-2.159
9	9.650	(13)	-63.605	-38.631	-2.159
JTAN	10.000	(13)	-77.551	-41.025	-2.159
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(17)	-181.253	118.118	-2.947
1	.350	(17)	-146.698	111.223	-2.947
2	1.150	(17)	-75.428	94.753	-2.947
3	1.550	(17)	-44.008	86.146	-2.947
4	2.500	(17)	18.638	64.712	-2.947
5	4.820	(14)	20.915	11.094	-1.890
6	7.140	(14)	17.105	-14.379	-1.890
7	8.090	(14)	-1.256	-24.007	-1.890
8	8.490	(14)	-11.583	-27.580	-1.890
9	9.290	(14)	-36.240	-33.872	-1.890
JTAN	9.640	(14)	-48.521	-36.267	-1.890
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(17)	-21.759	10.991	0.000
1	.350	(17)	-18.033	10.297	0.000
2	.750	(17)	-14.073	9.504	0.000
3	4.820	(17)	8.185	1.434	0.000
4	8.890	(17)	-2.399	-6.635	0.000
5	9.290	(17)	-5.212	-7.428	0.000
JTAN	9.640	(17)	-7.933	-8.122	0.000

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(14)	-48.521	36.267	-1.890
1	.350	(14)	-36.240	33.872	-1.890
2	1.150	(14)	-11.583	27.580	-1.890
3	1.550	(14)	-1.256	24.007	-1.890
4	2.500	(14)	17.105	14.379	-1.890
5	4.820	(15)	124.742	-15.638	-3.735
6	7.140	(15)	26.996	-77.792	-3.735
7	8.090	(15)	-48.251	-102.439	-3.735
8	8.490	(15)	-85.733	-112.337	-3.735
9	9.290	(15)	-170.391	-131.277	-3.735
JTAN	9.640	(15)	-211.309	-139.206	-3.735
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(12)	-154.835	56.992	-1.636
1	.350	(12)	-135.300	54.598	-1.636
2	1.150	(12)	-94.063	48.306	-1.636
3	1.550	(12)	-75.445	44.733	-1.636
4	2.500	(12)	-37.395	35.105	-1.636
5	5.000	(16)	76.225	-1.605	-2.054
6	7.500	(14)	69.238	-66.974	-3.195
7	8.450	(14)	-2.238	-91.621	-3.195
8	8.850	(14)	-38.817	-101.519	-3.195
9	9.650	(14)	-122.891	-120.458	-3.195
JTAN	10.000	(14)	-164.064	-128.386	-3.195
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(13)	-79.269	50.171	-2.446
1	.350	(13)	-62.122	47.776	-2.446
2	1.150	(13)	-26.342	41.484	-2.446
3	1.550	(13)	-10.453	37.911	-2.446
4	2.500	(13)	21.116	28.283	-2.446
5	4.820	(13)	57.184	2.810	-2.446
6	7.140	(16)	50.025	-49.157	-1.891
7	8.090	(16)	2.157	-70.590	-1.891
8	8.490	(16)	-23.041	-79.197	-1.891
9	9.290	(16)	-81.867	-95.668	-1.891
JTAN	9.640	(16)	-110.978	-102.562	-1.891
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(16)	3.055	6.333	0.000
1	.350	(16)	5.151	5.639	0.000
2	.750	(16)	7.248	4.846	0.000
3	4.820	(16)	10.550	-3.223	0.000
4	8.890	(16)	-18.990	-11.293	0.000
5	9.290	(16)	-23.666	-12.086	0.000
JTAN	9.640	(16)	-28.017	-12.780	0.000

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No. 113

PICK UP 3

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(14)	-20.723	11.400	0.000
1	.350	(17)	-20.301	10.700	0.000
2	.750	(17)	-16.180	9.907	0.000
3	5.000	(17)	8.017	1.480	0.000
4	9.250	(17)	-3.599	-6.946	0.000
5	9.650	(17)	-6.536	-7.739	0.000
JTAN	10.000	(17)	-9.366	-8.433	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(17)	-28.017	12.780	0.000
1	.350	(17)	-23.666	12.086	0.000
2	.750	(17)	-18.990	11.293	0.000
3	4.820	(17)	10.550	3.223	0.000
4	8.890	(17)	7.248	-4.846	0.000
5	9.290	(17)	5.151	-5.639	0.000
JTAN	9.640	(17)	3.055	-6.333	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(16)	-6.453	1.201	-211.343
JTAN	7.918	(16)	3.055	1.201	-219.812
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(16)	-21.264	5.041	-206.643
JTAN	7.918	(16)	18.651	5.041	-215.112
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(16)	-17.897	4.311	-204.083
JTAN	7.918	(16)	16.234	4.311	-212.552
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(16)	-26.061	6.039	-217.113
JTAN	7.918	(16)	21.759	6.039	-225.582

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(16)	-9.366	8.433	0.000
1	.350	(16)	-6.536	7.739	0.000
2	.750	(16)	-3.599	6.946	0.000
3	5.000	(16)	8.017	-1.480	0.000
4	9.250	(13)	-12.268	-10.076	0.000
5	9.650	(13)	-16.481	-10.988	0.000
JTAN	10.000	(13)	-20.466	-11.786	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(16)	-7.933	8.122	0.000
1	.350	(16)	-5.212	7.428	0.000
2	.750	(16)	-2.399	6.635	0.000
3	4.820	(16)	8.185	-1.434	0.000
4	8.890	(16)	-14.073	-9.504	0.000
5	9.290	(16)	-18.033	-10.297	0.000
JTAN	9.640	(16)	-21.759	-10.991	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(17)	26.061	-6.039	-217.113
JTAN	7.918	(17)	-21.759	-6.039	-225.582
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(17)	17.897	-4.311	-204.083
JTAN	7.918	(17)	-16.234	-4.311	-212.552
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(17)	21.264	-5.041	-206.643
JTAN	7.918	(17)	-18.651	-5.041	-215.112
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(17)	6.453	-1.201	-211.343
JTAN	7.918	(17)	-3.055	-1.201	-219.812

No. 114

PICK UP 3

AXIAL MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(14)	-48.521	36.267	-1.890
1	.350	(14)	-36.240	33.872	-1.890
2	1.150	(14)	-11.583	27.580	-1.890
3	1.550	(14)	-1.256	24.007	-1.890
4	2.500	(14)	17.105	14.379	-1.890
5	4.820	(14)	20.915	-11.094	-1.890
6	7.140	(14)	-34.373	-36.568	-1.890
7	8.090	(14)	-73.813	-46.196	-1.890
8	8.490	(14)	-43.016	-49.769	-1.890
9	9.290	(14)	-135.423	-56.061	-1.890
JTAN	9.640	(14)	-155.470	-58.455	-1.890
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(12)	-154.835	56.992	-1.636
1	.350	(12)	-135.300	54.598	-1.636
2	1.150	(12)	-94.063	48.306	-1.636
3	1.550	(12)	-75.445	44.733	-1.636
4	2.500	(12)	-37.395	35.105	-1.636
5	5.000	(12)	14.055	7.655	-1.636
6	7.500	(12)	.879	-19.795	-1.636
7	8.450	(12)	-22.626	-29.423	-1.636
8	8.850	(12)	-35.119	-32.996	-1.636
9	9.650	(12)	-64.109	-39.288	-1.636
JTAN	10.000	(12)	-78.285	-41.683	-1.636
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(14)	-155.470	58.455	-1.890
1	.350	(14)	-135.423	56.061	-1.890
2	1.150	(14)	-93.016	49.769	-1.890
3	1.550	(14)	-73.813	46.196	-1.890
4	2.500	(14)	-34.373	36.568	-1.890
5	4.820	(14)	20.915	11.094	-1.890
6	7.140	(14)	17.105	-14.379	-1.890
7	8.090	(14)	-1.256	-24.007	-1.890
8	8.490	(14)	-11.583	-27.580	-1.890
9	9.290	(14)	-36.240	-33.872	-1.890
JTAN	9.640	(14)	-48.521	-36.267	-1.890
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(12)	-11.731	9.960	0.000
1	.350	(12)	-8.384	9.162	0.000
2	.750	(12)	-4.902	8.250	0.000
3	4.820	(12)	9.790	-1.030	0.000
4	8.890	(12)	-13.286	-10.310	0.000
5	9.290	(12)	-17.592	-11.222	0.000
JTAN	9.640	(12)	-21.660	-12.020	0.000

AXIAL MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(13)	-65.010	112.351	-4.382
1	.350	(13)	-29.360	104.423	-4.382
2	1.150	(13)	42.088	85.483	-4.382
3	1.550	(13)	72.354	75.586	-4.382
4	2.500	(13)	128.838	50.939	-4.382
5	4.820	(13)	171.125	-11.213	-4.382
6	7.140	(13)	76.807	-73.366	-4.382
7	8.090	(13)	-.981	-98.013	-4.382
8	8.490	(13)	-40.219	-107.910	-4.382
9	9.290	(13)	-129.608	-126.850	-4.382
JTAN	9.640	(13)	-173.107	-134.778	-4.382
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(14)	-164.064	128.386	-3.195
1	.350	(14)	-122.891	120.458	-3.195
2	1.150	(14)	-38.817	101.519	-3.195
3	1.550	(14)	-2.238	91.621	-3.195
4	2.500	(14)	69.238	66.974	-3.195
5	5.000	(14)	148.550	-.000	-3.195
6	7.500	(14)	69.238	-66.974	-3.195
7	8.450	(14)	-2.238	-91.621	-3.195
8	8.850	(14)	-38.817	-101.519	-3.195
9	9.650	(14)	-122.891	-120.458	-3.195
JTAN	10.000	(14)	-164.064	-128.386	-3.195
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(17)	-181.253	118.118	-2.947
1	.350	(17)	-146.698	111.223	-2.947
2	1.150	(17)	-75.428	94.753	-2.947
3	1.550	(17)	-44.008	86.146	-2.947
4	2.500	(17)	18.638	64.712	-2.947
5	4.820	(17)	96.828	10.663	-2.947
6	7.140	(17)	68.114	-43.386	-2.947
7	8.090	(17)	25.727	-64.820	-2.947
8	8.490	(17)	2.838	-73.427	-2.947
9	9.290	(17)	-51.372	-89.897	-2.947
JTAN	9.640	(17)	-78.463	-96.792	-2.947
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(12)	-11.731	9.960	0.000
1	.350	(12)	-8.384	9.162	0.000
2	.750	(12)	-4.902	8.250	0.000
3	4.820	(12)	9.790	-1.030	0.000
4	8.890	(12)	-13.286	-10.310	0.000
5	9.290	(12)	-17.592	-11.222	0.000
JTAN	9.640	(12)	-21.660	-12.020	0.000

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No. 115

PICK UP 3

AXIAL MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(12)	-17.576	11.173	0.000
1	.350	(12)	-13.805	10.375	0.000
2	.750	(12)	-9.837	9.463	0.000
3	5.000	(12)	9.791	-.227	0.000
4	9.250	(12)	-11.764	-9.917	0.000
5	9.650	(12)	-15.913	-10.829	0.000
JTAN	10.000	(12)	-19.843	-11.627	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(12)	-21.546	12.228	0.000
1	.350	(12)	-17.406	11.430	0.000
2	.750	(12)	-13.017	10.518	0.000
3	4.820	(12)	10.909	1.239	0.000
4	8.890	(12)	-2.933	-8.041	0.000
5	9.290	(12)	-6.332	-8.953	0.000
JTAN	9.640	(12)	-9.605	-9.751	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(14)	5.321	-1.890	-110.347
JTAN	7.918	(14)	-9.641	-1.890	-120.086
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(12)	-10.429	1.833	-193.193
JTAN	7.918	(12)	4.083	1.833	-202.932
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(13)	1.718	-.286	-105.246
JTAN	7.918	(13)	-.549	-.286	-114.985
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(14)	-5.321	1.890	-110.347
JTAN	7.918	(14)	9.641	1.890	-120.086

AXIAL MINIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(12)	-17.576	11.173	0.000
1	.350	(12)	-13.805	10.375	0.000
2	.750	(12)	-9.837	9.463	0.000
3	5.000	(12)	9.791	-.227	0.000
4	9.250	(12)	-11.764	-9.917	0.000
5	9.650	(12)	-15.913	-10.829	0.000
JTAN	10.000	(12)	-19.843	-11.627	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(12)	-21.546	12.228	0.000
1	.350	(12)	-17.406	11.430	0.000
2	.750	(12)	-13.017	10.518	0.000
3	4.820	(12)	10.909	1.239	0.000
4	8.890	(12)	-2.933	-8.041	0.000
5	9.290	(12)	-6.332	-8.953	0.000
JTAN	9.640	(12)	-9.605	-9.751	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(12)	15.739	-3.469	-262.158
JTAN	7.918	(12)	-11.731	-3.469	-271.897
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(15)	-2.385	.548	-249.697
JTAN	7.918	(15)	1.957	.548	-259.436
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(17)	21.264	-5.041	-206.643
JTAN	7.918	(17)	-18.651	-5.041	-215.112
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(16)	-26.061	6.039	-217.113
JTAN	7.918	(16)	21.759	6.039	-225.582

No. 116

PICK UP 4

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(19)	-32.973	35.792	.542
1	.350	(19)	-20.805	33.710	.542
2	1.150	(19)	4.041	28.239	.542
3	1.550	(19)	14.723	25.131	.542
4	2.500	(19)	34.731	16.759	.542
5	4.820	(19)	47.916	-5.393	.542
6	7.140	(18)	11.076	-25.140	-2.908
7	8.090	(18)	-16.894	-33.512	-2.908
8	8.490	(18)	-30.929	-36.620	-2.908
9	9.290	(18)	-62.479	-42.091	-2.908
JTAN	9.640	(18)	-77.581	-44.173	-2.908
MAX	4.284	(19)	49.435	-.279	.542
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(19)	-78.637	42.904	2.113
1	.350	(19)	-63.980	40.822	2.113
2	1.150	(19)	-33.445	35.350	2.113
3	1.550	(19)	-19.918	32.243	2.113
4	2.500	(19)	6.846	23.871	2.113
5	5.000	(19)	36.685	.000	2.113
6	7.500	(19)	6.846	-23.871	2.113
7	8.450	(19)	-19.918	-32.243	2.113
8	8.850	(19)	-33.445	-35.350	2.113
9	9.650	(19)	-63.980	-40.822	2.113
JTAN	10.000	(19)	-78.637	-42.904	2.113
MAX	5.000	(19)	36.685	.000	2.113
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(18)	-77.581	44.173	-2.908
1	.350	(18)	-62.479	42.091	-2.908
2	1.150	(18)	-30.929	36.620	-2.908
3	1.550	(18)	-16.894	33.512	-2.908
4	2.500	(18)	11.076	25.140	-2.908
5	4.820	(19)	47.916	5.393	.542
6	7.140	(19)	34.731	-16.759	.542
7	8.090	(19)	14.723	-25.131	.542
8	8.490	(19)	4.041	-28.239	.542
9	9.290	(19)	-20.805	-33.710	.542
JTAN	9.640	(19)	-32.973	-35.792	.542
MAX	5.356	(19)	49.435	.279	.542

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(18)	-48.775	38.197	-2.908
1	.350	(18)	-35.765	36.115	-2.908
2	1.150	(18)	-8.995	30.643	-2.908
3	1.550	(18)	2.649	27.536	-2.908
4	2.500	(18)	24.942	19.164	-2.908
5	4.820	(18)	43.705	-2.988	-2.908
6	7.140	(19)	9.708	-27.545	.542
7	8.090	(19)	-20.547	-35.917	.542
8	8.490	(19)	-35.543	-39.024	.542
9	9.290	(19)	-69.017	-44.496	.542
JTAN	9.640	(19)	-84.961	-46.578	.542
MAX	4.284	(18)	43.936	2.125	-2.908
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(18)	-78.645	42.904	-3.146
1	.350	(18)	-63.988	40.822	-3.146
2	1.150	(18)	-33.453	35.350	-3.146
3	1.550	(18)	-19.926	32.243	-3.146
4	2.500	(18)	6.838	23.871	-3.146
5	5.000	(18)	36.676	-.000	-3.146
6	7.500	(18)	6.838	-23.871	-3.146
7	8.450	(18)	-19.926	-32.243	-3.146
8	8.850	(18)	-33.453	-35.350	-3.146
9	9.650	(18)	-63.988	-40.822	-3.146
JTAN	10.000	(18)	-78.645	-42.904	-3.146
MAX	5.000	(18)	36.676	-.000	-3.146
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(19)	-84.961	46.578	.542
1	.350	(19)	-69.017	44.496	.542
2	1.150	(19)	-35.543	39.024	.542
3	1.550	(19)	-20.547	35.917	.542
4	2.500	(19)	9.708	27.545	.542
5	4.820	(18)	43.705	2.988	-2.908
6	7.140	(18)	24.942	-19.164	-2.908
7	8.090	(18)	2.649	-27.536	-2.908
8	8.490	(18)	-8.995	-30.643	-2.908
9	9.290	(18)	-35.765	-36.115	-2.908
JTAN	9.640	(18)	-48.775	-38.197	-2.908
MAX	5.356	(18)	43.936	-2.125	-2.908

PICK UP 4

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(19)	-.299	7.230	0.000
1	.350	(19)	2.110	6.536	0.000
2	.750	(19)	4.565	5.743	0.000
3	4.820	(19)	11.516	-2.327	0.000
4	8.890	(18)	-9.301	-8.530	0.000
5	9.290	(18)	-12.872	-9.323	0.000
JTAN	9.640	(18)	-16.256	-10.017	0.000
MAX	3.213	(19)	12.696	.859	0.000
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(19)	-16.620	9.913	0.000
1	.350	(19)	-13.271	9.219	0.000
2	.750	(19)	-9.742	8.426	0.000
3	5.000	(19)	8.164	.000	0.000
4	9.250	(19)	-9.742	-8.426	0.000
5	9.650	(19)	-13.271	-9.219	0.000
JTAN	10.000	(19)	-16.620	-9.913	0.000
MAX	5.000	(19)	8.164	.000	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(18)	-16.256	10.017	0.000
1	.350	(18)	-12.872	9.323	0.000
2	.750	(18)	-9.301	8.530	0.000
3	4.820	(19)	11.516	2.327	0.000
4	8.890	(19)	4.565	-5.743	0.000
5	9.290	(19)	2.110	-6.536	0.000
JTAN	9.640	(19)	-.299	-7.230	0.000
MAX	6.427	(19)	12.696	-.859	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(18)	11.208	-2.908	-102.617
JTAN	7.918	(19)	-.299	.542	-108.681
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(18)	1.065	-.238	-99.295
JTAN	7.918	(19)	6.111	1.570	-110.169

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(18)	-11.815	9.096	0.000
1	.350	(18)	-8.752	8.402	0.000
2	.750	(18)	-5.550	7.609	0.000
3	4.820	(18)	8.996	-.461	0.000
4	8.890	(19)	-14.376	-10.396	0.000
5	9.290	(19)	-18.693	-11.189	0.000
JTAN	9.640	(19)	-22.730	-11.883	0.000
MAX	4.820	(18)	8.996	-.461	0.000
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(18)	-17.080	9.913	0.000
1	.350	(18)	-13.732	9.219	0.000
2	.750	(18)	-10.203	8.426	0.000
3	5.000	(18)	7.704	-.000	0.000
4	9.250	(18)	-10.203	-8.426	0.000
5	9.650	(18)	-13.732	-9.219	0.000
JTAN	10.000	(18)	-17.080	-9.913	0.000
MAX	5.000	(18)	7.704	-.000	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(19)	-22.730	11.883	0.000
1	.350	(19)	-18.693	11.189	0.000
2	.750	(19)	-14.376	10.396	0.000
3	4.820	(18)	8.996	.461	0.000
4	8.890	(18)	-5.550	-7.609	0.000
5	9.290	(18)	-8.752	-8.402	0.000
JTAN	9.640	(18)	-11.815	-9.096	0.000
MAX	4.820	(18)	8.996	.461	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(19)	-4.593	.542	-100.212
JTAN	7.918	(18)	-11.815	-2.908	-111.086
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(19)	-6.323	1.570	-101.700
JTAN	7.918	(18)	-.824	-.238	-107.764

No. 118

PICK UP 4

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(19)	6.323	-1.570	-101.700
JTAN	7.918	(18)	.824	.238	-107.764
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(19)	4.593	-.542	-100.212
JTAN	7.918	(18)	11.815	2.908	-111.086

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(18)	-1.065	.238	-99.295
JTAN	7.918	(19)	-6.111	-1.570	-110.169
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(18)	-11.208	2.908	-102.617
JTAN	7.918	(19)	.299	-.542	-108.681

No. 119

PICK UP 4

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(18)	-48.775	38.197	-2.908
1	.350	(18)	-35.765	36.115	-2.908
2	1.150	(18)	-8.995	30.643	-2.908
3	1.550	(18)	2.649	27.536	-2.908
4	2.500	(18)	24.942	19.164	-2.908
5	4.820	(18)	43.705	-2.988	-2.908
6	7.140	(18)	11.076	-25.140	-2.908
7	8.090	(18)	-16.894	-33.512	-2.908
8	8.490	(18)	-30.929	-36.620	-2.908
9	9.290	(18)	-62.479	-42.091	-2.908
JTAN	9.640	(18)	-77.581	-44.173	-2.908
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(19)	-78.637	42.904	2.113
1	.350	(19)	-63.980	40.822	2.113
2	1.150	(19)	-33.445	35.350	2.113
3	1.550	(19)	-19.918	32.243	2.113
4	2.500	(19)	6.846	23.871	2.113
5	5.000	(19)	36.685	.000	2.113
6	7.500	(19)	6.846	-23.871	2.113
7	8.450	(19)	-19.918	-32.243	2.113
8	8.850	(19)	-33.445	-35.350	2.113
9	9.650	(19)	-63.980	-40.822	2.113
JTAN	10.000	(19)	-78.637	-42.904	2.113
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(19)	-84.961	46.578	.542
1	.350	(19)	-69.017	44.496	.542
2	1.150	(19)	-35.543	39.024	.542
3	1.550	(19)	-20.547	35.917	.542
4	2.500	(19)	9.708	27.545	.542
5	4.820	(19)	47.916	5.393	.542
6	7.140	(19)	34.731	-16.759	.542
7	8.090	(19)	14.723	-25.131	.542
8	8.490	(19)	4.041	-28.239	.542
9	9.290	(19)	-20.805	-33.710	.542
JTAN	9.640	(19)	-32.973	-35.792	.542
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(18)	-11.815	9.096	0.000
1	.350	(18)	-9.752	8.402	0.000
2	.750	(18)	-5.550	7.609	0.000
3	4.820	(18)	9.996	-.461	0.000
4	8.890	(18)	-9.301	-8.530	0.000
5	9.290	(18)	-12.872	-9.323	0.000
JTAN	9.640	(18)	-16.256	-10.017	0.000

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(19)	-32.973	35.792	.542
1	.350	(19)	-20.805	33.710	.542
2	1.150	(19)	4.041	28.239	.542
3	1.550	(19)	14.723	25.131	.542
4	2.500	(19)	34.731	16.759	.542
5	4.820	(19)	47.916	-5.393	.542
6	7.140	(19)	9.708	-27.545	.542
7	8.090	(19)	-20.547	-35.917	.542
8	8.490	(19)	-35.543	-39.024	.542
9	9.290	(19)	-69.017	-44.496	.542
JTAN	9.640	(19)	-84.961	-46.578	.542
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(18)	-78.645	42.904	-3.146
1	.350	(18)	-63.988	40.822	-3.146
2	1.150	(18)	-33.453	35.350	-3.146
3	1.550	(18)	-19.926	32.243	-3.146
4	2.500	(18)	6.838	23.871	-3.146
5	5.000	(18)	36.676	-.000	-3.146
6	7.500	(18)	6.838	-23.871	-3.146
7	8.450	(18)	-19.926	-32.243	-3.146
8	8.850	(18)	-33.453	-35.350	-3.146
9	9.650	(18)	-63.988	-40.822	-3.146
JTAN	10.000	(18)	-78.645	-42.904	-3.146
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(18)	-77.581	44.173	-2.908
1	.350	(18)	-62.479	42.091	-2.908
2	1.150	(18)	-30.929	36.620	-2.908
3	1.550	(18)	-16.894	33.512	-2.908
4	2.500	(18)	11.076	25.140	-2.908
5	4.820	(18)	43.705	2.988	-2.908
6	7.140	(18)	24.942	-19.164	-2.908
7	8.090	(18)	2.649	-27.536	-2.908
8	8.490	(18)	-8.995	-30.643	-2.908
9	9.290	(18)	-35.765	-36.115	-2.908
JTAN	9.640	(18)	-48.775	-38.197	-2.908
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(19)	-.299	7.230	0.000
1	.350	(19)	2.110	6.536	0.000
2	.750	(19)	4.565	5.743	0.000
3	4.820	(19)	11.516	-2.327	0.000
4	8.890	(19)	-14.376	-10.396	0.000
5	9.290	(19)	-18.693	-11.189	0.000
JTAN	9.640	(19)	-22.730	-11.883	0.000

No./20

PICK UP 4

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(19)	-16.620	9.913	0.000
1	.350	(19)	-13.271	9.219	0.000
2	.750	(19)	-9.742	8.426	0.000
3	5.000	(19)	8.164	.000	0.000
4	9.250	(19)	-9.742	-8.426	0.000
5	9.650	(19)	-13.271	-9.219	0.000
JTAN	10.000	(19)	-16.620	-9.913	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(19)	-22.730	11.883	0.000
1	.350	(19)	-18.693	11.189	0.000
2	.750	(19)	-14.376	10.396	0.000
3	4.820	(19)	11.516	2.327	0.000
4	8.890	(19)	4.565	-5.743	0.000
5	9.290	(19)	2.110	-6.536	0.000
JTAN	9.640	(19)	-.299	-7.230	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(19)	-4.593	.542	-100.212
JTAN	7.918	(19)	-.299	.542	-108.681
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(19)	-6.323	1.570	-101.700
JTAN	7.918	(19)	6.111	1.570	-110.169
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(18)	-1.065	.238	-99.295
JTAN	7.918	(18)	.824	.238	-107.764
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(18)	-11.208	2.908	-102.617
JTAN	7.918	(18)	11.815	2.908	-111.086

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(18)	-17.080	9.913	0.000
1	.350	(18)	-13.732	9.219	0.000
2	.750	(18)	-10.203	8.426	0.000
3	5.000	(18)	7.704	-.000	0.000
4	9.250	(18)	-10.203	-8.426	0.000
5	9.650	(18)	-13.732	-9.219	0.000
JTAN	10.000	(18)	-17.080	-9.913	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(18)	-16.256	10.017	0.000
1	.350	(18)	-12.872	9.323	0.000
2	.750	(18)	-9.301	8.530	0.000
3	4.820	(18)	8.996	.461	0.000
4	8.890	(18)	-5.550	-7.609	0.000
5	9.290	(18)	-8.752	-8.402	0.000
JTAN	9.640	(18)	-11.815	-9.096	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(18)	11.208	-2.908	-102.617
JTAN	7.918	(18)	-11.815	-2.908	-111.086
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(18)	1.065	-.238	-99.295
JTAN	7.918	(18)	-.824	-.238	-107.764
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(19)	6.323	-1.570	-101.700
JTAN	7.918	(19)	-6.111	-1.570	-110.169
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(19)	4.593	-.542	-100.212
JTAN	7.918	(19)	.299	-.542	-108.681

No. 121

PICK UP 4

AXIAL MAXIMUM

= = MEMBER 1 (1 - 2) G = =

	-----L---	-CASE-	-----M---	-----Q---	-----N---
ITAN	0.000	(19)	-32.973	35.792	.542
1	.350	(19)	-20.805	33.710	.542
2	1.150	(19)	4.041	28.239	.542
3	1.550	(19)	14.723	25.131	.542
4	2.500	(19)	34.731	16.759	.542
5	4.820	(19)	47.916	-5.393	.542
6	7.140	(19)	9.708	-27.545	.542
7	8.090	(19)	-20.547	-35.917	.542
8	8.490	(19)	-35.543	-39.024	.542
9	9.290	(19)	-69.017	-44.496	.542
JTAN	9.640	(19)	-84.961	-46.578	.542

= = MEMBER 2 (2 - 3) G = =

	-----L---	-CASE-	-----M---	-----Q---	-----N---
ITAN	0.000	(19)	-78.637	42.904	2.113
1	.350	(19)	-63.980	40.822	2.113
2	1.150	(19)	-33.445	35.350	2.113
3	1.550	(19)	-19.918	32.243	2.113
4	2.500	(19)	6.846	23.871	2.113
5	5.000	(19)	36.685	.000	2.113
6	7.500	(19)	6.846	-23.871	2.113
7	8.450	(19)	-19.918	-32.243	2.113
8	8.850	(19)	-33.445	-35.350	2.113
9	9.650	(19)	-63.980	-40.822	2.113
JTAN	10.000	(19)	-78.637	-42.904	2.113

= = MEMBER 3 (3 - 4) G = =

	-----L---	-CASE-	-----M---	-----Q---	-----N---
ITAN	0.000	(19)	-84.951	46.578	.542
1	.350	(19)	-69.017	44.496	.542
2	1.150	(19)	-35.543	39.024	.542
3	1.550	(19)	-20.547	35.917	.542
4	2.500	(19)	9.708	27.545	.542
5	4.820	(19)	47.916	5.393	.542
6	7.140	(19)	34.731	-16.759	.542
7	8.090	(19)	14.723	-25.131	.542
8	8.490	(19)	4.041	-28.239	.542
9	9.290	(19)	-20.805	-33.710	.542
JTAN	9.640	(19)	-32.973	-35.792	.542

= = MEMBER 4 (5 - 6) G = =

	-----L---	-CASE-	-----M---	-----Q---	-----N---
ITAN	0.000	(18)	-11.815	9.096	0.000
1	.350	(18)	-8.752	8.402	0.000
2	.750	(18)	-5.550	7.609	0.000
3	4.820	(18)	8.996	-.461	0.000
4	8.890	(18)	-9.301	-8.530	0.000
5	9.290	(18)	-12.872	-9.323	0.000
JTAN	9.640	(18)	-16.256	-10.017	0.000

AXIAL MINIMUM

= = MEMBER 1 (1 - 2) G = =

	-----L---	-CASE-	-----M---	-----Q---	-----N---
ITAN	0.000	(18)	-48.775	38.197	-2.908
1	.350	(18)	-35.765	36.115	-2.908
2	1.150	(18)	-8.995	30.643	-2.908
3	1.550	(18)	2.649	27.536	-2.908
4	2.500	(18)	24.942	19.164	-2.908
5	4.820	(18)	43.705	-2.988	-2.908
6	7.140	(18)	11.076	-25.140	-2.908
7	8.090	(18)	-16.894	-33.512	-2.908
8	8.490	(18)	-30.929	-36.620	-2.908
9	9.290	(18)	-62.479	-42.091	-2.908
JTAN	9.640	(18)	-77.581	-44.173	-2.908

= = MEMBER 2 (2 - 3) G = =

	-----L---	-CASE-	-----M---	-----Q---	-----N---
ITAN	0.000	(18)	-78.645	42.904	-3.146
1	.350	(18)	-63.988	40.822	-3.146
2	1.150	(18)	-33.453	35.350	-3.146
3	1.550	(18)	-19.926	32.243	-3.146
4	2.500	(18)	6.838	23.871	-3.146
5	5.000	(18)	36.676	-.000	-3.146
6	7.500	(18)	6.838	-23.871	-3.146
7	8.450	(18)	-19.926	-32.243	-3.146
8	8.850	(18)	-33.453	-35.350	-3.146
9	9.650	(18)	-63.988	-40.822	-3.146
JTAN	10.000	(18)	-78.645	-42.904	-3.146

= = MEMBER 3 (3 - 4) G = =

	-----L---	-CASE-	-----M---	-----Q---	-----N---
ITAN	0.000	(18)	-77.581	44.173	-2.908
1	.350	(18)	-62.479	42.091	-2.908
2	1.150	(18)	-30.929	36.620	-2.908
3	1.550	(18)	-16.894	33.512	-2.908
4	2.500	(18)	11.076	25.140	-2.908
5	4.820	(18)	43.705	2.988	-2.908
6	7.140	(18)	24.942	-19.164	-2.908
7	8.090	(18)	2.649	-27.536	-2.908
8	8.490	(18)	-8.995	-30.643	-2.908
9	9.290	(18)	-35.765	-36.115	-2.908
JTAN	9.640	(18)	-48.775	-38.197	-2.908

= = MEMBER 4 (5 - 6) G = =

	-----L---	-CASE-	-----M---	-----Q---	-----N---
ITAN	0.000	(18)	-11.815	9.096	0.000
1	.350	(18)	-8.752	8.402	0.000
2	.750	(18)	-5.550	7.609	0.000
3	4.820	(18)	8.996	-.461	0.000
4	8.890	(18)	-9.301	-8.530	0.000
5	9.290	(18)	-12.872	-9.323	0.000
JTAN	9.640	(18)	-16.256	-10.017	0.000

No. 122

PICK UP 4

AXIAL MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(18)	-17.080	9.913	0.000
1	.350	(18)	-13.732	9.219	0.000
2	.750	(18)	-10.203	8.426	0.000
3	5.000	(18)	7.704	-.000	0.000
4	9.250	(18)	-10.203	-8.426	0.000
5	9.650	(18)	-13.732	-9.219	0.000
JTAN	10.000	(18)	-17.080	-9.913	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(18)	-16.256	10.017	0.000
1	.350	(18)	-12.872	9.323	0.000
2	.750	(18)	-9.301	8.530	0.000
3	4.820	(18)	8.996	.461	0.000
4	8.890	(18)	-5.550	-7.609	0.000
5	9.290	(18)	-8.752	-8.402	0.000
JTAN	9.640	(18)	-11.815	-9.096	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(19)	-4.593	.542	-100.212
JTAN	7.918	(19)	-.299	.542	-108.681
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(18)	1.065	-.238	-99.295
JTAN	7.918	(18)	-.824	-.238	-107.764
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(18)	-1.065	.238	-99.295
JTAN	7.918	(18)	.824	.238	-107.764
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(19)	4.593	-.542	-100.212
JTAN	7.918	(19)	.299	-.542	-108.681

AXIAL MINIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(18)	-17.080	9.913	0.000
1	.350	(18)	-13.732	9.219	0.000
2	.750	(18)	-10.203	8.426	0.000
3	5.000	(18)	7.704	-.000	0.000
4	9.250	(18)	-10.203	-8.426	0.000
5	9.650	(18)	-13.732	-9.219	0.000
JTAN	10.000	(18)	-17.080	-9.913	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(18)	-16.256	10.017	0.000
1	.350	(18)	-12.872	9.323	0.000
2	.750	(18)	-9.301	8.530	0.000
3	4.820	(18)	8.996	.461	0.000
4	8.890	(18)	-5.550	-7.609	0.000
5	9.290	(18)	-8.752	-8.402	0.000
JTAN	9.640	(18)	-11.815	-9.096	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(18)	11.208	-2.908	-102.617
JTAN	7.918	(18)	-11.815	-2.908	-111.086
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(19)	-6.323	1.570	-101.700
JTAN	7.918	(19)	6.111	1.570	-110.169
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(19)	6.323	-1.570	-101.700
JTAN	7.918	(19)	-6.111	-1.570	-110.169
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(18)	-11.208	2.908	-102.617
JTAN	7.918	(18)	11.815	2.908	-111.086

No. 123

PICK UP 5

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(20)	-2.316	23.147	-2.500
1	.350	(20)	5.511	21.550	-2.500
2	1.150	(20)	21.124	17.356	-2.500
3	1.550	(20)	27.596	14.973	-2.500
4	2.500	(20)	38.856	8.555	-2.500
5	4.820	(20)	39.002	-8.429	-2.500
6	7.140	(21)	16.638	-14.190	-.447
7	8.090	(21)	.024	-20.609	-.447
8	8.490	(21)	-8.703	-22.991	-.447
9	9.290	(21)	-28.824	-27.186	-.447
JTAN	9.640	(21)	-38.623	-28.782	-.447
MAX	3.213	(20)	43.096	3.333	-2.500
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(20)	-44.686	29.772	-1.260
1	.350	(20)	-34.541	28.175	-1.260
2	1.150	(20)	-13.628	23.980	-1.260
3	1.550	(20)	-4.506	21.598	-1.260
4	2.500	(20)	13.048	15.179	-1.260
5	5.000	(20)	28.121	-3.122	-1.260
6	7.500	(21)	13.048	-15.179	-1.260
7	8.450	(21)	-4.506	-21.598	-1.260
8	8.850	(21)	-13.628	-23.980	-1.260
9	9.650	(21)	-34.541	-28.175	-1.260
JTAN	10.000	(21)	-44.686	-29.772	-1.260
MAX	4.444	(20)	28.725	.945	-1.260
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(20)	-38.623	28.782	-.447
1	.350	(20)	-28.824	27.186	-.447
2	1.150	(20)	-8.703	22.991	-.447
3	1.550	(20)	.024	20.609	-.447
4	2.500	(20)	16.638	14.190	-.447
5	4.820	(21)	39.002	8.429	-2.500
6	7.140	(21)	38.856	-8.555	-2.500
7	8.090	(21)	27.596	-14.973	-2.500
8	8.490	(21)	21.124	-17.356	-2.500
9	9.290	(21)	5.511	-21.550	-2.500
JTAN	9.640	(21)	-2.316	-23.147	-2.500
MAX	6.427	(21)	43.096	-3.333	-2.500

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(21)	-65.551	34.369	-.447
1	.350	(21)	-53.797	32.773	-.447
2	1.150	(21)	-29.206	28.578	-.447
3	1.550	(21)	-18.245	26.195	-.447
4	2.500	(21)	3.677	19.777	-.447
5	4.820	(21)	29.858	2.793	-.447
6	7.140	(20)	-.253	-25.412	-2.500
7	8.090	(20)	-27.528	-31.831	-2.500
8	8.490	(20)	-40.743	-34.213	-2.500
9	9.290	(20)	-69.842	-38.408	-2.500
JTAN	9.640	(20)	-83.569	-40.004	-2.500
MAX	5.356	(21)	30.304	-1.127	-.447
= = MEMBER 2 (2 - 3) G = =					
ITAN	0.000	(21)	-75.901	36.015	-1.260
1	.350	(21)	-63.571	34.418	-1.260
2	1.150	(21)	-37.664	30.224	-1.260
3	1.550	(21)	-26.045	27.841	-1.260
4	2.500	(21)	-2.559	21.422	-1.260
5	5.000	(21)	28.121	3.122	-1.260
6	7.500	(20)	-2.559	-21.422	-1.260
7	8.450	(20)	-26.045	-27.841	-1.260
8	8.850	(20)	-37.664	-30.224	-1.260
9	9.650	(20)	-63.571	-34.418	-1.260
JTAN	10.000	(20)	-75.901	-36.015	-1.260
MAX	5.000	(21)	28.121	3.122	-1.260
= = MEMBER 3 (3 - 4) G = =					
ITAN	0.000	(21)	-83.569	40.004	-2.500
1	.350	(21)	-69.842	38.408	-2.500
2	1.150	(21)	-40.743	34.213	-2.500
3	1.550	(21)	-27.528	31.831	-2.500
4	2.500	(21)	-.253	25.412	-2.500
5	4.820	(20)	29.858	-2.793	-.447
6	7.140	(20)	3.677	-19.777	-.447
7	8.090	(20)	-18.245	-26.195	-.447
8	8.490	(20)	-29.206	-28.578	-.447
9	9.290	(20)	-53.797	-32.773	-.447
JTAN	9.640	(20)	-65.551	-34.369	-.447
MAX	4.284	(20)	30.304	1.127	-.447

CRC-FANSY V6.3

PICK UP 5

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.000	(20)	17.594	2.036	0.000
1	.350	(20)	18.213	1.504	0.000
2	.750	(20)	18.693	.896	0.000
3	4.820	(20)	9.749	-5.291	0.000
4	8.890	(21)	7.891	-2.420	0.000
5	9.290	(21)	6.801	-3.028	0.000
JTAN	9.640	(21)	5.648	-3.560	0.000
MAX	1.071	(20)	18.902	.408	0.000
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(20)	1.399	4.722	0.000
1	.350	(20)	2.958	4.190	0.000
2	.750	(20)	4.513	3.582	0.000
3	5.000	(20)	6.007	-2.879	0.000
4	9.250	(21)	4.513	-3.582	0.000
5	9.650	(21)	2.958	-4.190	0.000
JTAN	10.000	(21)	1.399	-4.722	0.000
MAX	3.333	(20)	3.693	-.345	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(20)	5.648	3.560	0.000
1	.350	(20)	6.801	3.028	0.000
2	.750	(20)	7.891	2.420	0.000
3	4.820	(21)	9.749	5.291	0.000
4	8.890	(21)	18.693	-.896	0.000
5	9.290	(21)	18.213	-1.504	0.000
JTAN	9.640	(21)	17.594	-2.036	0.000
MAX	8.569	(21)	18.902	-.408	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(21)	36.749	-8.514	-83.758
JTAN	7.918	(20)	17.594	5.567	-79.029
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(21)	37.279	-8.880	-74.164
JTAN	7.918	(20)	34.810	9.307	-85.636

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 4 (5 - 6) G = =					
ITAN	0.080	(21)	-30.665	11.094	0.000
1	.350	(21)	-26.875	10.562	0.000
2	.750	(21)	-22.772	9.954	0.000
3	4.820	(21)	5.149	3.767	0.000
4	8.890	(20)	-24.375	-11.478	0.000
5	9.298	(20)	-29.088	-12.086	0.000
JTAN	9.640	(20)	-33.411	-12.618	0.000
MAX	5.356	(20)	6.697	-6.105	0.000
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(21)	-27.387	10.479	0.000
1	.350	(21)	-23.812	9.947	0.000
2	.750	(21)	-19.955	9.339	0.000
3	5.000	(21)	6.007	2.879	0.000
4	9.250	(20)	-19.955	-9.339	0.000
5	9.650	(20)	-23.812	-9.947	0.000
JTAN	10.000	(20)	-27.387	-10.479	0.000
MAX	5.000	(21)	6.007	2.879	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(21)	-33.411	12.618	0.000
1	.350	(21)	-29.088	12.086	0.000
2	.750	(21)	-24.375	11.478	0.000
3	4.820	(20)	5.149	-3.767	0.000
4	8.890	(20)	-22.772	-9.954	0.000
5	9.290	(20)	-26.875	-10.562	0.000
JTAN	9.640	(20)	-30.665	-11.094	0.000
MAX	4.284	(21)	6.697	6.105	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(20)	-26.486	5.567	-72.536
JTAN	7.918	(21)	-30.665	-8.514	-90.251
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(20)	-38.883	9.307	-79.143
JTAN	7.918	(21)	-33.035	-8.880	-80.657

PICK UP 5

MOMENT MAXIMUM

	-----L---	-CASE-	-----M---	-----Q---	-----N---
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(21)	38.883	-9.307	-79.143
JTAN	7.918	(20)	33.035	8.880	-80.657
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(21)	26.486	-5.567	-72.536
JTAN	7.918	(20)	30.665	8.514	-90.251

MOMENT MINIMUM

	-----L---	-CASE-	-----M---	-----Q---	-----N---
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(20)	-37.279	8.880	-74.164
JTAN	7.918	(21)	-34.810	-9.307	-85.636
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(20)	-36.749	8.514	-83.758
JTAN	7.918	(21)	-17.594	-5.567	-79.029

No. 126

PICK UP 5

SHEAR MAXIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(21)	-65.551	34.369	-.447
1	.350	(21)	-53.797	32.773	-.447
2	1.150	(21)	-29.206	28.578	-.447
3	1.550	(21)	-18.245	26.195	-.447
4	2.500	(21)	3.677	19.777	-.447
5	4.820	(21)	29.858	2.793	-.447
6	7.140	(21)	16.638	-14.190	-.447
7	8.090	(21)	.024	-20.609	-.447
8	8.490	(21)	-8.703	-22.991	-.447
9	9.290	(21)	-28.824	-27.186	-.447
JTAN	9.640	(21)	-38.623	-28.782	-.447

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(21)	-75.901	36.015	-1.260
1	.350	(21)	-63.571	34.418	-1.260
2	1.150	(21)	-37.664	30.224	-1.260
3	1.550	(21)	-26.045	27.841	-1.260
4	2.500	(21)	-2.559	21.422	-1.260
5	5.000	(21)	28.121	3.122	-1.260
6	7.500	(21)	13.048	-15.179	-1.260
7	8.450	(21)	-4.506	-21.598	-1.260
8	8.850	(21)	-13.628	-23.980	-1.260
9	9.650	(21)	-34.541	-28.175	-1.260
JTAN	10.000	(21)	-44.686	-29.772	-1.260

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(21)	-83.569	40.004	-2.500
1	.350	(21)	-69.842	38.408	-2.500
2	1.150	(21)	-40.743	34.213	-2.500
3	1.550	(21)	-27.528	31.831	-2.500
4	2.500	(21)	-.253	25.412	-2.500
5	4.820	(21)	39.002	8.429	-2.500
6	7.140	(21)	38.856	-8.555	-2.500
7	8.090	(21)	27.596	-14.973	-2.500
8	8.490	(21)	21.124	-17.356	-2.500
9	9.290	(21)	5.511	-21.550	-2.500
JTAN	9.640	(21)	-2.316	-23.147	-2.500

= = MEMBER 4 (5 - 6) G = =

	L	CASE	M	Q	N
ITAN	0.000	(21)	-30.665	11.094	0.000
1	.350	(21)	-26.875	10.562	0.000
2	.750	(21)	-22.772	9.954	0.000
3	4.820	(21)	5.149	3.767	0.000
4	8.890	(21)	7.891	-2.420	0.000
5	9.290	(21)	6.801	-3.028	0.000
JTAN	9.640	(21)	5.648	-3.560	0.000

SHEAR MINIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(20)	-2.316	23.147	-2.500
1	.350	(20)	5.511	21.550	-2.500
2	1.150	(20)	21.124	17.356	-2.500
3	1.550	(20)	27.596	14.973	-2.500
4	2.500	(20)	38.856	8.555	-2.500
5	4.820	(20)	39.002	-8.429	-2.500
6	7.140	(20)	-.253	-25.412	-2.500
7	8.090	(20)	-27.528	-31.831	-2.500
8	8.490	(20)	-40.743	-34.213	-2.500
9	9.290	(20)	-69.842	-38.408	-2.500
JTAN	9.640	(20)	-83.569	-40.004	-2.500

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(20)	-44.686	29.772	-1.260
1	.350	(20)	-34.541	28.175	-1.260
2	1.150	(20)	-13.628	23.980	-1.260
3	1.550	(20)	-4.506	21.598	-1.260
4	2.500	(20)	13.048	15.179	-1.260
5	5.000	(20)	28.121	-3.122	-1.260
6	7.500	(20)	-2.559	-21.422	-1.260
7	8.450	(20)	-26.045	-27.841	-1.260
8	8.850	(20)	-37.664	-30.224	-1.260
9	9.650	(20)	-63.571	-34.418	-1.260
JTAN	10.000	(20)	-75.901	-36.015	-1.260

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(20)	-38.623	28.782	-.447
1	.350	(20)	-28.824	27.186	-.447
2	1.150	(20)	-8.703	22.991	-.447
3	1.550	(20)	.024	20.609	-.447
4	2.500	(20)	16.638	14.190	-.447
5	4.820	(20)	29.858	-2.793	-.447
6	7.140	(20)	3.677	-19.777	-.447
7	8.090	(20)	-18.245	-26.195	-.447
8	8.490	(20)	-29.206	-28.578	-.447
9	9.290	(20)	-53.797	-32.773	-.447
JTAN	9.640	(20)	-65.551	-34.369	-.447

= = MEMBER 4 (5 - 6) G = =

	L	CASE	M	Q	N
ITAN	0.000	(20)	17.594	2.036	0.000
1	.350	(20)	18.213	1.504	0.000
2	.750	(20)	18.693	.896	0.000
3	4.820	(20)	9.749	-5.291	0.000
4	8.890	(20)	-24.375	-11.478	0.000
5	9.290	(20)	-29.088	-12.086	0.000
JTAN	9.640	(20)	-33.411	-12.618	0.000

PICK UP 5

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(21)	-27.387	10.479	0.000
1	.350	(21)	-23.812	9.947	0.000
2	.750	(21)	-19.955	9.339	0.000
3	5.000	(21)	6.007	2.879	0.000
4	9.250	(21)	4.513	-3.582	0.000
5	9.650	(21)	2.958	-4.190	0.000
JTAN	10.000	(21)	1.399	-4.722	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(21)	-33.411	12.618	0.000
1	.350	(21)	-29.088	12.086	0.000
2	.750	(21)	-24.375	11.478	0.000
3	4.820	(21)	9.749	5.291	0.000
4	8.890	(21)	18.693	-.896	0.000
5	9.290	(21)	18.213	-1.504	0.000
JTAN	9.640	(21)	17.594	-2.036	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(20)	-26.486	5.567	-72.536
JTAN	7.918	(20)	17.594	5.567	-79.029
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(20)	-38.883	9.307	-79.143
JTAN	7.918	(20)	34.810	9.307	-85.636
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(20)	-37.279	8.880	-74.164
JTAN	7.918	(20)	33.035	8.880	-80.657
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(20)	-36.749	8.514	-83.758
JTAN	7.918	(20)	30.665	8.514	-90.251

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(20)	1.399	4.722	0.000
1	.350	(20)	2.958	4.190	0.000
2	.750	(20)	4.513	3.582	0.000
3	5.000	(20)	6.007	-2.879	0.000
4	9.250	(20)	-19.955	-9.339	0.000
5	9.650	(20)	-23.812	-9.947	0.000
JTAN	10.000	(20)	-27.387	-10.479	0.800
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(20)	5.648	3.560	0.000
1	.350	(20)	6.801	3.028	0.000
2	.750	(20)	7.891	2.420	0.000
3	4.820	(20)	5.149	-3.767	0.000
4	8.890	(20)	-22.772	-9.954	0.000
5	9.290	(20)	-26.875	-10.562	0.000
JTAN	9.640	(20)	-30.665	-11.094	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(21)	36.749	-8.514	-83.758
JTAN	7.918	(21)	-30.665	-8.514	-90.251
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(21)	37.279	-8.880	-74.164
JTAN	7.918	(21)	-33.035	-8.880	-80.657
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(21)	38.883	-9.307	-79.143
JTAN	7.918	(21)	-34.810	-9.307	-85.636
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(21)	26.486	-5.567	-72.536
JTAN	7.918	(21)	-17.594	-5.567	-79.029

No. 127

No. 128

PICK UP 5

AXIAL MAXIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(21)	-65.551	34.369	-.447
1	.350	(21)	-53.797	32.773	-.447
2	1.150	(21)	-29.206	28.578	-.447
3	1.550	(21)	-18.245	26.195	-.447
4	2.500	(21)	3.677	19.777	-.447
5	4.820	(21)	29.858	2.793	-.447
6	7.140	(21)	16.638	-14.190	-.447
7	8.090	(21)	.024	-20.609	-.447
8	8.490	(21)	-8.703	-22.991	-.447
9	9.290	(21)	-28.824	-27.186	-.447
JTAN	9.640	(21)	-38.623	-28.782	-.447

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(20)	-44.686	29.772	-1.260
1	.350	(20)	-34.541	28.175	-1.260
2	1.150	(20)	-13.628	23.980	-1.260
3	1.550	(20)	-4.506	21.598	-1.260
4	2.500	(20)	13.048	15.179	-1.260
5	5.000	(20)	28.121	-3.122	-1.260
6	7.500	(20)	-2.559	-21.422	-1.260
7	8.450	(20)	-26.045	-27.841	-1.260
8	8.850	(20)	-37.664	-30.224	-1.260
9	9.650	(20)	-63.571	-34.418	-1.260
JTAN	10.000	(20)	-75.901	-36.015	-1.260

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(20)	-38.623	28.782	-.447
1	.350	(20)	-28.824	27.186	-.447
2	1.150	(20)	-8.703	22.991	-.447
3	1.550	(20)	.024	20.609	-.447
4	2.500	(20)	16.638	14.190	-.447
5	4.820	(20)	29.858	-2.793	-.447
6	7.140	(20)	3.677	-19.777	-.447
7	8.090	(20)	-18.245	-26.195	-.447
8	8.490	(20)	-29.206	-28.578	-.447
9	9.290	(20)	-53.797	-32.773	-.447
JTAN	9.640	(20)	-65.551	-34.369	-.447

= = MEMBER 4 (5 - 6) G = =

	L	CASE	M	Q	N
ITAN	0.000	(20)	17.594	2.036	0.000
1	.350	(20)	18.213	1.504	0.000
2	.750	(20)	18.693	.896	0.000
3	4.820	(20)	9.749	-5.291	0.000
4	8.890	(20)	-24.375	-11.478	0.000
5	9.290	(20)	-29.088	-12.086	0.000
JTAN	9.640	(20)	-33.411	-12.616	0.000

AXIAL MINIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(20)	-2.316	23.147	-2.500
1	.350	(20)	5.511	21.550	-2.500
2	1.150	(20)	21.124	17.356	-2.500
3	1.550	(20)	27.596	14.973	-2.500
4	2.500	(20)	38.856	8.555	-2.500
5	4.820	(20)	39.002	-8.429	-2.500
6	7.140	(20)	-.253	-25.412	-2.500
7	8.090	(20)	-27.528	-31.831	-2.500
8	8.490	(20)	-40.743	-34.213	-2.500
9	9.290	(20)	-69.842	-38.408	-2.500
JTAN	9.640	(20)	-83.569	-40.004	-2.500

= = MEMBER 2 (2 - 3) G = =

	L	CASE	M	Q	N
ITAN	0.000	(20)	-44.686	29.772	-1.260
1	.350	(20)	-34.541	28.175	-1.260
2	1.150	(20)	-13.628	23.980	-1.260
3	1.550	(20)	-4.506	21.598	-1.260
4	2.500	(20)	13.048	15.179	-1.260
5	5.000	(20)	28.121	-3.122	-1.260
6	7.500	(20)	-2.559	-21.422	-1.260
7	8.450	(20)	-26.045	-27.841	-1.260
8	8.850	(20)	-37.664	-30.224	-1.260
9	9.650	(20)	-63.571	-34.418	-1.260
JTAN	10.000	(20)	-75.901	-36.015	-1.260

= = MEMBER 3 (3 - 4) G = =

	L	CASE	M	Q	N
ITAN	0.000	(21)	-83.569	40.004	-2.500
1	.350	(21)	-69.842	38.408	-2.500
2	1.150	(21)	-40.743	34.213	-2.500
3	1.550	(21)	-27.528	31.831	-2.500
4	2.500	(21)	-.253	25.412	-2.500
5	4.820	(21)	39.002	8.429	-2.500
6	7.140	(21)	38.856	-8.555	-2.500
7	8.090	(21)	27.596	-14.973	-2.500
8	8.490	(21)	21.124	-17.356	-2.500
9	9.290	(21)	5.511	-21.550	-2.500
JTAN	9.640	(21)	-2.316	-23.147	-2.500

= = MEMBER 4 (5 - 6) G = =

	L	CASE	M	Q	N
ITAN	0.000	(20)	17.594	2.036	0.000
1	.350	(20)	18.213	1.504	0.000
2	.750	(20)	18.693	.896	0.000
3	4.820	(20)	9.749	-5.291	0.000
4	8.890	(20)	-24.375	-11.478	0.000
5	9.290	(20)	-29.088	-12.086	0.000
JTAN	9.640	(20)	-33.411	-12.618	0.000

PICK UP 5

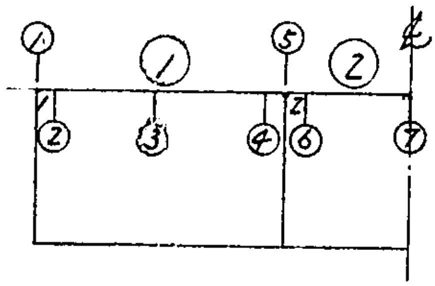
AXIAL MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(20)	1.399	4.722	0.000
1	.350	(20)	2.958	4.190	0.000
2	.750	(20)	4.513	3.582	0.000
3	5.000	(20)	6.007	-2.879	0.000
4	9.250	(20)	-19.955	-9.339	0.000
5	9.650	(20)	-23.812	-9.947	0.000
JTAN	10.000	(20)	-27.387	-10.479	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(20)	5.648	3.560	0.000
1	.350	(20)	6.801	3.028	0.000
2	.750	(20)	7.891	2.420	0.000
3	4.820	(20)	5.149	-3.767	0.000
4	8.890	(20)	-22.772	-9.954	0.000
5	9.290	(20)	-26.875	-10.562	0.000
JTAN	9.640	(20)	-30.665	-11.094	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(20)	-26.486	5.567	-72.536
JTAN	7.918	(20)	17.594	5.567	-79.029
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(21)	37.279	-8.880	-74.164
JTAN	7.918	(21)	-33.035	-8.880	-80.657
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(20)	-37.279	8.880	-74.164
JTAN	7.918	(20)	33.035	8.880	-80.657
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(21)	26.486	-5.567	-72.536
JTAN	7.918	(21)	-17.594	-5.567	-79.029

AXIAL MINIMUM

	L	CASE	M	Q	N
= = MEMBER 5 (6 - 7) G = =					
ITAN	0.000	(20)	1.399	4.722	0.000
1	.350	(20)	2.958	4.190	0.000
2	.750	(20)	4.513	3.582	0.000
3	5.000	(20)	6.007	-2.879	0.000
4	9.250	(20)	-19.955	-9.339	0.000
5	9.650	(20)	-23.812	-9.947	0.000
JTAN	10.000	(20)	-27.387	-10.479	0.000
= = MEMBER 6 (7 - 8) G = =					
ITAN	0.000	(20)	5.648	3.560	0.000
1	.350	(20)	6.801	3.028	0.000
2	.750	(20)	7.891	2.420	0.000
3	4.820	(20)	5.149	-3.767	0.000
4	8.890	(20)	-22.772	-9.954	0.000
5	9.290	(20)	-26.875	-10.562	0.000
JTAN	9.640	(20)	-30.665	-11.094	0.000
= = MEMBER 7 (1 - 5) C = =					
ITAN	0.000	(21)	36.749	-8.514	-83.758
JTAN	7.918	(21)	-30.665	-8.514	-90.251
= = MEMBER 8 (2 - 6) C = =					
ITAN	0.000	(20)	-38.883	9.307	-79.143
JTAN	7.918	(20)	34.810	9.307	-85.636
= = MEMBER 9 (3 - 7) C = =					
ITAN	0.000	(21)	38.883	-9.307	-79.143
JTAN	7.918	(21)	-34.810	-9.307	-85.636
= = MEMBER 10 (4 - 8) C = =					
ITAN	0.000	(20)	-36.749	8.514	-83.758
JTAN	7.918	(20)	30.665	8.514	-90.251

(6) Calculation of upper beam



(1) Calculation of compressive stress caused by bending

(a) Summary of stresses

(i) At the support point

Pick up No. 2

		(1)				(2)			
		①	CO.	⑤	CO.	⑤	CO.	○	CO.
Combined stress	Top	-113.38	12	-211.51	15	-208.92	15		
	Bottom	—	—	—	—	—	—		
Dead load		-50.90	11	-91.84	11	-90.44	11		

(Note) CO. — Combination

(ii) Span moment

		(1)		(2)	
		③	CO.	⑦	CO.
combined stress	Bottom	171.15	13	148.55	14
Mmin	〃	—	—	—	—

(iii) Transit point to haunch

		(1)				(2)			
		②	CO.	④	CO.	⑥	CO.	○	CO.
Combined stress	Bottom	72.35	13	—	—	—	—		

(b) Allowable stress of upper beam, safe against cracking

(i) At the support point 1

Dead load $M_d = -50.90^{tm}$ (case1)

Train load + Impact $M_L = (-48.38-14.11) = -62.49$ (case5)

$\Sigma M = -113.39^{tm}$

$$\alpha = \frac{62.49}{113.39} = 0.55 > 0.25$$

There fore $\sigma_{sa} = 1000$ kg/cm²

(ii) At the support point 2, 3

Dead load $M_d = -91.64^{tm}$ (case1)

Train load + Impact $M_L = -119.67$ " (case5)

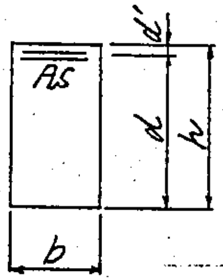
$\Sigma M = -211.31^{tm}$

$$\alpha = \frac{119.67}{211.31} = 0.57 > 0.25$$

There fore $\sigma_{sa} = 1000$ kg/cm²

(c) Cross Section

(i) Cross Section at the support point



$b = 70^{cm}$

$h = 160$ "

$d' = 2.5 + 1.9 + 1.6 + 3.2 = 9.2^{cm}$

$d = 160 - 9.2 = 150.8^{cm}$

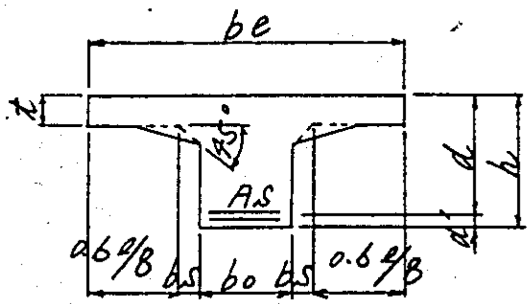
(effective height used for shearing stress calculation)

(ii) Effective width of T-beam compression fibre

$$be = b_o + 2\,(bs + \frac{0.6}{8}\cdot l)$$

$$be1 = 0.70 + 2 \times (0.15 + \frac{0.60}{8} \times 9.64) = 2.45^{m}$$

$$be2 = 0.70 + 2 \times (0.15 + \frac{0.60}{8} \times 10.00) = 2.50^{m}$$



$b_o = 70^{cm}$

$h = 120$ "

$d' = 3.0 + 1.3 + 1.6 + 3.2 = 9.1^{cm}$

$d = 120 - 9.1 = 110.9^{cm}$

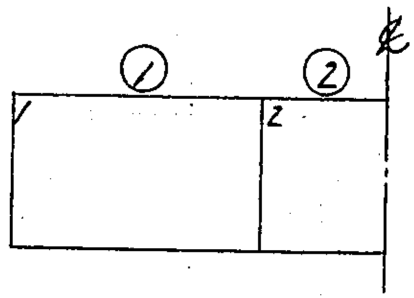
$t = 28^{cm}$

(d) Bending stress calculation

	①					
	①	①	②	③		
M (tm)	-50.90	-113.39	72.35	171.13		
N (t)						
S (t)						
b (cm)	70	〃	245	245		
h (cm)	160	〃	120	120		
d (cm)	150.8	〃	113.8	110.9		
d' (cm)	9.2	〃	6.2	9.1		
As (cm²)	D32 < 7/2 71.48	〃	D32 - 7 55.59	D32 < 6/7 103.25		
p	0.00677	〃	0.00199	0.00380		
As' (cm²)						
p'						
e=M/N (cm)						
e=M/N+u (cm)						
e=M/N−u (cm)						
e/h (t)			(28)	(28)		
d/e						
d'/h						
d'/d (t/d)			(0.246)	(0.252)		
M/bd² (kg/cm²)	3.198	7.123	2.280	5.679		
k				0.287		
c						
j				0.907		
1/Lc	6.32	〃	9.96			
1/Ls	169	〃	541			
β=σs/σc						
σc (kg/cm²)		45.0	22.7	44.3		
σs (kg/cm²)	540	1200	1230	1650		
τ (kg/cm²)						
σsa (kg/cm²)	1000	1800	1800	1800		
σca (kg/cm²)		90	90	90		
τa (kg/cm²)						
Nomogram number	M-1	〃	M-47.M-1	M-47.48		
Combination	D	D+T+L	D+T+L	D+T+L		

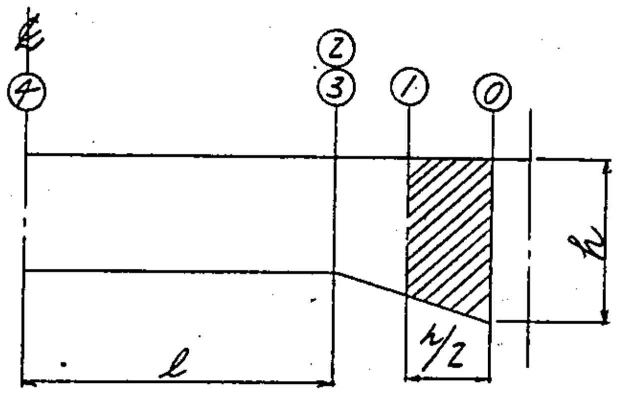
	①		②			
	⑤	⑤	⑦			
M (tm)	-91.64	-211.31	148.55			
N (t)						
S (t)						
b (cm)	70	〃	250			
h (cm)	160	〃	120			
d (cm)	150.8	〃	110.9			
d' (cm)	9.2	〃	9.1			
As (cm^2)	D32 < 7/5 95.30	〃	D32 < 6/7 103.25			
p	0.00903	〃	0.00372			
As' (cm^2)						
p'						
e = M/N (cm)						
e = M/N + u (cm)						
e = M/N − u (cm)						
e/h (t)			(28)			
d/e						
d'/h						
d'/d (t/d)			(0.252)			
M/bd² (kg/cm²)	5.757	13.275	4.831			
k			0.285			
c						
j			0.902			
1/Lc	5.74	〃				
1/Ls	128	〃				
β = σs/σc						
σc (kg/cm²)		76.2	37.9			
σs (kg/cm²)	740	1700	1430			
τ (kg/cm²)						
σsa (kg/cm²)	1000	1800	1800			
σca (kg/cm²)		90	90			
τa (kg/cm²)						
Nomogram number	M-1	〃	M-47-48			
Combination	D	D+T+I	D+T+I			

(2) Calculation of shearing stress



(a) Summary of shearing stresses

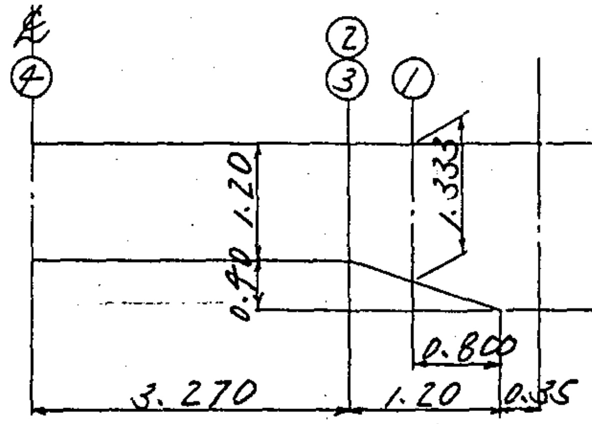
For examining Section 0, shearing stress at section 1. is used



	①				②			
	Left support	CO.	Right support	CO.	Left support	CO.	Right support	CO.
⓪	110.26	12 (1+2+3)	-131.28	15 (1+5)	127.31	15 (1+5)		
①	91.32		-112.34		108.37			
②	56.77		-102.44		98.47			
③	56.77		-102.44		98.47			
④	-5.38		-15.64		6.85			

(Note) CO. - Combination

(b) Shearing stress caused by bending



(i) Correction for shearing stress

$$S = So - \frac{M}{d}(\tan\alpha)$$

Where, M : Bending moment (tm)

d : Effective height (m)

α : An angle of elevation of the member

So: shearing stress caused by bending

	So (t)	M (tm)	d (cm)	tan α	S (t)
①	112.34	-85.73	1.241	1/3	89.31
②	102.44	-48.25	1.108	1/3	87.92
③	102.44	——	1.108	——	102.44
④	15.64	——	1.108	——	15.64

Combination 15 (1 + 5)

(ii) Shearing stress

$$\tau = \frac{S}{b \cdot d}$$

Where

τ : Shearing stress (kg/cm²)

S : Shearing force (kg)

b : Width of member (cm)

d : Effective height of member

$$\tau b1 = \frac{89.31 \times 10^3}{70 \times 124.1} = 10.28 \text{ kg/cm}^2 < 17 \text{ kg/cm}^2$$

$$\tau b2 = \frac{87.92 \times 10^3}{70 \times 110.8} = 11.34 \quad " \quad < \quad "$$

$$\tau b3 = \frac{102.44 \times 10^3}{70 \times 110.8} = 13.21 \quad " \quad < \quad "$$

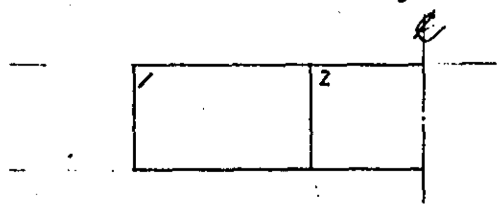
$$\tau b4 = \frac{15.64 \times 10^3}{70 \times 110.8} = 2.02 \quad " \quad < \quad "$$

(C) Shearing stress caused by torsional moment

(i) Torsional moment

Refer the result of computer analysis on torsional moment.

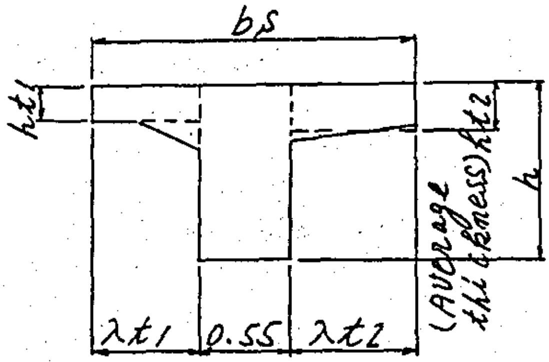
(Without the beam for electric pole, Single track loading)



point		Distance (m)	Mt (tm)	
			①-② member	②-③ member
⓪	Column front	0.350	13.93	14.68
①	h/2 point	1.150	11.44	12.15
②	Transit pt. of haunch	1.550	9.46	10.11
③	〃	1.550	9.46	10.11
④	Mid - span	(4.820) 5.000	0	0

Value in ( ) represents 1-2 member

(ii) Effective width



One side effective width of projected flange subjected to the torsional moment is calculated followed the equation.

$$\lambda t = 3 \cdot ht$$

Intermediate part

$$\lambda t_1 \leqq l_b/2$$

Cantilever part

$$\lambda t_2 \leqq l_c$$

Where,

λt : One side effective width of projected flange (m)

h_t : Thickness of projected flange (m)

l_b : net clearance between girders (m)

l_c : Projecting length of cantilever slab (m)

$h_{t1} = 0.28^m$ $h_{t2} = 0.315^m$ (Average thickness)

$\lambda t_1 = 3 \times 0.28 = 0.840^m < \frac{l_b}{2} = 2.150^m$

$\lambda t_2 = 3 \times 0.315 = 0.945'' < l_c = 2.100''$

Column front $h_0 = 1.600^m$

$l/2$ point $h_1 = 1.333''$

Transit pt. of haunch $h_2 = h_3 = 1.200^m$

(iii) Shearing stress caused by torsion on T section

Torsional shearing stress is calculated followed the equation.

$$\tau_{ti} = \frac{M_T}{I_t} \cdot b_i \cdot \eta_i$$

Where, τti : Shearing stress of concrete calculated on each rectangular Section (kg/cm^2)

MT : Torsional moment (kg/cm^2)

bi : Shorter side of each rectangular Section (cm)

~~ηi :~~ Referred Table - 40. (2).

It : Torsional moment of inertia (cm^4)

ai : Longer side of each rectangular Section

ki : Referred Table - 40. (2).

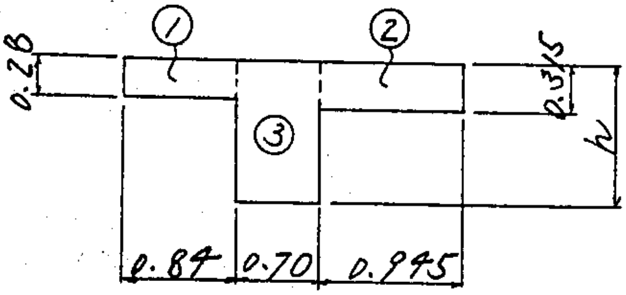
Table - 40. (2) Coefficient ηi

a/b	1.0	1.2	1.5	1.75	2.0	2.5	3.0	4.0	5.0
ηi	0.675	0.759	0.848	0.895	0.930	0.968	0.985	0.997	0.999

Table - 40. (3). Coefficient ki

a/b	1.0	1.2	1.5	1.75	2.0	2.5	3.0	4.0	5.0
ki	0.140	0.166	0.196	0.214	0.229	0.249	0.263	0.281	0.292

(i) Torsional moment of inertia



		$a^{(m)}$	$b^{(m)}$	a/b	k	$I_t = k \cdot a \cdot b^3$ (m^4)
①		0.840	0.280	3.000	0.263	$0.263 \times 0.840 \times 0.28^3 = 0.00485$
②		0.945	0.315	3.000	0.263	$0.263 \times 0.945 \times 0.315^3 = 0.00777$
③	column front	1.600	0.700	2.286	0.240	$0.240 \times 1.600 \times 0.700^3 = 0.13171$
	h/2 Pt.	1.333	0.700	1.904	0.223	$0.223 \times 1.333 \times 0.700^3 = 0.10196$
	Transit Pt. of haunch	1.200	0.700	1.714	0.211	$0.211 \times 1.200 \times 0.700^3 = 0.08685$

Column front

$\Sigma I_{t0} = 0.00485 + 0.00777 + 0.13171$

$= 0.14433\ m^4 = 14.433 \times 10^6\ cm^4$

h/2 point

$\Sigma I_{t1} = 0.00485 + 0.00777 + 0.10196$

$= 0.11458\ m^4 = 11.485 \times 10^6\ cm^4$

Transit point of haunch

$\Sigma I_{t2} = 0.00485 + 0.00777 + 0.08685$

$= 0.09947\ m^4 = 9.947 \times 10^6\ cm^4$

(ii) Torsional moment beared by longitudinal beam.

(for calculation of axial re-bars)

$$Mt = M_T \cdot \frac{It_3}{\Sigma It}$$

Column front

$$Mt_0 = 14.68 \times \frac{13.171 \times 10^6}{14.433 \times 10^6} = 13.40 \ ^{tm}$$

h/2 point

$$Mt_1 = 12.15 \times \frac{10.196 \times 10^6}{11.458 \times 10^6} = 10.81 \ \text{"}$$

Transit point of haunch

$$Mt_2 = Mt_3 = 10.11 \times \frac{8.685 \times 10^6}{9.947 \times 10^6} = 8.83 \ ^{tm}$$

(iii) Torsional shearing stress of longitudinal beam

$\ell/2$ point

$M_T = 12.15^{tm}$

$a = 133.3^{cm} \quad b = 70^{cm}$

$$\frac{a}{b} = \frac{133.3}{70} = 1.904$$

Table - 40. (2) $\eta = 0.917$

$$\tau_{t1} = \frac{12.15 \times 10^5}{11.458 \times 10^6} \times 70.0 \times 0.917 = 6.81 \ \mathrm{kg/cm^2}$$

Transit point of haunch

$M_t = 10.11^{tm}$

$a = 120^{cm} \quad b = 70^{cm}$

$$\frac{a}{b} = \frac{120}{70} = 1.714$$

Table - 40. (2) $\eta = 0.888$

$$\tau_{t2} = \frac{10.11 \times 10^5}{9.947 \times 10^6} \times 70.0 \times 0.888 = 6.32 \ \mathrm{kg/cm^2}$$

(d) Combined shearing stress

$\tau_b < 3.9$ kg/cm² --- Diagonal tension re-bars not are not required calculation

$\tau_b < 17$ " --- Diagonal tension re-bars are calculated.

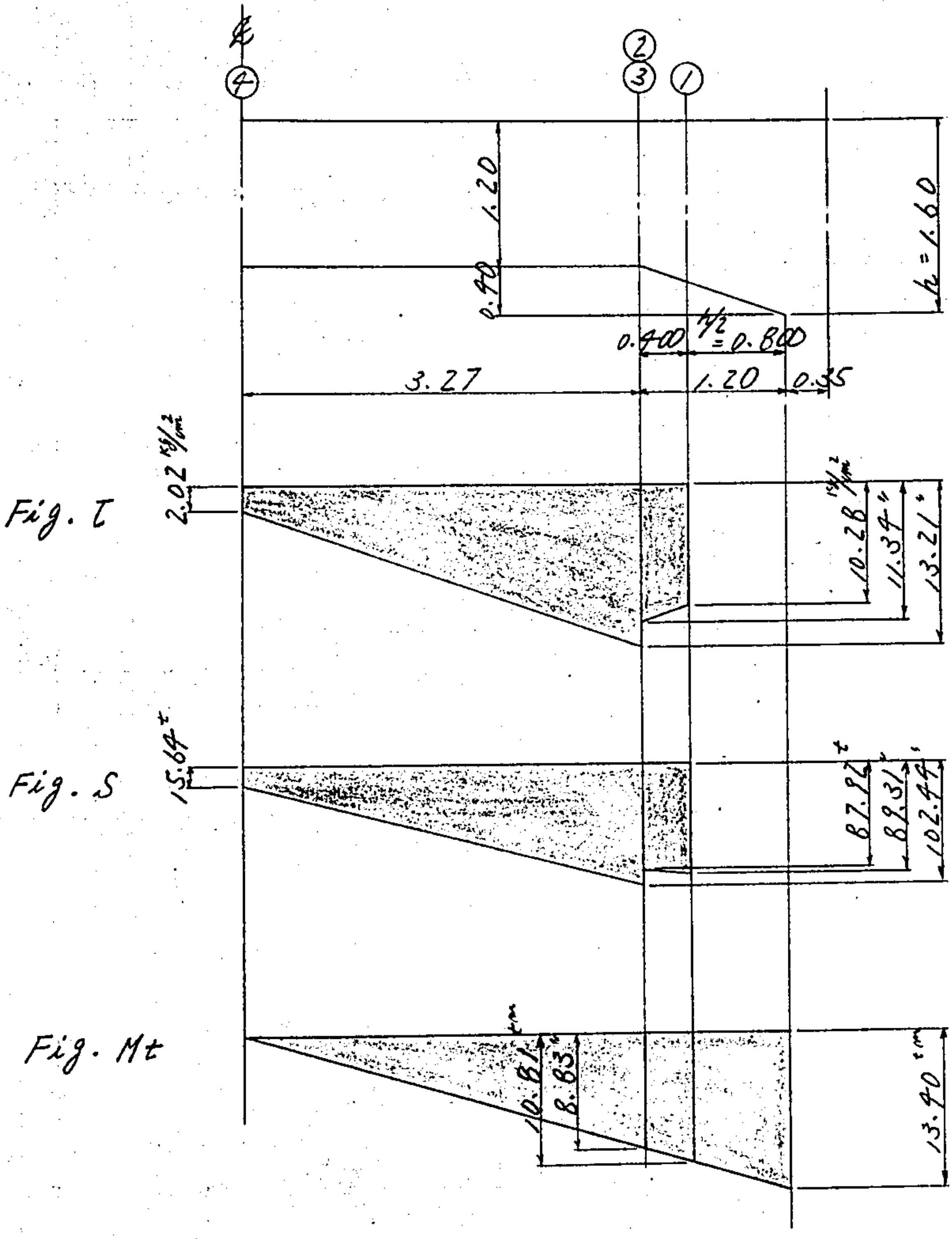
$\tau_b + \tau_t < 17 \times 1.3 = 22.1$ kg/cm² --- Torsion is considered

	τ_b		τ_t				
h/2 point	10.28	+	6.81	=	17.09 kg/cm²	<	22.1 kg/cm²
Transit pt. of haunch	11.34	+	6.32	=	17.66 "	<	" "
"	13.21	+	6.32	=	19.53 "	<	" "
Span Center Point	2.02	+	0	=	2.02 "	<	" "

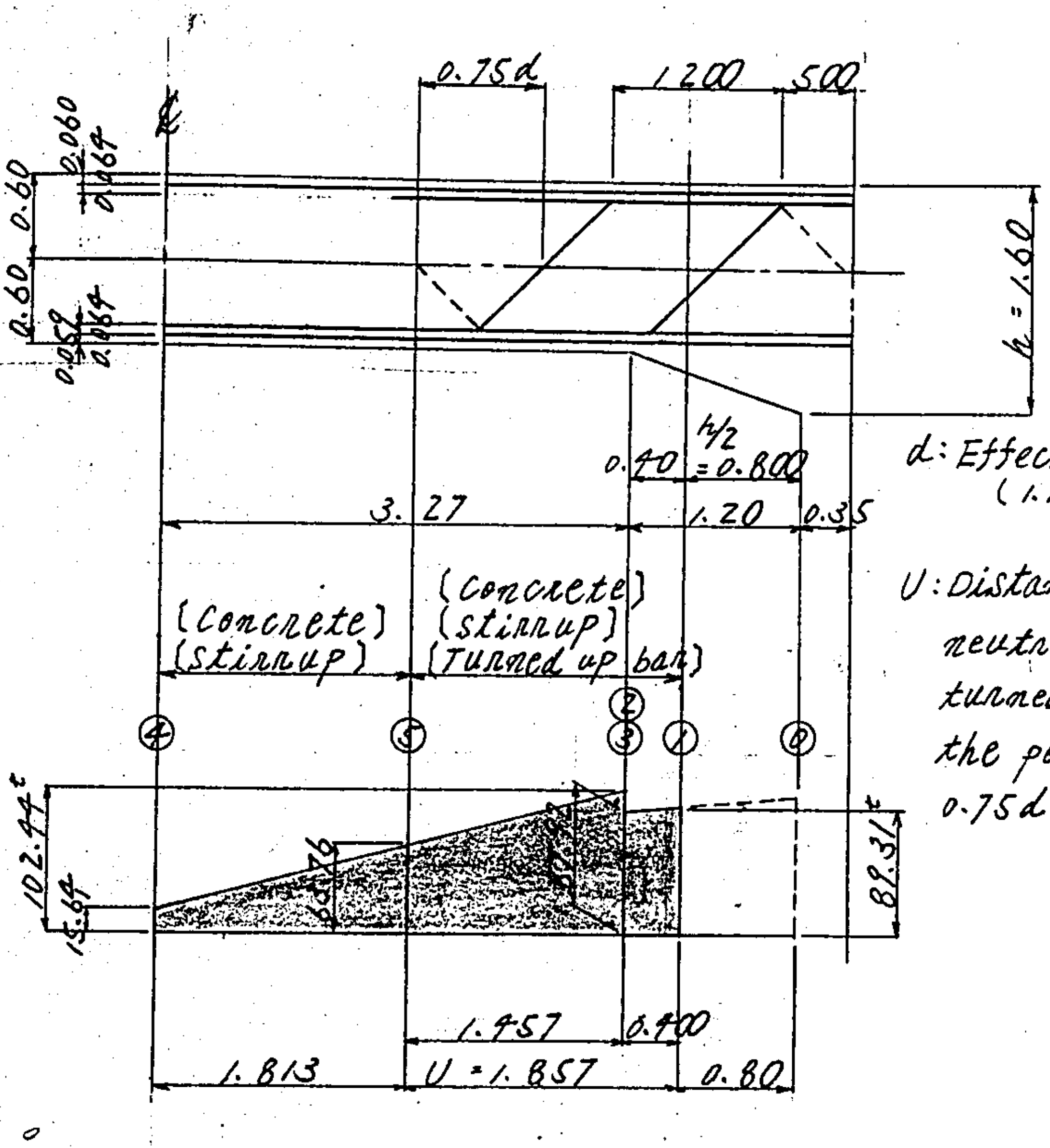
Calculated as above, diagonal tension re-bars are examined.

(3). Calculation of diagonal tension re-bars

(a) Shearing stress caused by bending



(b) Share of shearing force



d : Effective height (1.108ᵐ)

U : Distance from the neutral point of turned up bar to the point of 0.75d

$$U = (0.50 + 1.20 + 0.600 - 0.060 - 0.064 + 0.75 \times 1.108) - (0.35 + 0.800) = 1.857^{m}$$

Sd at point U

$$Sd = \frac{102.44 - 15.64}{3.270} \times 1.813 + 15.64 = 63.76^{t}$$

(c) Shearing force beared by concrete

(i) Area F subjected total shear within the range of U

$F = (87.92 + 89.31) \times 0.400 \times 1/2 + (102.44 + 63.76) \times 1.457 \times 1/2 = 156.52^{tm}$

(ii) Area Fc subjected shear beared by concrete

$Sc = 1/2 \cdot \tau c \cdot b \cdot d$

Where

Sc: Shearing force beared by concrete (t)

τc : $\sigma ck = 240$ kg/cm², $\tau c = 3.9$ kg/cm²

b : Width of cross section of member (cm)

d : Effective height of member (cm)

$Sc_1 = 1/2 \times 3.9 \times 70 \times 110.8 \times 10^{-3} = 15.12^{t}$

$Sc_2 = 1/2 \times 3.9 \times 70 \times 124.1 \times 10^{-3} = 16.94$ "

$\therefore Fc = 15.12 \times 1.457 + (15.12 + 16.94) \times 0.400 \times 1/2$

$= 28.44^{tm}$

(d) Shearing force beared by stirrup

Arrange stirrups D13 - 2 sets in 15.0cm ctc.

i) Torsional shearing stress

$$\sigma st = \frac{Mt \cdot s}{0.8 \cdot AV \cdot b_1 \cdot h_1} \times \frac{a_1}{b_1}$$

Where,

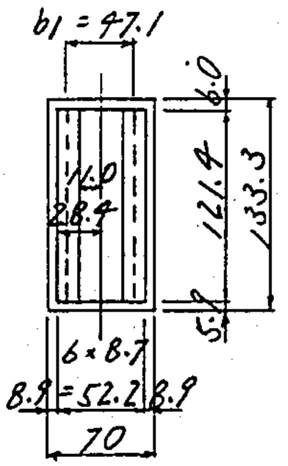
Mt : Torsional moment (tm)

s : ctc distance of stirrup (cm)

Av : Gross cross section of coupled stirrups (cm^2)

b_1, h_1 : Length of short long side of stirrup

(i) At h/2 point



Mt : $10.81^{\ tm}$

s : $15.0^{\ cm}$

Av : $1.267 \times 4 = 5.07^{\ cm^2}$

h_1 : $121.4 + 3.2 + 1.3 = 125.9^{\ cm}$

b_1 : $\dfrac{11.0^2 + 28.4^2}{11.0 + 28.4} \times 2 = 47.1^{\ cm}$

$$\sigma st_1 = \frac{10.81 \times 10^5 \times 15.0}{0.8 \times 5.07 \times 47.1 \times 125.9} \times \frac{28.4 \times 2}{47.1}$$

$$= 813 \ kg/cm^2 < 1800 \ kg/cm^2$$

(ii) At the transit point to haunch

$Mt = 8.83^{\ tm}$

$s = 15.0^{\ cm}$

$Av = 1.267 \times 4 = 5.07^{\ cm^2}$

$b_1 = 47.1^{\ cm}$

$h_1 = 120 - 6.0 - 5.9 + 3.2 + 1.3 = 112.6^{\ cm}$

$$\sigma_{st2} = \frac{8.83 \times 10^5 \times 15.0}{0.8 \times 5.07 \times 47.1 \times 112.6} \times \frac{28.4 \times 2}{47.1}$$

$$= 743 \ kg/cm^2 < 1800 \ kg/cm^2$$

(iii) At U point

$$Mt = \frac{8.83}{3.270} \times 1.813 = 4.90 \ tm$$

$$h_1 = 112.6 \ cm$$

$$\sigma_{st3} = \frac{4.90 \times 10^5 \times 15.0}{0.8 \times 5.07 \times 47.1 \times 112.6} \times \frac{28.4 \times 2}{47.1}$$

$$= 412 \ kg/cm^2 < 1800 \ kg/cm^2$$

ii) Bending shear beared by stirrup

In the case when combined with torsional moment, allowable shearing stress is as 20 percent increased.

$$\sigma_{sa} = 1800 \times 1.2 = 2160 \ kg/cm^2$$

$$Sv = \frac{(\sigma_{sa} - \sigma_{st}) \cdot Av \cdot d}{1.15 \cdot s}$$

(i) At h/2 point

$$(2160 - 813) = 1347 \ kg/cm^2 < 1800 \ kg/cm^2$$

$$d = 124.1 \ cm$$

$$Sv = \frac{1347 \times 5.07 \times 124.1}{1.15 \times 15.0 \times 10^3} = 49.13 \ t$$

(ii) At the point transit to haunch

$(2160 - 743) = 1417\ ^{Kg/cm^2} < 1800\ ^{Kg/cm^2}$

$d = 110.8\ ^{cm}$

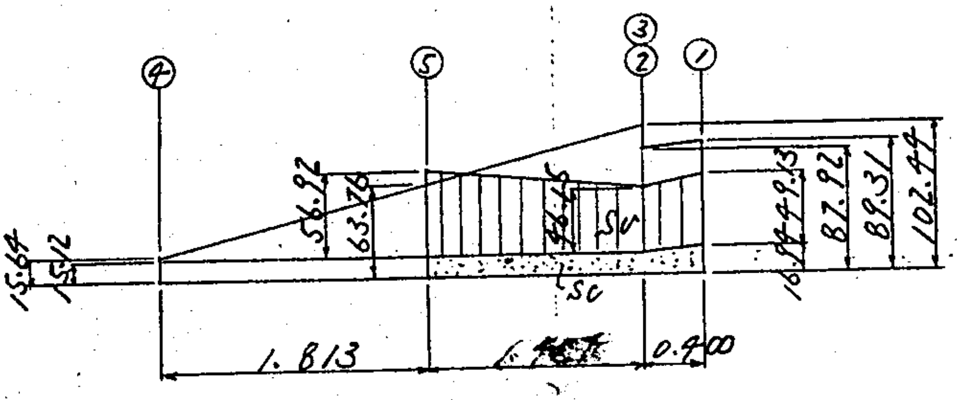
$$S_v = \frac{1417 \times 5.07 \times 110.8}{1.15 \times 15.0 \times 10^3} = 46.15\ ^t$$

(iii) At U point

$(2160 - 412) = 1748\ ^{Kg/cm^2} < 1800\ ^{Kg/cm^2}$

$d = 110.8\ ^{cm}$

$$S_v = \frac{1748 \times 5.07 \times 110.8}{1.15 \times 15.0 \times 10^3} = 56.92\ ^t$$



Area Fv for the shear beared by stirrup

$F_v = (56.92 + 46.15) \times 1.457 \times 1/2 + (46.15 + 49.13)$

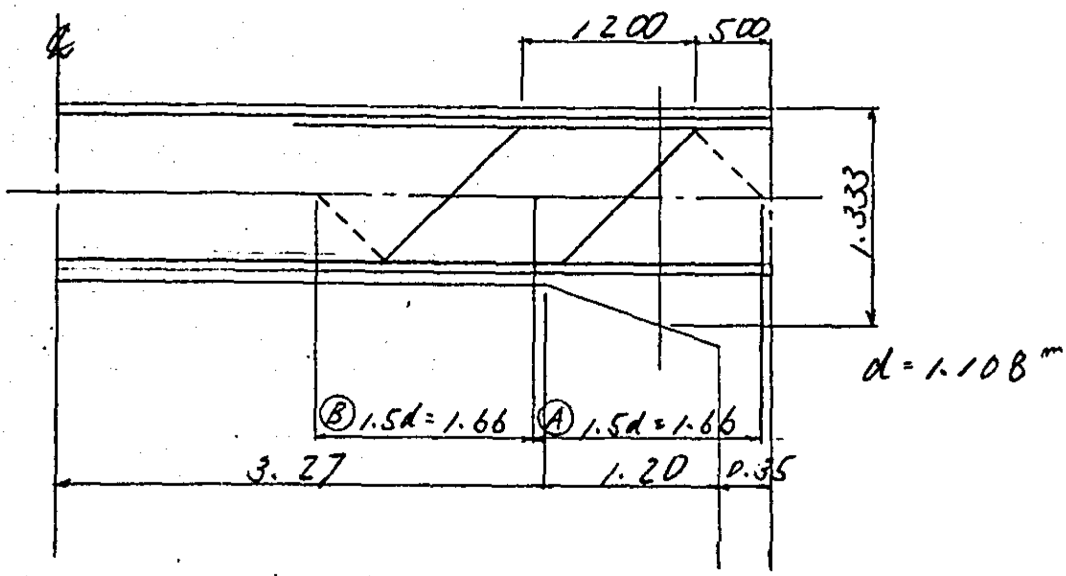
$\times 0.400 \times 1/2 = 94.14\ ^t$

$1/2 \times (F - F_c) = 1/2 \times (156.52 - 28.44) = 64.04\ ^t$

$< F_v = 94.14\ ^t$

(e) Shear beared by turned up bar

(i) Shear beared by Ⓐ



Effective range of turned up bars is assumed as the distance of 0.75d of each arrangement.

$As = D32 - 2 = 15.88\ cm^2$

$d = 133.3 - 9.2 = 124.1\ cm$

$\sin\theta + \cos\theta = 1.414$

$$F_{ba} = \frac{\sigma_{sa} \cdot A_s \cdot d \cdot (\sin\theta + \cos\theta)}{1.15}$$

Where,

σ_{sa} : Allowable tensile stress of bar (kg/cm²)

A_s : Cross section of turned up bar (cm²)

θ : Elevation angle of turned up bar with the axis of member $\theta = 45°$

s : Spacing of turned up bars in axial direction of member (m)

$$Fb \cdot A = \frac{1800 \times 15.88 \times 124.1 \times 1.414}{1.15 \times 10^5} = 43.62^{tm}$$

Therefore, the average resisting shear within 1.5d distance will be

$$Sb \cdot A = \frac{Fb \cdot A}{s} = \frac{43.62}{1.66} = 26.28^{t}$$

(ii) Shear beared by Ⓑ

$$As = D32 - 2 = 15.88^{cm^2}$$

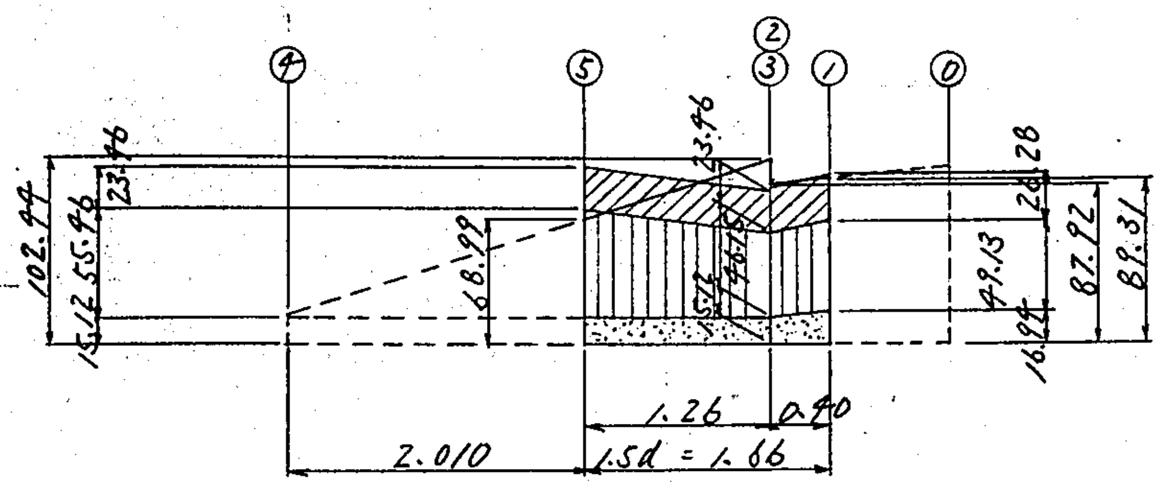
$$d = 110.8^{cm}$$

$$Fb \cdot B = \frac{1800 \times 15.88 \times 110.8 \times 1.414}{1.15 \times 10^5} = 38.94^{tm}$$

$$Sb \cdot B = \frac{38.94}{1.66} = 23.46^{t}$$

(f) Resultant resisting shear

(i) Section Ⓐ



Area of acting shear

$F = (68.99 + 102.44) \times 1.26 \times 1/2 + (87.92 + 89.31)$

$\times 0.40 \times 1/2 = 143.45^{t \cdot m}$

Area of resisting shear

$F_c = 15.12 \times 1.26 + (15.12 + 16.94) \times 0.40 \times 1/2 = 25.46^{tm}$

$F_v = (55.46 + 46.15) \times 1.26 \times 1/2 + (46.15 + 49.13)$

$\times 0.40 \times 1/2 = 83.07^{t \cdot m}$

$F_v > 1/2 (F - F_c) = 1/2 \times (143.45 - 25.46) = 117.99^{tm}$

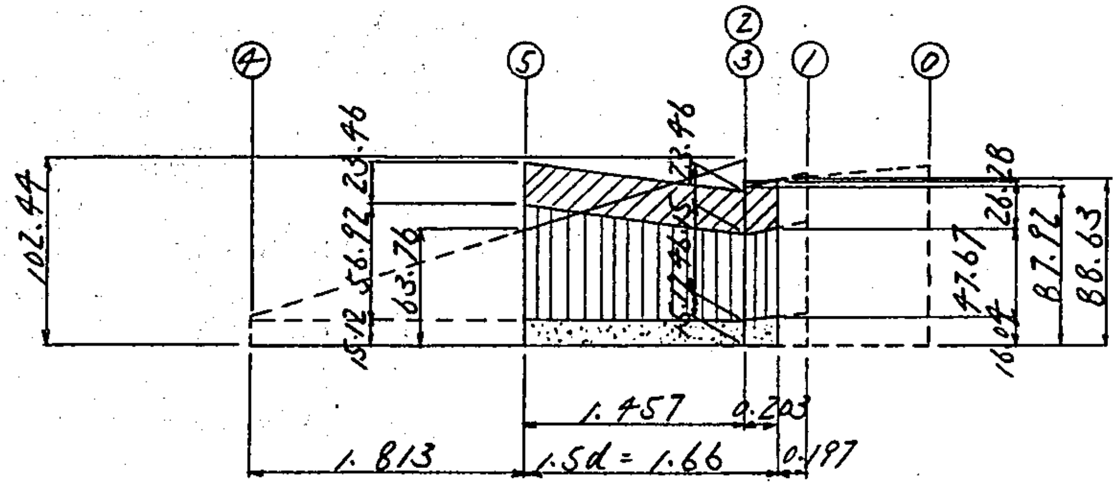
$F_b = 23.46 \times 1.26 + 26.28 \times 0.40$

$= 40.07^{t \cdot m}$

$F_c + F_v + F_b = 25.46 + 83.07 + 40.07$

$= 148.60^{tm} > F = 143.45^{tm}$

(ii) Section Ⓑ



Area of acting shear

$F = (63.76 + 102.44) \times 1.457 \times 1/2 + (87.92 + 88.63)$

$\times 0.203 \times 1/2 = 139.00^{t \cdot m}$

Area of resisting shear

$F_c = 15.12 \times 1.457 + (15.12 + 16.04) \times 0.203 \times 1/2 = 25.19^{t \cdot m}$

$F_v = (56.92 + 46.15) \times 1.457 \times 1/2 + (46.15 + 47.67)$

$\times 0.203 \times 1/2 = 84.61^{t \cdot m}$

$F_v > 1/2 (F - F_c) = 1/2 \times (139.00 - 25.19) = 113.81^{tm}$

$F_b = 23.46 \times 1.457 + 26.28 \times 0.203$

$= 39.52^{tm}$

$F_c + F_v + F_b = 25.19 + 84.61 + 39.52$

$= 149.32^{tm} > F = 139.00^{tm}$

(g) Calculation of bars in axial direction

Required bars are calculated followed the equation

$$As = \frac{Mt\,(b_1 + h_1)}{0.8 \cdot \sigma sa \cdot b_1 \cdot h_1}$$

Where

As : Bars in axial direction

Mt : Torsional moment

σsa : Allowable stress of bar

b_1, h_1 : Length of short/Long side of stirrup

i) At Column front

Mt : 13.40 ^{tm}

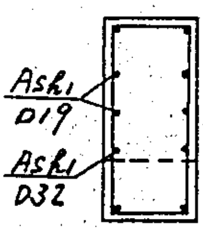
σs : 1800 $^{kg/cm^2}$

b_1 : 28.4 × 2 = 56.8 ^{cm}

h_1 : 160.0 − 6.0 − 5.9 + 3.2 + 1.3 = 152.6 ^{cm}

$$As = \frac{13.40 \times 10^5 \times (56.8 + 152.6)}{0.8 \times 1800 \times 56.8 \times 152.6} = 22.48\ cm^2$$

Required bar arrangement for shorter side



$$Asb_1 = 22.48 \times \frac{56.8}{2 \times (56.8 + 152.6)} = 3.05\ cm^2$$

Required bar arrangement for longer side

$$Ash_1 = 22.48 \times \frac{152.6}{2 \times (56.8 + 152.6)} = 8.19\ cm^2$$

(i) Top side (refer the calculation of bending stress)

.... Use main bars for this purpose as well.

$$As = \frac{1800 \times 1.2 - 1700}{1800} \times 95.30 = 24.35\ cm^2 > 3.05\ cm^2$$

$$As' = D32 - 12 = 95.30\ cm^2$$

(ii) Bottom side (refer the same) ... Use haunch bar for this purpose as well

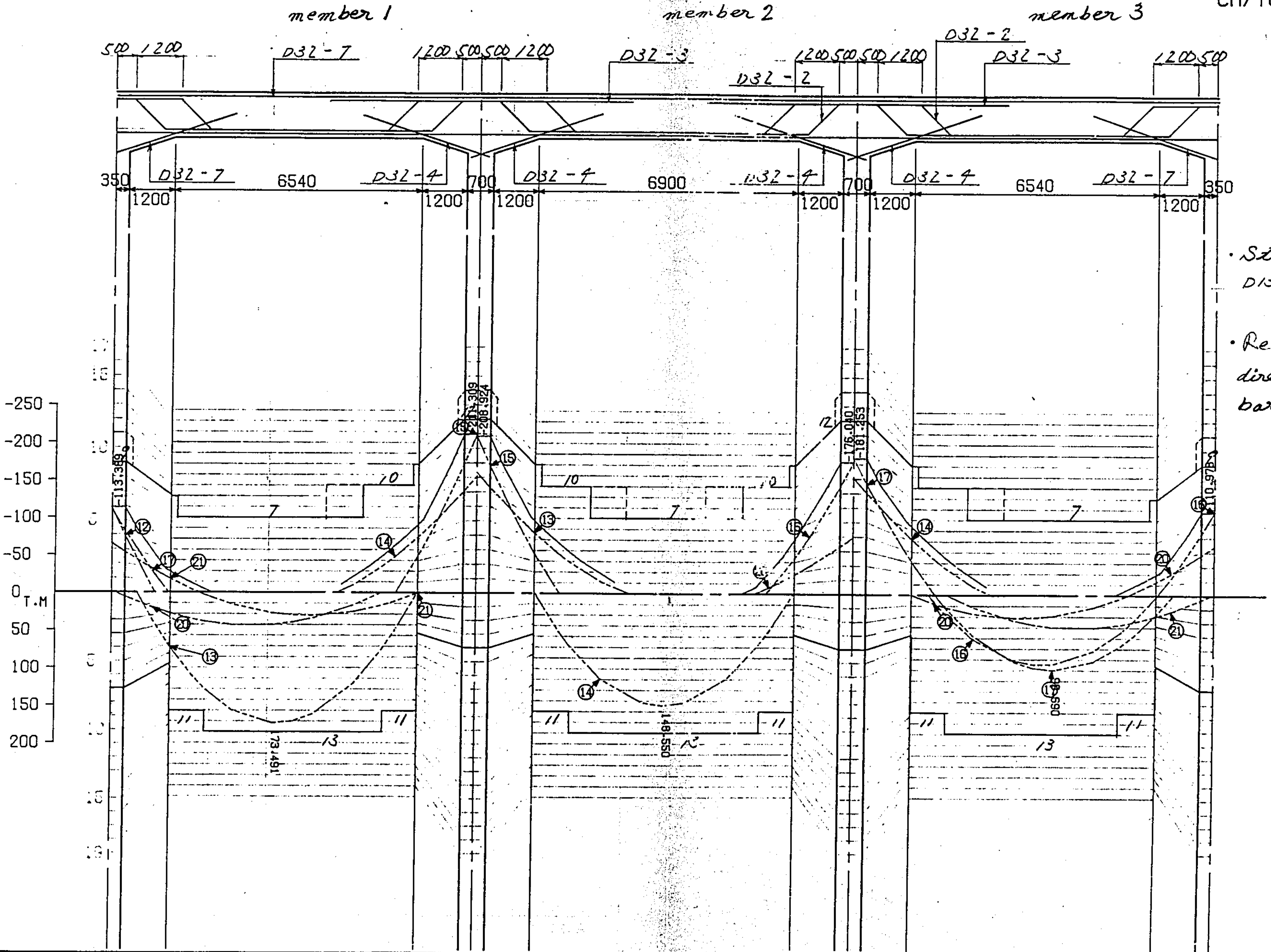
$$As = D32 - 4 = 31.77\ cm^2 > 3.05\ cm^2$$

(iii) Side (One side)

$$As = \begin{matrix} D19 - 2 \\ D32 - 1 \end{matrix} > 13.67\ cm^2 > 8.19\ cm^2$$

Resisting bending moment diagram

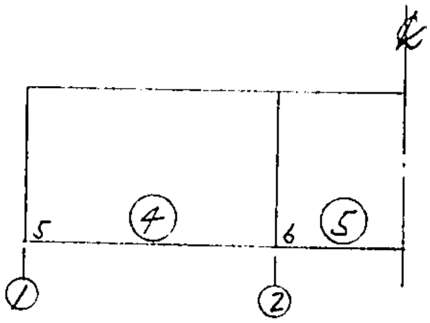
Scale 1/100
CM/TON 1.0/50



· Stirrup
D13 - 2sets, 150 ctc

· Re-bars in axial direction D19-2 bars (one side)

[7] Calculation of buried beam



(1) Summary of stresses

(a) Bending moment

Pick up No.2

	④				⑤			
	①	CO.	②	CO.	②	CO.	○	CO.
TOP	-30.67	21	-33.91	20	-27.39	21		
Bottom	18.69	20	6.80	21	9.97	20		
Dead load	-9.80	11	-20.82	11	-19.49	11		

(b) Shearing force

④				⑤			
Left h/2 point	CO.	Left h/2 point	CO.	Left h/2 point	CO.	Left h/2 point	CO.
9.95	21	-11.48	20	9.91	17		

(Note) CO. — Combination

(C) Stress Calculation

	④					
	① Bottom	② TOP	② TOP			
M (tm)	18.69	-20.82	-33.41			
N (t)						
S (t)						
b (cm)	60	60	60			
h (cm)	80	80	80			
d (cm)	65	72.9	72.9			
d' (cm)	15	7.1	7.1			
As (cm²)	D32 - 5 =39.71	D32 - 5 =39.71	D32 - 5 =39.71			
p	0.01018	0.00908	0.00908			
As' (cm²)						
p'						
e= M/N (cm)						
e= M/N+u (cm)						
e= M/N−u (cm)						
e/h						
d/e						
d' /h						
d' /d						
Ne/bd² (kg/cm²)	7.37	6.53	10.48			
k						
c						
j						
1/Lc	5.53	5.73	5.73			
1/Ls	114	127	127			
β= σs/σc						
σc (kg/cm²)	40.8		60			
σs (kg/cm²)	840	830	1330			
τ (kg/cm²)						
σsa (kg/cm²)	90		90			
σca (kg/cm²)	1800	1600	1800			
τa (kg/cm²)						
Nomogram number	M-1	〃	〃			
combination	D + S	D	D + S			

(3). Required minimum bar arrangement

(i) Top of the support point

$$As = \frac{M}{\sigma sa \cdot j \cdot d} \times \frac{4}{3} = \frac{33.41 \times 10^5}{1800 \times 0.875 \times 72.1} \times \frac{4}{3} = 39.23 \text{ cm}^2$$

Therefore,

$$D32 - 5 = 39.71 \text{ cm}^2 > 39.23 \text{ cm}^2$$

(ii) Bottom of support point

$$As = \frac{18.69 \times 10^5}{1800 \times 0.875 \times 65} \times \frac{4}{3} = 24.34 \text{ cm}^2$$

Therefore

$$D32 - 5 = 39.71 \text{ cm}^2 > 24.34 \text{ cm}^2$$

(4) Shearing stress

(a) Shearing stress caused by bending

$$\tau = \frac{S}{b \cdot d}$$

$$S = 11.48 \text{ t}$$

$$\tau = \frac{11.48 \times 10^3}{60 \times 72.1} = 2.65 \text{ kg/cm}^2 < 3.9 \text{ kg/cm}^2$$

Therefore stirrup

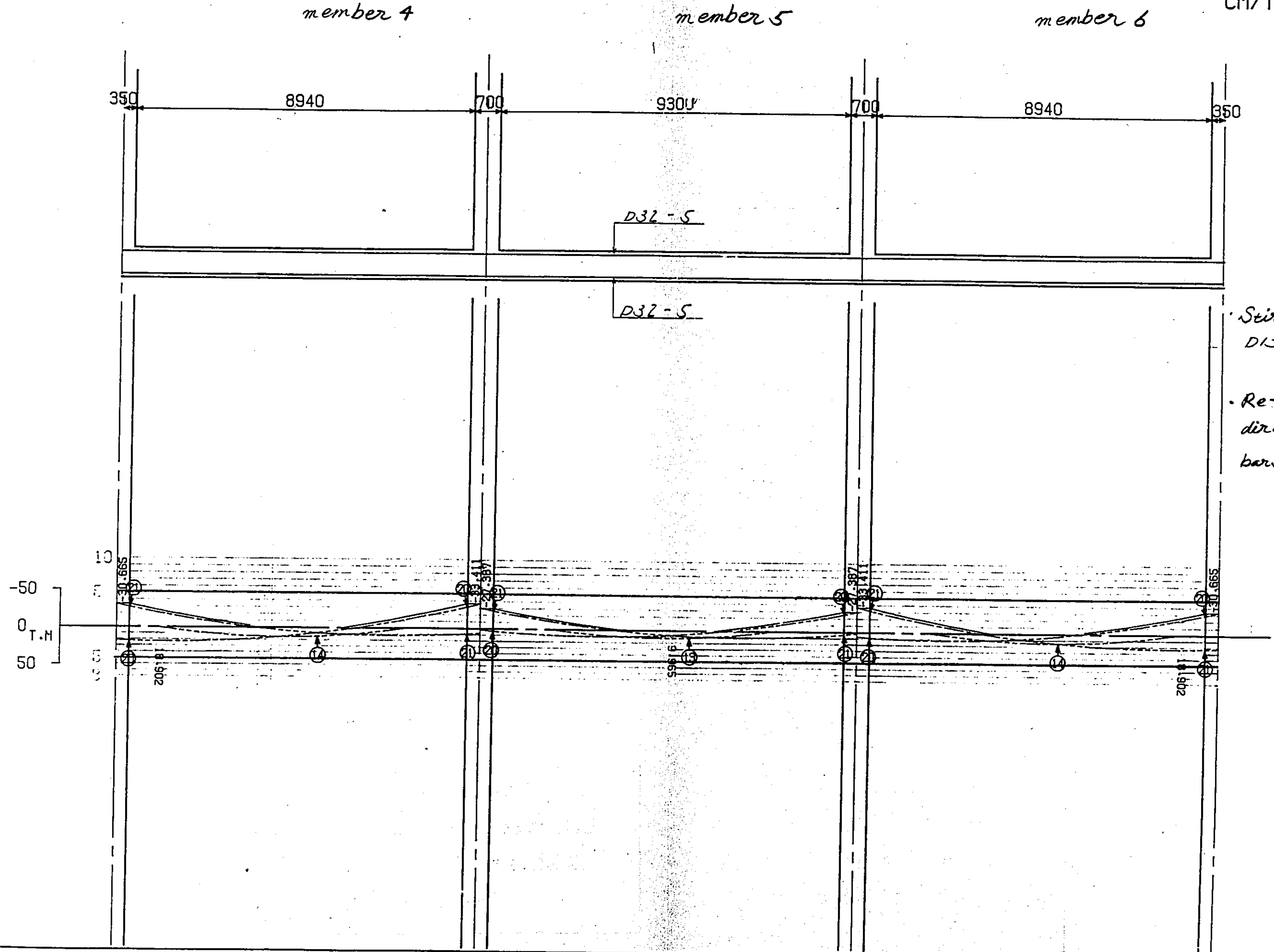
Use D13 - One set in 25 cm ctc.

Bar arrangement in axial direction

Use D16 - 2 bars (One side)

Resisting bending moment diagram

Scale 1/100
CM/TON 1.0/50



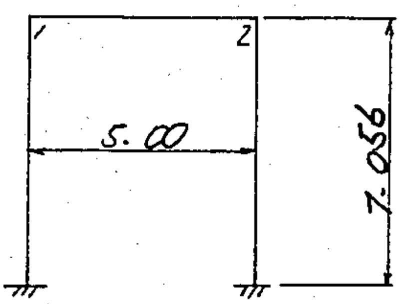
· Stirrup
D13 - 1sets - 250 cc

· Re-bars in axial direction D16-2 bars (one side)

§6 Rigid frame analysis on transversal section (①-①) of elevated structure

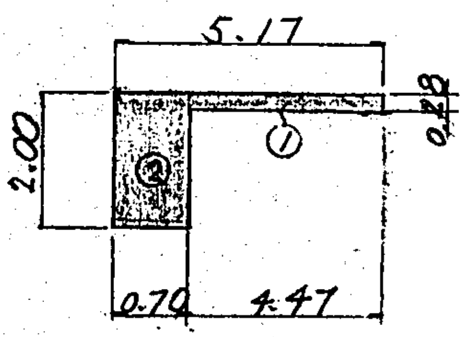
(1) Elements for rigid frame analysis

1. Configulation and dimension



2. Cross-sectional area and moment of Inertia of the member

(1) Member (1~2)



effective width

$b_e = 9.64 \times 1/2 + 0.35$

$= 5.17^m$

	b (m)	h (m)	A (m²)	y (m)	A·y (m³)
①	4.470	0.280	1.252	0.140	0.17528
②	0.700	2.000	1.400	1.000	1.40000
Σ			2.652		1.57528

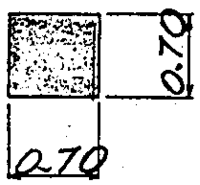
$$y = \frac{1.57528}{2.652} = 0.594^m$$

	$b^{(m)}$	$h^{(m)}$	$A^{(m^2)}$	$y_0^{(m)}$	I_0 (m^4)	$A \cdot y_0^2$ (m^4)	$I_0 + A \cdot y_0^2$ (m^4)
①	4.470	0.280	1.252	0.454	0.00818	0.25806	0.26624
②	0.700	2.000	1.400	0.406	0.46667	0.23077	0.69744
Σ			2.652		0.47485	0.48883	0.96368

Cross-Sectional Area $A = 2.652^{m^2}$

Moment of Inertia $I = 0.96368^{m^4}$

(2) Member (1~3. 2~4)



$A = 0.70 \times 0.70 = 0.490^{m^2}$

$I = 1/12 \times 0.70 \times 0.70^3 = 0.02001^{m^4}$

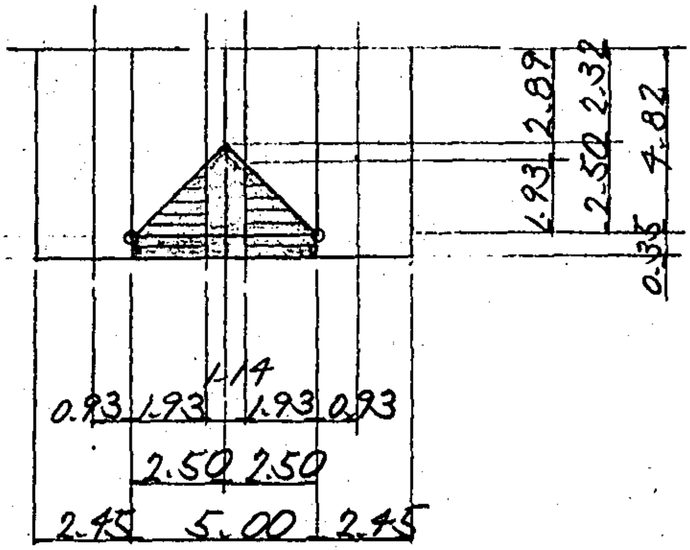
(3) axial height

$h_1 = 7.650 - 0.594 = 7.056^{m}$

(2) Calculation of loads

1. Dead Load

(1) Member (1 - 2)



(a) Disthibuted Load (A)

Weight of Slab ~~grading~~ Concrete and Ballast

Slab	2.5 t/m³ × 0.28	=	0.700 t/m²
grading concrete	2.35 " × 0.07	=	0.165 "
Ballast	1.9 " × 0.481	=	0.914 "
	wd	=	1.78 t/m²

$wd_1 = 1.78\ t/m^2 \times 0.35 = 0.62\ t/m$

$wd_2 = 1.78\ " \times (0.35 + 2.50) = 5.07\ t/m$

(b) Distributed load (B) of Track assembly

Distributed width

$b = 2.00 + 1.5 \times (0.316 + 0.07) + 0.28 = 2.86^{m}$

$w = 0.45\ t/m \times \frac{1}{2.86} = 0.16\ t/m^2$

$w_{d3} = 0.16\ t/m^2 \times 0.35 = 0.06\ t/m$

$w_{d4} = 0.16\ '' \times (0.35 + 1.93) = 0.36\ ''$

(c) Distributed load (c) of cross beam and haunch of Slub

Beam	$2.5\ t/m^3 \times 0.70 \times 1.72$	$= 3.01\ t/m$
Haunch	$2.5\ '' \times 0.45 \times 0.15 \times 1/2$	$= 0.08\ ''$
	w_{d5}	$= 3.09\ t/m$

(d) Concentrated load of elements acting at joint P1. P2 as shown below

1) Weight of elements on the slub except the weight of track assembly

$(2.94 - 0.45^{t/m}) \times (0.35 + 4.82) = 12.87^{t}$

2) Distributed load (A)

$1.78^{t/m^2} \times (2.32 + 4.82) \times 1/2 \times 2.50 = 15.89^{t}$

3) Distributed load (B)

$0.16^{t} \times (2.89 + 4.82) \times 1/2 \times 1.93 = 1.19^{t}$

4) Distributed load (C)

$0.16^{t} \times (4.82 + 0.35) \times 0.93 = 0.77^{t}$

5) Cantilever slab

$2.5^{t/m^3} \times (0.20 + 0.43) \times 1/2 \times 2.10 \times 5.17 = 8.55^{t}$

6) Haunch of slab

$2.5^{t} \times 0.45 \times 0.15 \times 1/2 \times 4.02 = 0.34^{t}$

7) Longitndinal beam

$2.5^{t} \times 0.35 \times (1.20 + 0.92) \times 2.06 = 3.82^{t}$

8) Haunch of longitudinal beam

$2.5^{t} \times 1.20 \times 0.40 \times 1/2 \times 0.70 =$ [illegible]

(9) Beam for Bridge support

$2.5^{t/m^3} \times (0.45 + 0.75) \times 1/2 \times 0.70 \times 1.40 = 0.41^t$

(10) Subtraction of Distributed loads (c)

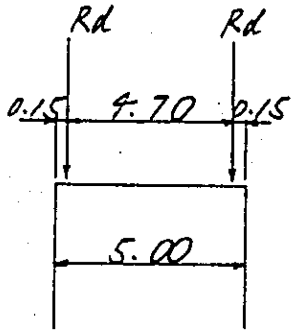
$-3.09^{t/m} \times 0.35 = -1.08^t$

(11) Deficit of Column weight

$2.5^{t/m^3} \times 0.70 \times 0.70 \times (0.594 - 0.28) = 0.38^t$

$P_1 = P_2 = 43.56^t$

(e) Reaction of T-beam superstructure



$Rd = \frac{118.90}{2} = 59.45^t$

Column weight

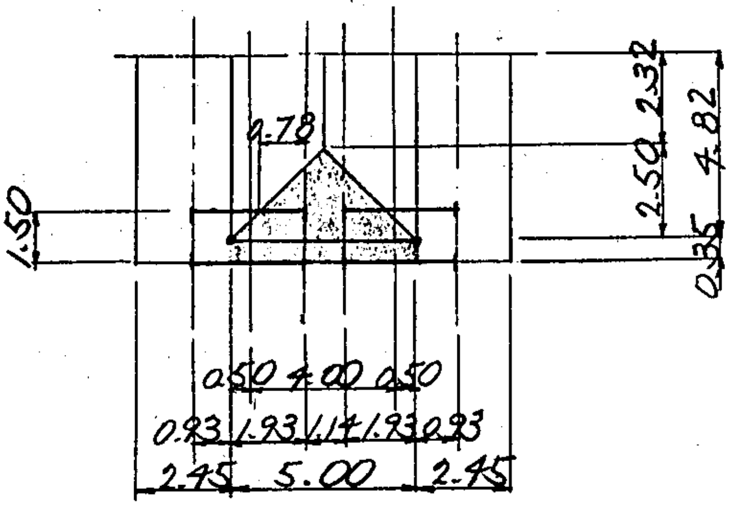
$g = 2.5^{t/m^3} \times 0.70 \times 0.70 = 1.23^{t/m}$

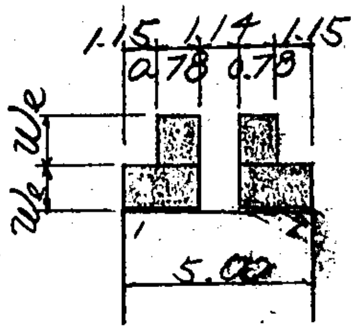
2. Train Load and Impact

(1) Train Load (single track)

KS-16.

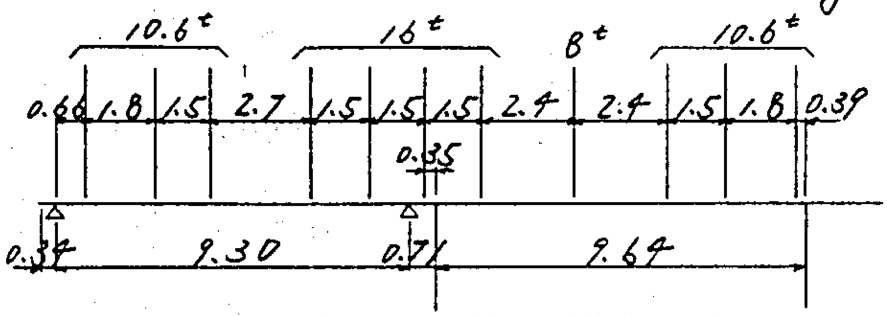
(a) Distributed load acting on rigid-frame





$$We = \frac{16}{2.86} = 5.59^{t/m}$$

(b) concentrated loads caused axial loads acting on longitudinal beams and T-beams of the bridge



(i) Concentrated load caused by axial load acting on longitudinal beam

$$R_C = \frac{1}{9.64} \times \{10.6 \times (0.39 + 2.19 + 3.69) + 8.0 \times 6.09 + 16.0 \times 8.49\} + 16.0 = 42.04^t$$

$$P = 42.04^t - 5.59^{t/m} \times (0.78 + 1.93) = 26.89^t$$

(ii) Concentrated load caused axial load acting on T-beam bridge

$$R_B = \frac{1}{9.30} \times \{10.6 \times (0.66 + 2.46 + ~~3.96~~) + 16 \times (6.66 + 8.16)\} = 33.57^t$$

(2) Impact coefficient

(a) Within rigid frame section

$l_1 = 5.00^m \longrightarrow i_{01} = 0.480$

$l_2 = 9.73$ " $\longrightarrow i_{02} = 0.433$

For the case of double track redvction is made follwed formula.

- Red tion of impact coefficient

$$i_1 = 0.480 \times (1 - \frac{5.00}{200}) = 0.468$$

$$i_2 = 0.433 \times (1 - \frac{9.73}{200}) = 0.412$$

(b) Within T-beam bridge section

$\ell = 9.30^m \longrightarrow i_{03} = 0.437$

· Reduction of impact coefficient

$i_3 = 0.437 \times (1 - \frac{9.30}{200}) = 0.417$

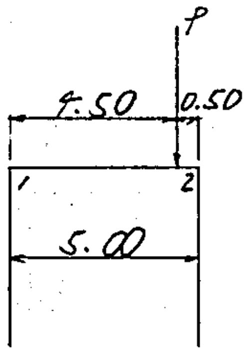
(3) Train Load + Impact

(a) Load acting on rigid frame

$w_{\ell+i} = 5.59^{t/m} \times (1 + 0.468) = 8.21^{t/m}$

$P_{\ell+i} = 26.89^t \times (1 + 0.412) = 37.97^t$

· concentrated load subjected single track loading



$P_1 = \frac{P}{5.00} \times 0.50 = 0.100 \cdot P$

$P_2 = \frac{P}{5.00} \times 4.50 = 0.900 \cdot P$

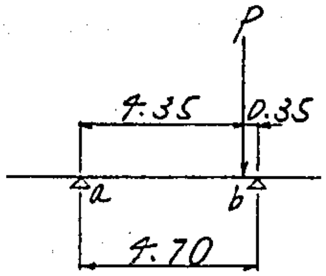
$P_1 = 37.97 \times 0.100 = 3.80^t$

$P_2 = 37.97 \times 0.900 = 34.17^t$

(b) Reaction of T-beam bridge

$P = 33.57^t \times (1 + 0.417) = 47.57^t$

· concentrated load occured subjected
single track loading



$$P_a = \frac{P}{4.70} \times 0.35 = 0.0745 \cdot P$$

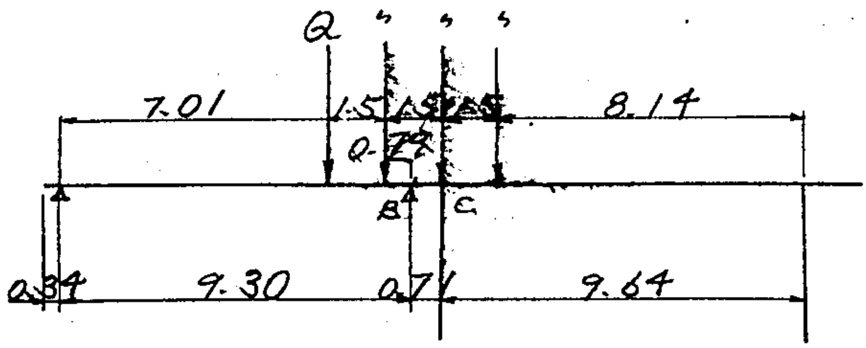
$$P_b = \frac{P}{4.70} \times 4.35 = 0.9255 \cdot P$$

$$P_a = 47.57 \times 0.0745 = 3.54^t$$

$$P_b = 47.57 \times 0.9255 = 44.03^t$$

3. Train Lateral Load

$$Q = 16 \times 0.15 = 2.40^t$$



$$R_B = \frac{1}{9.30} \times 2.40 \times (7.01 + 8.51) = 4.01^t$$

$$R_C = \frac{1}{9.64} \times 2.40 \times (8.14 + 9.64) = 4.43$$

8.44^t

$\therefore\ H = 8.44^t$

4. Force of temperature change and/or Drying Contraction

· Temperature rise

$+10°C$

· Temperature drop + Drying Contraction

$-15°C$

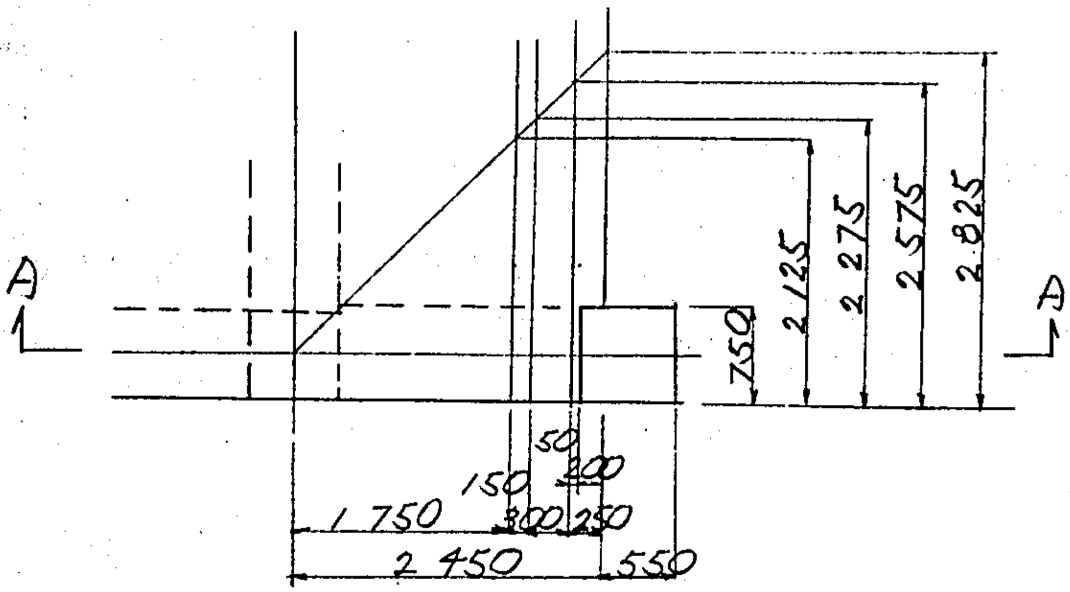
5. Dead load + Seismic force

$Kh = 0.1$

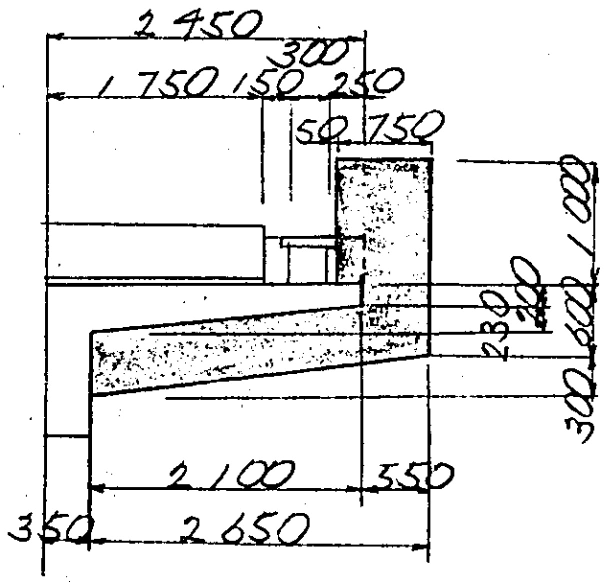
$$H = \{3.09^{t/m} \times 5.00 + (0.62+5.07)^{t/m} \times 1/2 \times 2.50 \times 2$$
$$+ (0.06+0.36)^{t/m} \times 1/2 \times 1.93 \times 2 + 43.56^{t} \times 2$$
$$+ 59.45^{t} \times 2 + 1.23^{t/m} \times 7.056 \times 1/2 \times 2\} \times 0.10$$
$$= 24.52^{t}$$

6. Load of electric pole,

Support of electric pole and related installations



Section A – A



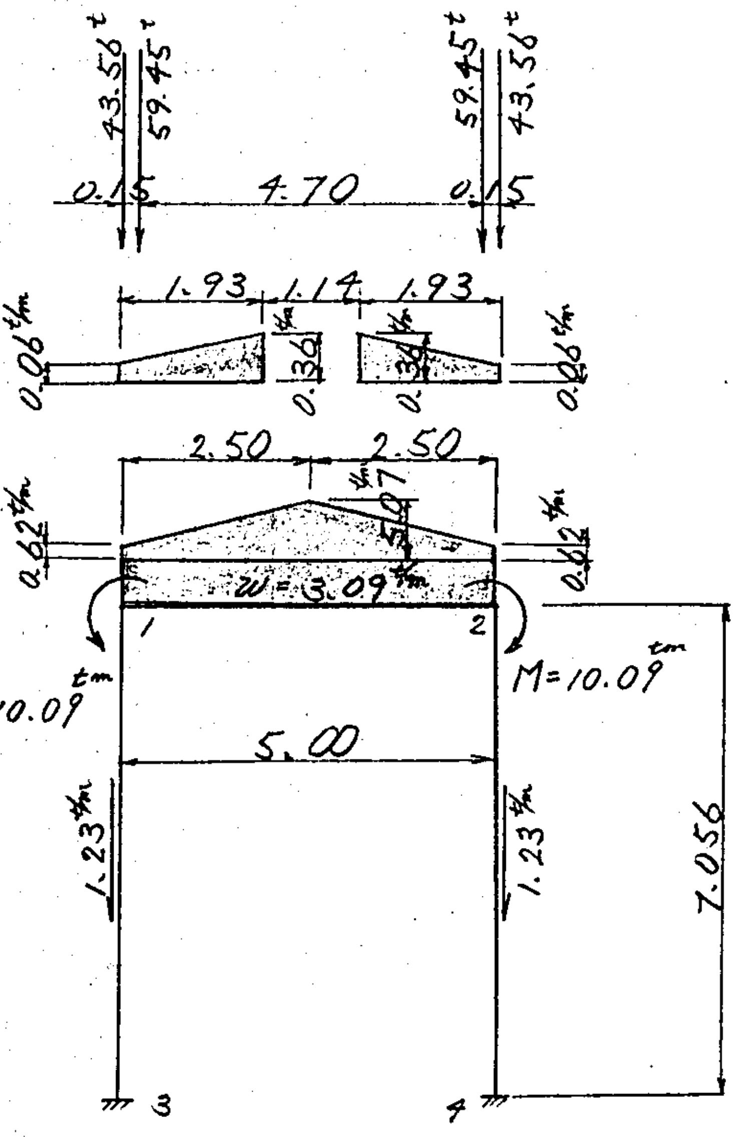
electric pole load

$M = 5.00^{tm}$ $N = 2.00^{t}$ $H = 0.50^{t}$

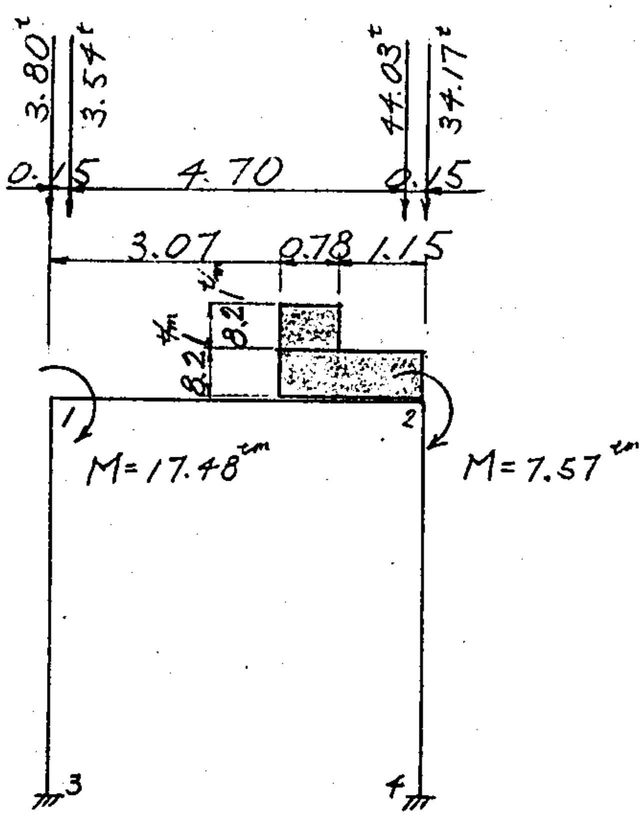
	Calculation	$N^{(t)}$	$x^{(m)}$	$M^{(tm)}$
Electric pole				±5.00
〃		∘ 2.00	2.625	5.25
handrail	$0.20^{t/m} \times 1.975$	(0.40)	2.350	0.94
Curb	$2.5^{t/m^3} \times 0.30 \times 0.25 \times 1.95$	(0.37)	2.325	0.86
ballast stopper	$2.5'' \times 0.15 \times 0.30 \times 2.20$	(0.25)	1.825	0.46
Duct cover	$2.5'' \times 0.05 \times 0.30 \times 2.425$	(0.09)	2.050	0.18
Cable	$0.06^{t/m} \times 2.425$	(0.15)	2.050	0.31
ballast	$1.9'' \times 0.481 \times (0.375+2.125)$			
	$\times 1/2 \times 1.75$	(2.00)	1.079	2.16
grading concrete	$2.35'' \times 0.07 \times (0.375+2.125)$			
	$\times 1/2 \times 1.75$	(0.36)	1.079	0.39
Slab	$2.5'' \times 0.20 \times (0.75+2.825)$			
	$\times 1/2 \times 2.10$	(1.88)	1.603	3.01
〃	$2.5'' \times 0.23 \times (0.75+2.825)$			
	$\times 1/4 \times 2.10$	(1.08)	1.327	1.43
Support of electric pole	$2.5'' \times \{0.60 \times 2.65 - (0.20+0.43)$			
	$\times 1/2 \times 2.10\} \times 0.75$	∘ 1.74	2.238	3.98
〃	$2.5'' \times 0.30 \times 2.65 \times 1/3 \times 0.75$	∘ 0.75	1.233	0.92
〃	$2.5'' \times 0.75 \times 0.75 \times 1.00$	∘ 1.41	2.625	3.70
		∘ 5.90^t		+28.59^{tm} / −19.59

(3) Loading diagram

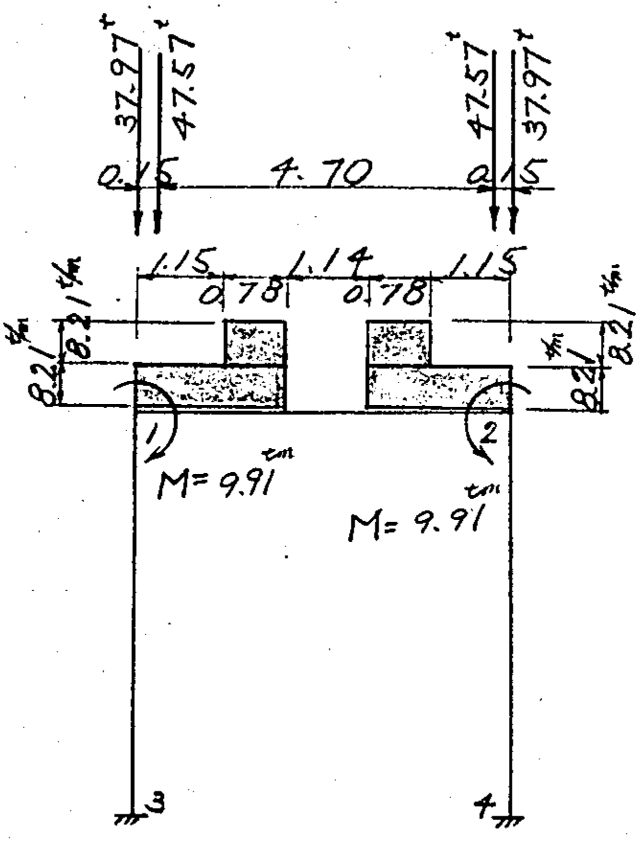
1. case 1 Dead load



2. case 2 Train load + Inpact

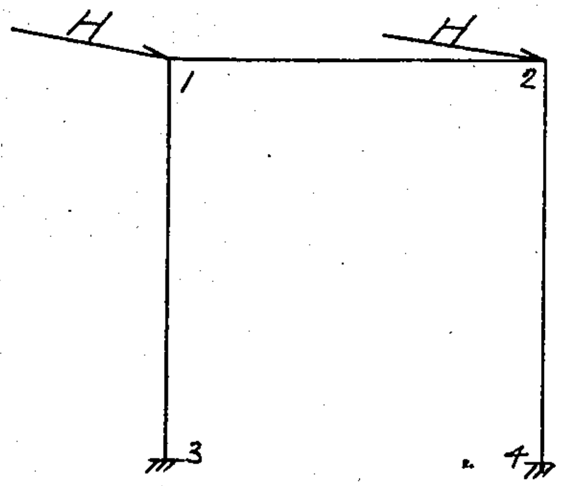


3. case 3 Train load + Inpact

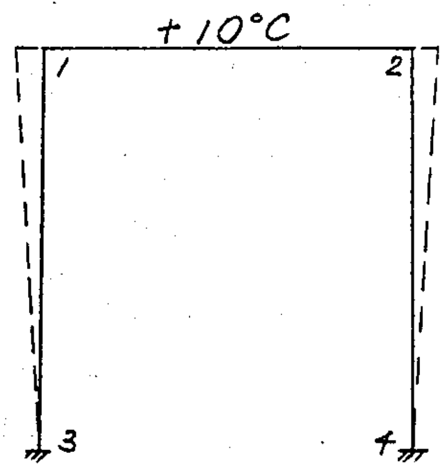


4. case 4 Train lateral load

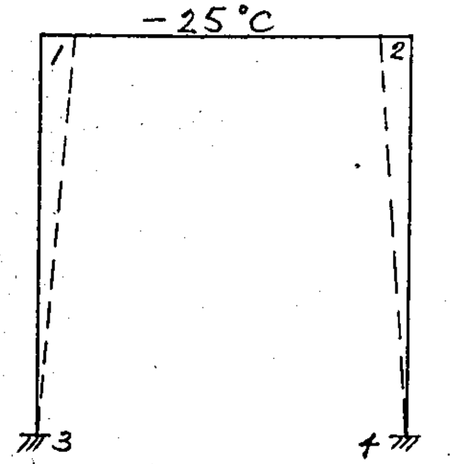
$$H = \frac{8.44}{2} = 4.22^{t}$$



5. case 5 Temperature rise

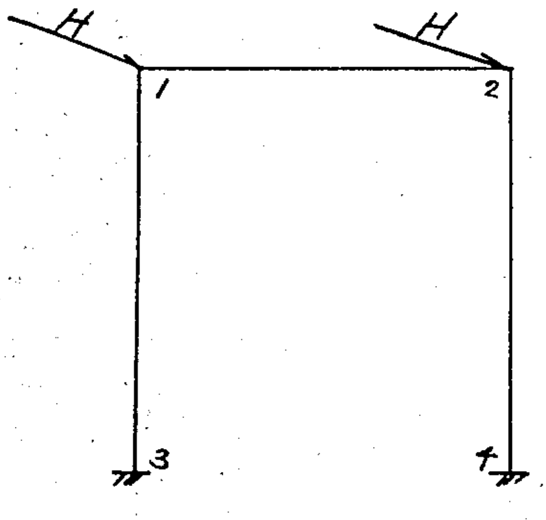


6. case 6. Temperature drop + drying contraction

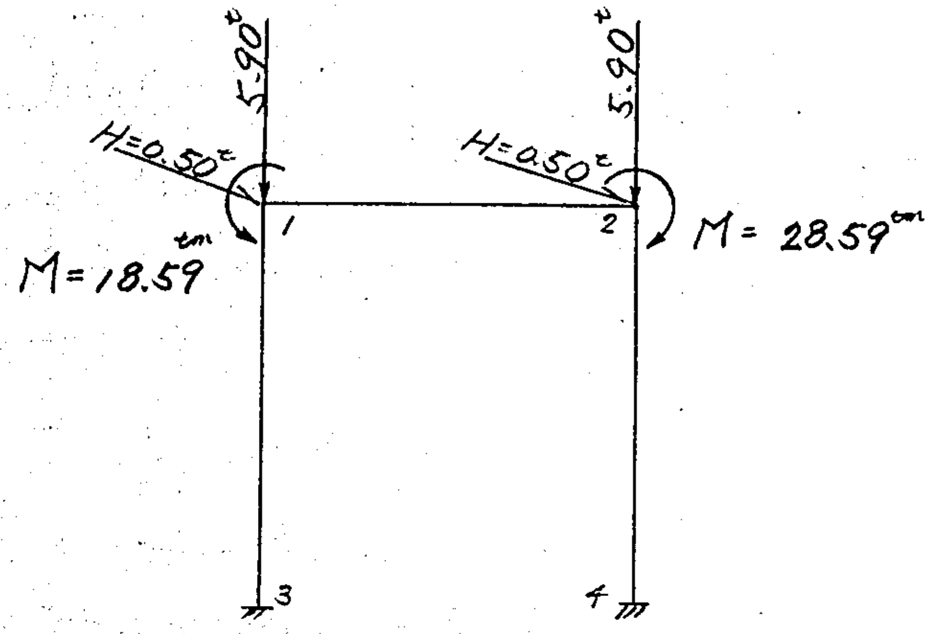


7. case 7 Seismic load

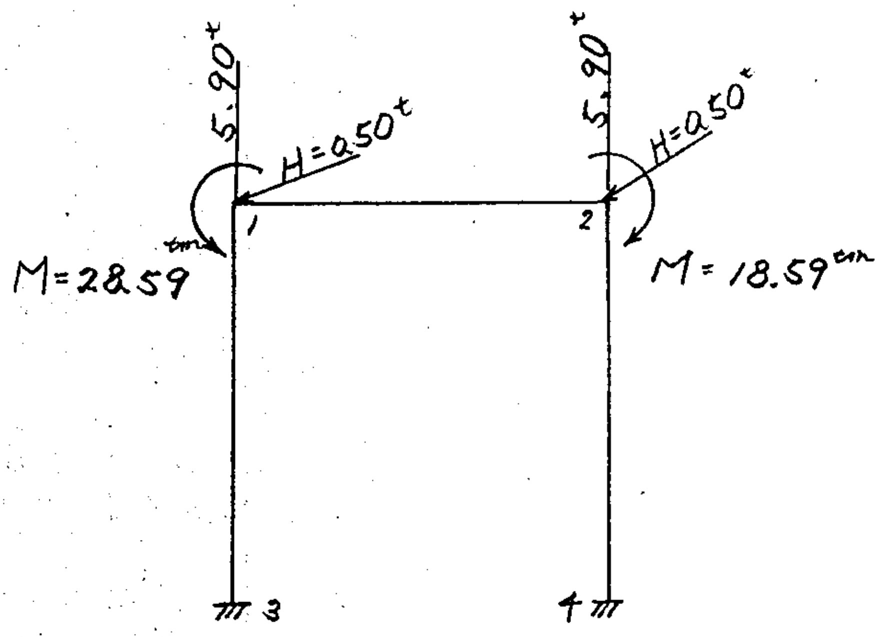
$$H = \frac{24.52}{2} = 12.26^{t}$$



8. case 8 Electric pole load

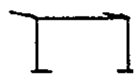
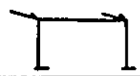
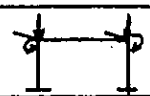
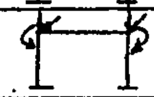


9. case 9 Electric pole load



(4) Combination of loads

1. Basic load

Case No.	Kind of load	loading pattern
1	Dead load	
2	Train load + Impact	
3	Train load + Impact	
4	Train Lateral load	
5	Temperature	+ 10°C
6	Temperature + contraction	− 25°C
7	Seismic load	
8	Electric pole load	
9	Electric pole load	

2. Combined loads

Case No.	Combination of loads	α
10	1	1.0000
11	1 + 2	〃
12	1 + 3	〃
13	1 + 2 + 4	0.8696
14	1 + 3 + 4	〃
15	1 + 2 − 4	〃
16	1 + 3 − 4	〃
17	1 + 5	〃
18	1 + 6	〃
19	1 + 7	0.6667
20	1 − 7	〃
21	1 + 8	1.0000
22	1 + 9	〃
23	1 + 2 + 8	〃
24	1 + 3 + 8	〃
25	1 + 2 − 9	〃
26	1 + 3 − 9	〃
27	1 + 2 + 4 + 8	0.8696
28	1 + 3 + 4 + 8	〃

case No.	Combination of loads	α
29	1 + 2 − 4 + 9	0.8696
30	1 + 3 − 4 + 9	〃
31	1 + 5 + 8	〃
32	1 + 6 + 8	〃
33	1 + 5 + 9	〃
34	1 + 6 + 9	〃
35	1 + 7 + 8	0.6667
36	1 − 7 + 9	〃

3. Critical case

No.1 case 10 (Without the load of electric pole) the case of analysis safe against cracking

No.2 case 11 ~ 20 (〃) the case of analysis of beams.

No.3 case 21 ~ 22 (With the load of electric pole) the case of analysis safe against craking

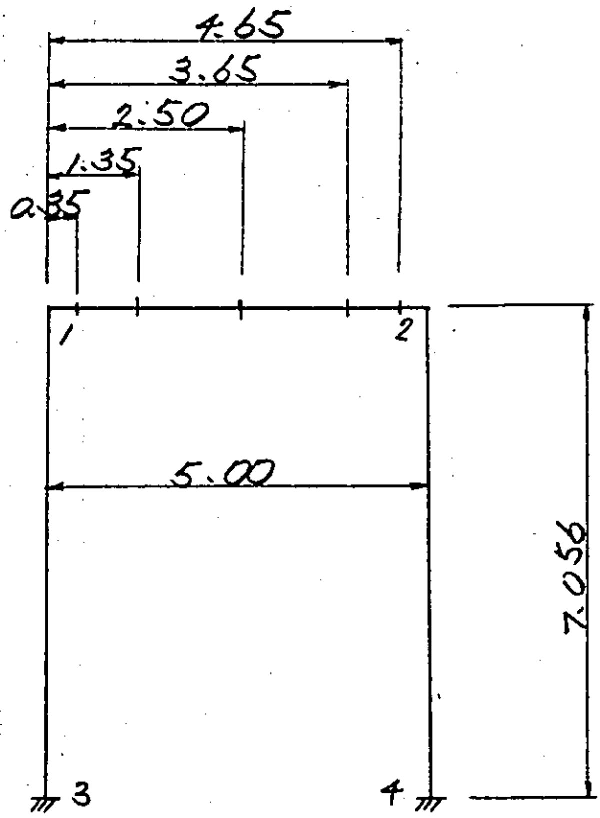
No.4 case 23 ~ 26 (〃) the case of analysis of beams.

No.5 case 11 ~ 20, 〃 23 ~ 36 the case of analysis of column.

No.6 case 11 ~ 16, 〃 23 ~ 30 the case of analysis of foundations.

No.7 case 19 ~ 20, 35 ~ 36 the case of siesmic analysis of foundations

4. Points of computing Stresses

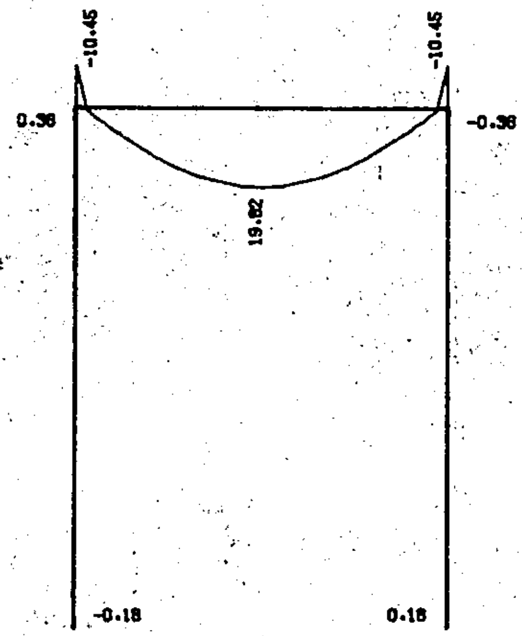


(5) stress diagram

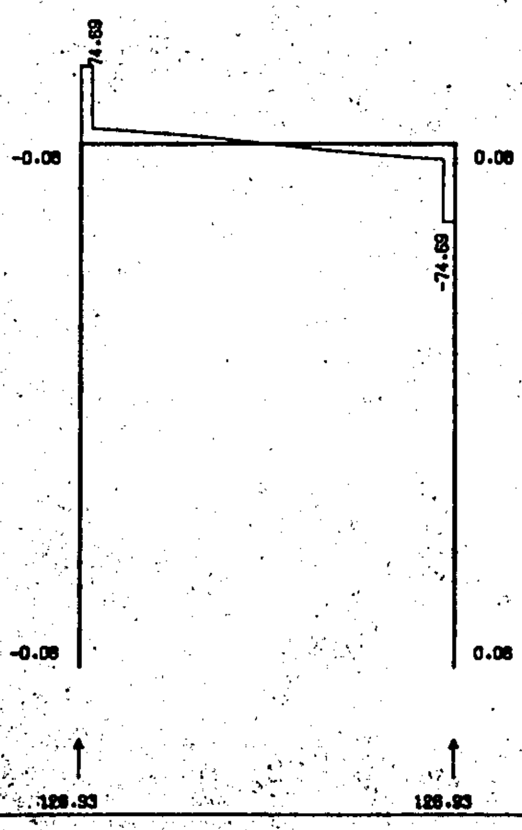
VIADUCT OF DOUBLE TRACK (3*10=30) C1

CASE 1 (DEAD LOAD)

BENDING MOMENT



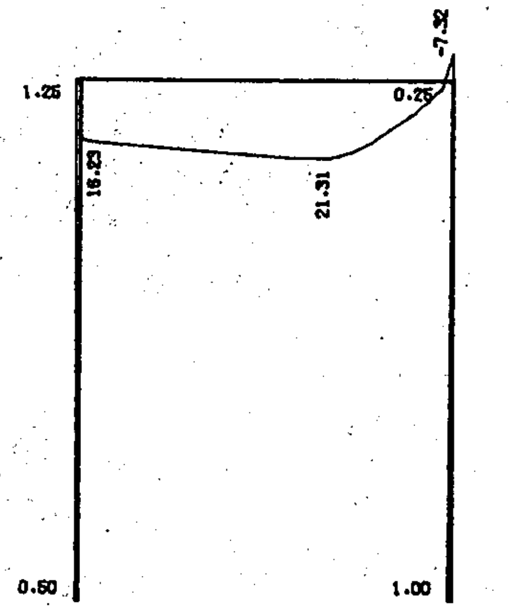
SHEARING FORCE



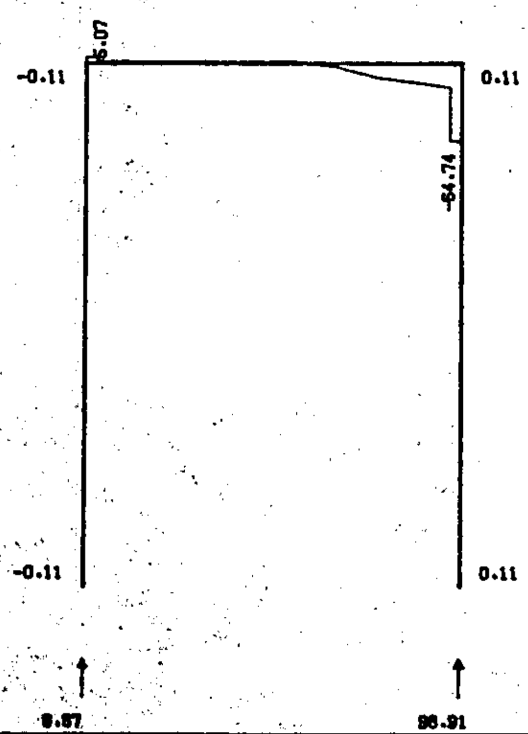
VIADUCT OF DOUBLE TRACK (3*10=30) C1

CASE 2 (TRAIN LOAD + INPACT LOAD 1)

BENDING MOMENT



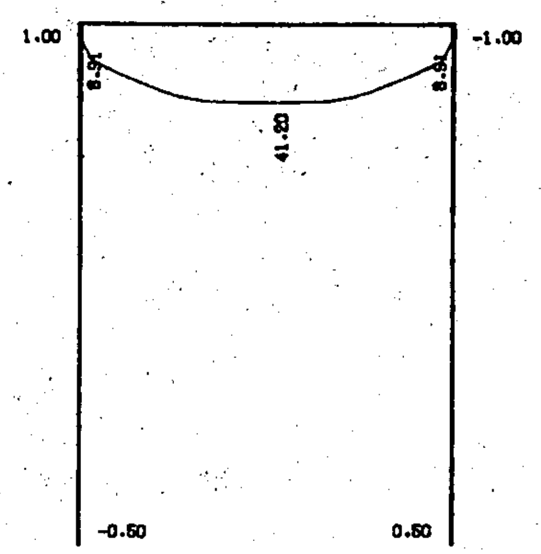
SHEARING FORCE



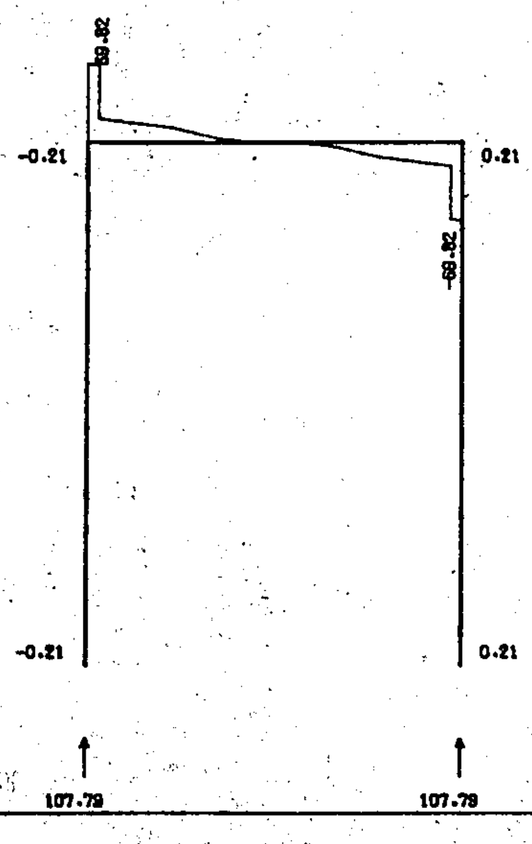
VIADUCT OF DOUBLE TRACK (3*10=30) C1

CASE 3 (TRAIN LOAD + INPACT LOAD 2)

BENDING MOMENT



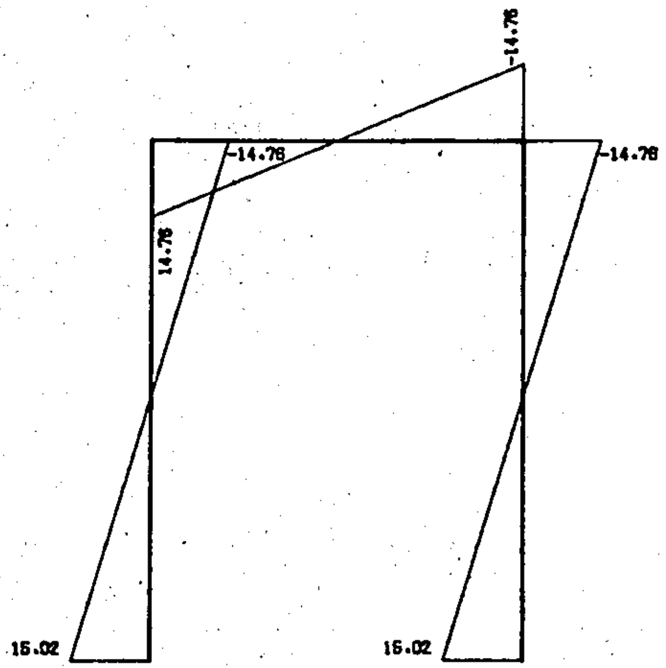
SHEARING FORCE



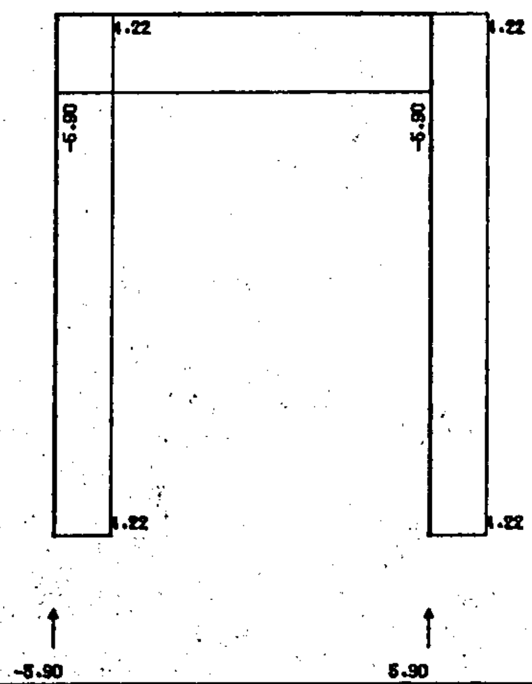
VIADUCT OF DOUBLE TRACK (3*10=30) C1

CASE 4 (TRAIN LATERAL LOAD)

BENDING MOMENT



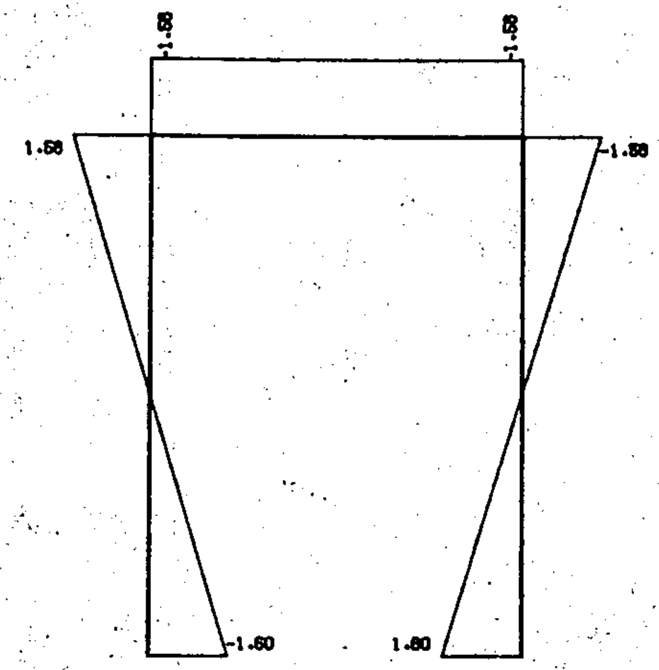
SHEARING FORCE



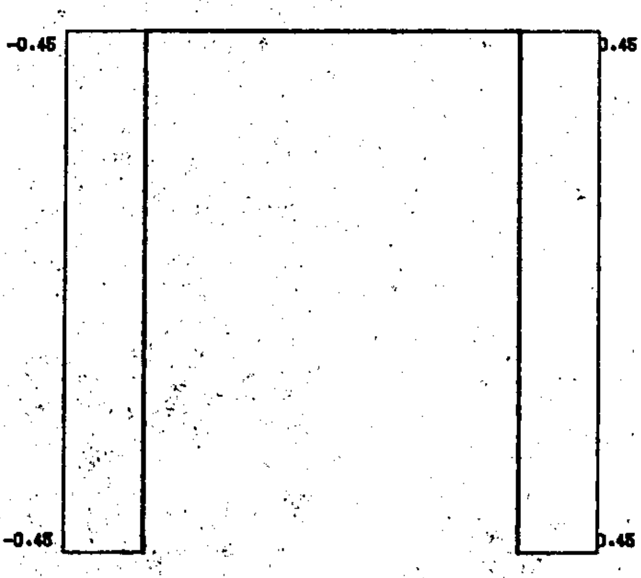
VIADUCT OF DOUBLE TRACK (3*10=30) C1

CASE 5 (TEMPERATURE)

BENDING MOMENT



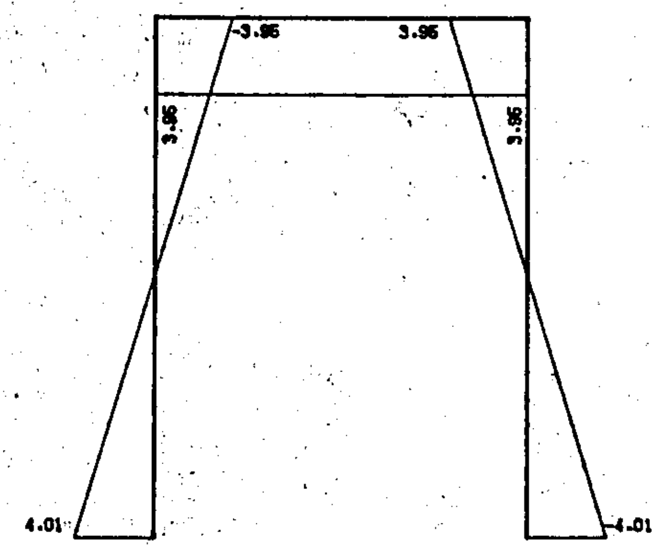
SHEARING FORCE



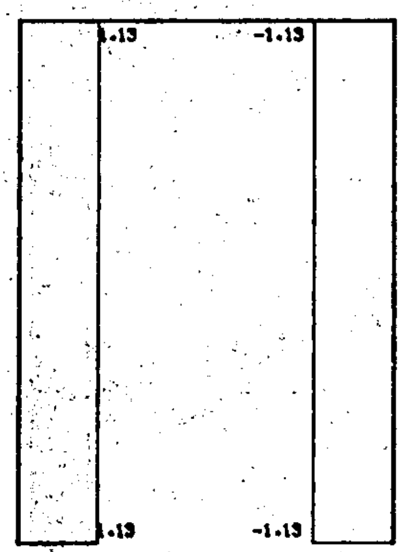
VIADUCT OF DOUBLE TRACK (3*10=30) C1

CASE 6 (TEMPERATURE + SCHRINKAGE)

BENDING MOMENT



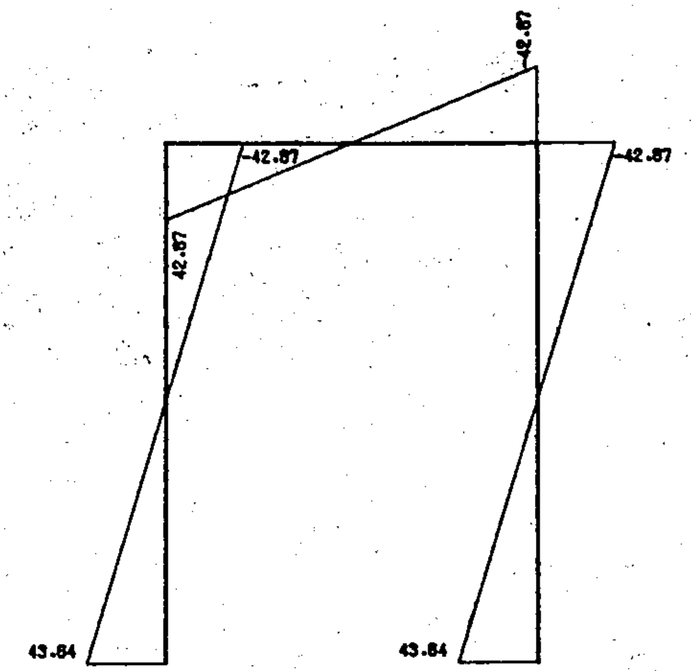
SHEARING FORCE



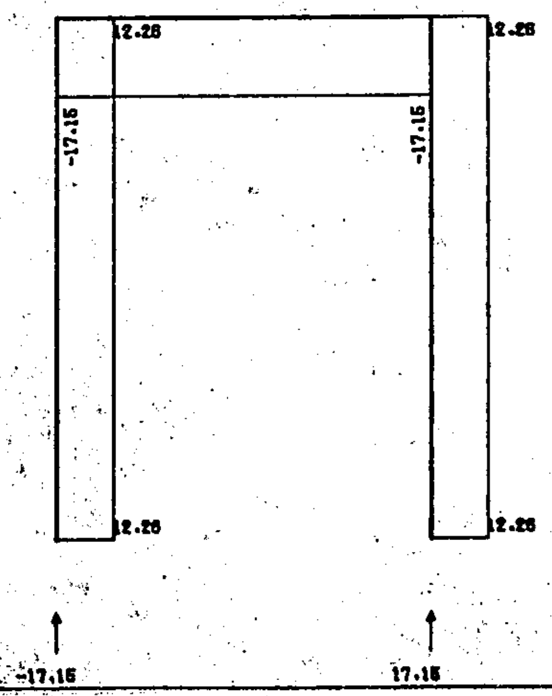
VIADUCT OF DOUBLE TRACK (3*10=30) C1

CASE 7 (SEISMIC LOAD)

BENDING MOMENT



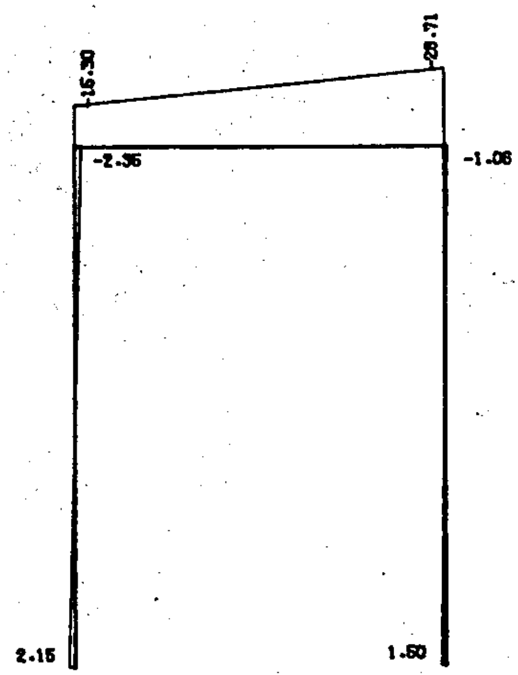
SHEARING FORCE



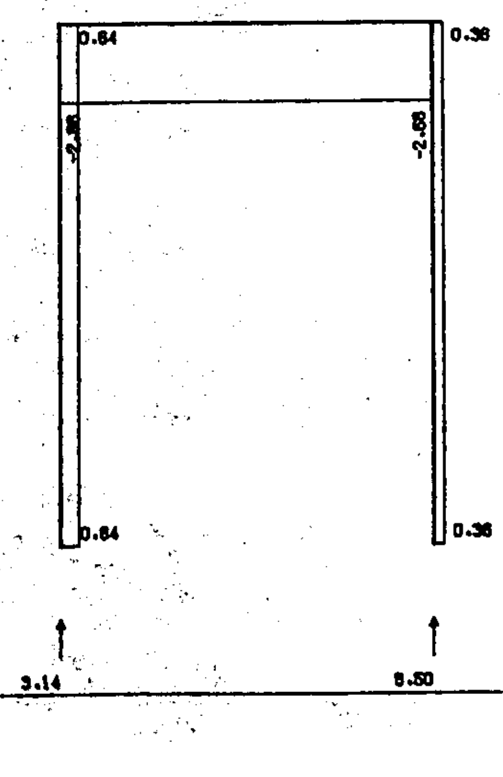
VIADUCT OF DOUBLE TRACK (3*10=30) C1

CASE 8 (ELECTRIC POLE LOAD 1)

BENDING MOMENT



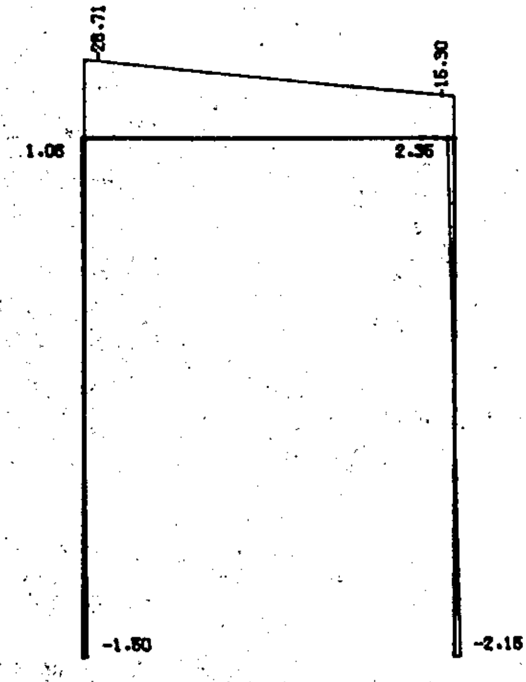
SHEARING FORCE



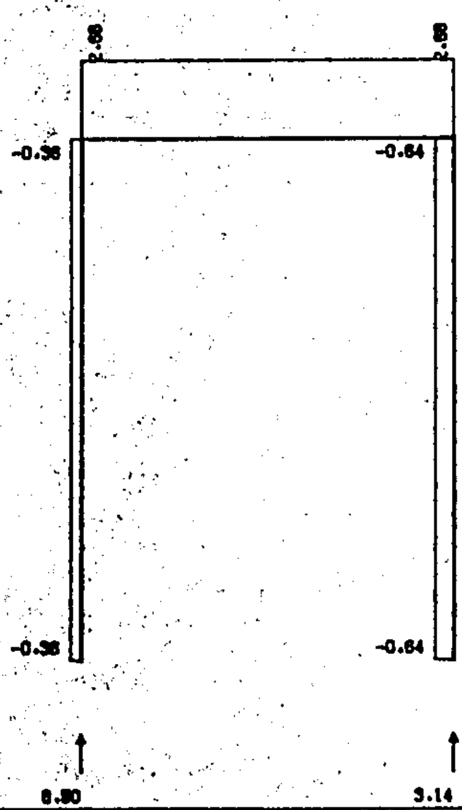
VIADUCT OF DOUBLE TRACK (3*10=30) C1

CASE 9 (ELECTRIC POLE LOAD 2)

BENDING MOMENT



SHEARING FORCE



INPUT DATA

No. 193

```
=== INPUT DATA ===                                                                      CRC-FANSY   V6.3

      5   10        20        30        40        50        60        70        80     CARD NUMBER
 ................................................................................
 TITLE      VIADUCT OF DOUBLE TRACK (3*10=30) C1                                              1
 PLOT             1      2                          6.0                                       2
 TYPE1-1-1        L=5.0      H=7.056    M1=2.652,0.96368                                      3
                  M2-3=0.49,0.02001     P=2.7E+6,1.0E-5     S=0                               4
 POINT     1 0.35       1.35      2.5       3.65      4.65     *0.15     *4.85                5
 PICKUP           1    1  10                                                                  6
                  2    1  11   20                                                             7
                  3    1  21   22                                                             8
                  4    1  23   36                                                             9
                  5    2  11   20   23   36                                                  10
                  6    2  11   16   23   30                                                  11
                  7    2  19   20   35   36                                                  12
 LOAD             1     CASE  1 (DEAD LOAD)                                                  13
 J                1               -43.56    10.09                                            14
                  2               -43.56   -10.09                                            15
 SC               1    2-59.45     0.15    -59.45     4.7                                    16
 D                1  3 2-0.06     -0.36     1.93                          1.14               17
                        -0.36     -0.06     1.93                                             18
                  1  2 2-0.62     -5.07     2.5      -5.07    -0.62       2.5                19
 DL               1    2-3.09                                                                20
                  2    2-1.23                                 3                              21
 END                                                                                         22
 LOAD             2     CASE  2 (TRAIN LOAD + INPACT LOAD 1)                                 23
 J                1               -3.8     -17.48                                            24
                  2               -34.17    -7.57                                            25
 SC               1    2-3.54      0.15    -44.03     4.7                                    26
 L                1    2-8.21     -8.21     3.07      1.15                                   27
                  1    2-8.21     -8.21     3.07                                             28
 END                                                                                         29
 LOAD             3     CASE  3 (TRAIN LOAD + INPACT LOAD 2)                                 30
 J                1               -37.97    -9.91                                            31
                  2               -37.97     9.91                                            32
 SC               1    2-47.57     0.15    -47.57     4.7                                    33
 D                1  4 2                    1.15     -8.21    -8.21       0.78               34
                                            1.14     -8.21    -8.21       0.78               35
                  1  3 2-8.21     -8.21     1.93                          1.14               36
                        -8.21     -8.21     1.93                                             37
 END                                                                                         38
 LOAD             4     CASE  4 (TRAIN LATERAL LOAD)                                         39
 J                1      4.22                                 2                              40
 END                                                                                         41
 LOAD             5     CASE  5 (TEMPERATURE)                                                42
 T                1      10.0                                                                43
 END                                                                                         44
 LOAD             6     CASE  6 (TEMPERATURE + SCHRINKAGE)                                   45
 T                1     -25.0                                                                46
 END                                                                                         47
 LOAD             7     CASE  7 (SEISMIC LOAD)                                               48
 J                1      12.26                                2                              49
 END                                                                                         50
 LOAD             8     CASE  8 (ELECTRIC POLE LOAD 1)                                       51
 J                1      0.5      -5.82     17.65                                            52
                  2      0.5      -5.82    -27.65                                            53
 END                                                                                         54
 LOAD             9     CASE  9 (ELECTRIC POLE LOAD 2)                                       55
 J                1     -0.5      -5.82     27.65                                            56
                  2     -0.5      -5.82    -17.65                                            57
```

No. 194

```
=== INPUT DATA ===                                                    CRC-FANSY   V6.3
       5   10         20        30        40        50        60        70        80   CARD NUMBER
    ................................................................................
    END                                                                                  58
    MT2     10                 1                                                         59
            11                 1    2                                                    60
            12                 1    3                                                    61
            130.8696           1    2    4                                               62
            140.8696           1    3    4                                               63
            150.8696           1    2   -4                                               64
            160.8696           1    3   -4                                               65
            170.8696           1    5                                                    66
            180.8696           1    6                                                    67
            190.6667           1    7                                                    68
            200.6667           1   -7                                                    69
            21                 1    8                                                    70
            22                 1    9                                                    71
            23                 1    2    8                                               72
            24                 1    3    8                                               73
            25                 1    2    9                                               74
            26                 1    3    9                                               75
            270.8696           1    2    4    6                                          76
            280.8696           1    3    4    6                                          77
            290.8696           1    2   -4    9                                          78
            300.8696           1    3   -4    9                                          79
            310.8696           1    5    8                                               80
            320.8696           1    6    8                                               81
            330.8696           1    5    9                                               82
            340.8696           1    6    9                                               83
            350.6667           1    7    8                                               84
            360.6667           1   -7    9                                               85
    FINISH                                                                               86
```

```
TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1                                        CRC-FANSY  V6.3

--------------
 CONTROL DATA
--------------
      METHOD     STRUCTURE   J.RENUMBER  M.RENUMBER   S.F. DIS.  UNI.SPRING  STAN.STIF.    BARA      SKEW MEM.
    ----------  ----------  ----------  ----------  ----------  ----------  ----------  ----------  ----------
       *DIS*     *RAHMEN*      *OFF*       *OFF*       *OFF*       *OFF*       *OFF*       *OFF*       *OFF*

------------
 LOAD TITLE
------------
     LOAD  1   CASE  1 (DEAD LOAD)                                    LOAD  2   CASE  2 (TRAIN LOAD + INPACT LOAD 1)
     LOAD  3   CASE  3 (TRAIN LOAD + INPACT LOAD 2)                   LOAD  4   CASE  4 (TRAIN LATERAL LOAD)
     LOAD  5   CASE  5 (TEMPERATURE)                                  LOAD  6   CASE  6 (TEMPERATURE + SCHRINKAGE)
     LOAD  7   CASE  7 (SEISMIC LOAD)                                 LOAD  8   CASE  8 (ELECTRIC POLE LOAD 1)
     LOAD  9   CASE  9 (ELECTRIC POLE LOAD 2)

     MIX  10   CASE 10 (   1.0000 * 1)                                MIX  11   CASE 11 (1+2)
     MIX  12   CASE 12 (1+3)                                          MIX  13   CASE 13 (1+2+4)
     MIX  14   CASE 14 (1+3+4)                                        MIX  15   CASE 15 (1+2-4)
     MIX  16   CASE 16 (1+3-4)                                        MIX  17   CASE 17 (1+5)
     MIX  18   CASE 18 (1+6)                                          MIX  19   CASE 19 (1+7)
     MIX  20   CASE 20 (1-7)                                          MIX  21   CASE 21 (1+8)
     MIX  22   CASE 22 (1+9)                                          MIX  23   CASE 23 (1+2+8)
     MIX  24   CASE 24 (1+3+8)                                        MIX  25   CASE 25 (1+2+9)
     MIX  26   CASE 26 (1+3+9)                                        MIX  27   CASE 27 (1+2+4+6)
     MIX  28   CASE 28 (1+3+4+8)                                      MIX  29   CASE 29 (1+2-4+9)
     MIX  30   CASE 30 (1+3-4+9)                                      MIX  31   CASE 31 (1+5+8)
     MIX  32   CASE 32 (1+6+8)                                        MIX  33   CASE 33 (1+5+9)
     MIX  34   CASE 34 (1+6+9)                                        MIX  35   CASE 35 (1+7+6)
     MIX  36   CASE 36 (1-7+9)

-------------------
 PICK UP LOAD CASE
-------------------

     PICK  1      10
     PICK  2      11   12   13   14   15   16   17   18   19   20
     PICK  3      21   22
     PICK  4      23   24   25   26   27   28   29   30   31   32   33   34   35   36
     PICK  5      11   12   13   14   15   16   17   18   19   20   23   24   25   26   27   28   29   30   31   32   33   34   35
                  36
     PICK  6      11   12   13   14   15   16   23   24   25   26   27   28   29   30
     PICK  7      19   20   35   36
```

No.195

TITLE..VIADUCT CF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

No. 196

JOINT DATA

JOINT NUMBER 4

JOINT	X	Y
1	0.0000	7.0560
2	5.0000	7.0560
3	0.0000	0.0000
4	5.0000	0.0000

MEMBER DATA

MEMBER NUMBER 3

MEMBER	ITAN	JTAN	CONNECT. ITAN	JTAN	LENGTH	A	I	PRO.NUM
1	1	2	FIX	FIX	5.0000	2.65200	.9636800	1
2	1	3	FIX	FIX	7.0560	.49000	.0200100	1
3	2	4	FIX	FIX	7.0560	.49000	.0200100	1

PROPERTY DATA

PROPERTY NUMBER 1

PROPERTY	E	G	EPS
1	2.700E+06	0.	1.000E-05

SUPPORT DATA

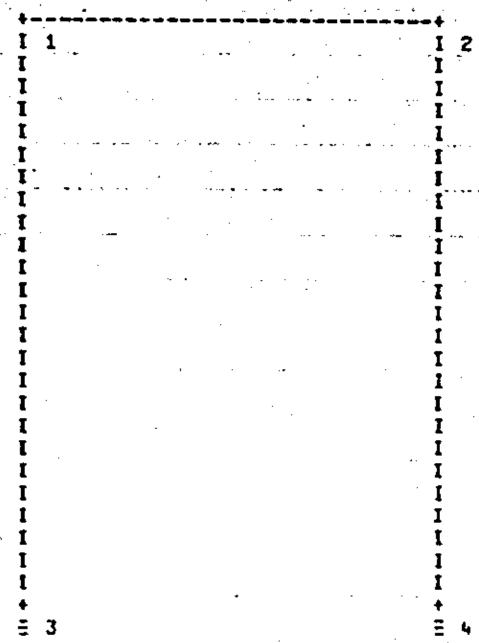
SUPPORT NUMBER 2

SUPPORT	X	Y	THET Z
3	FIX	FIX	FIX
4	FIX	FIX	FIX

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1

CRC-FANSY V6.3

STRUCTURAL FIGURE



No. 197

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

No. 198

MOVE DATA

MEMBER	ITAN	JTAN	POINT 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	......	......	.150	.150	.350	1.350	2.500	3.650	4.650	4.850	4.850					
2	......	......														
3	......	......														

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

No. 199

LOAD DATA

	M/J	NAME	D	W1	W2	L1	L2
LOAD - 1		CASE 1 (DEAD LOAD)					
MEMBER	1	LINEAR	Y	-.060	-.360	0.000	3.070
		LINEAR	Y	-.360	-.060	3.070	0.000
		LINEAR	Y	-.620	-5.070	0.000	2.500
		LINEAR	Y	-5.070	-.620	2.500	0.000
		LINEAR	Y	-3.090	-3.090	0.000	0.000
		CONCENT	Y	-59.450		.150	
		CONCENT	Y	-59.450		4.850	
	2	LINEAR	Y	-1.230	-1.230	0.000	0.000
	3	LINEAR	Y	-1.230	-1.230	0.000	0.000
JOINT	1	JOINTLOAD	Y	-43.560			
		JOINTLOAD	Z	10.090			
	2	JOINTLOAD	Y	-43.560			
		JOINTLOAD	Z	-10.090			
LOAD - 2		CASE 2 (TRAIN LOAD + INPACT LOAD 1)					
MEMBER	1	LINEAR	Y	-8.210	-8.210	3.070	1.150
		LINEAR	Y	-8.210	-8.210	3.070	0.000
		CONCENT	Y	-3.540		.150	
		CONCENT	Y	-44.030		4.850	
JOINT	1	JOINTLOAD	Y	-3.800			
		JOINTLOAD	Z	-17.480			
	2	JOINTLOAD	Y	-34.170			
		JOINTLOAD	Z	-7.570			
LOAD - 3		CASE 3 (TRAIN LOAD + INPACT LOAD 2)					
MEMBER	1	LINEAR	Y	-8.210	-8.210	1.150	3.070
		LINEAR	Y	-8.210	-8.210	3.070	1.150
		LINEAR	Y	-8.210	-8.210	0.000	3.070
		LINEAR	Y	-8.210	-8.210	3.070	0.000
		CONCENT	Y	-47.570		.150	
		CONCENT	Y	-47.570		4.850	
JOINT	1	JOINTLOAD	Y	-37.970			
		JOINTLOAD	Z	-9.910			
	2	JOINTLOAD	Y	-37.970			
		JOINTLOAD	Z	9.910			
LOAD - 4		CASE 4 (TRAIN LATERAL LOAD)					
JOINT	1	JOINTLOAD	X	4.220			
	2	JOINTLOAD	X	4.220			
LOAD - 5		CASE 5 (TEMPERATURE)					
MEMBER	1	TEMP		10.0(DO)			
LOAD - 6		CASE 6 (TEMPERATURE + SCHRINKAGE)					
MEMBER	1	TEMP		-25.0(DO)			
LOAD - 7		CASE 7 (SEISMIC LOAD)					

LOAD DATA

	M/J	NAME	D	W1	W2	L1	L2
JOINT	1	JOINTLOAD	X	12.260			
	2	JOINTLOAD	X	12.260			
LOAD - 8		CASE 8 (ELECTRIC POLE LOAD 1)					
JOINT	1	JOINTLOAD	X	.500			
		JOINTLOAD	Y	-5.820			
		JOINTLOAD	Z	17.650			
	2	JOINTLOAD	X	.500			
		JOINTLOAD	Y	-5.820			
		JOINTLOAD	Z	-27.650			
LOAD - 9		CASE 9 (ELECTRIC POLE LOAD 2)					
JOINT	1	JOINTLOAD	X	-.500			
		JOINTLOAD	Y	-5.820			
		JOINTLOAD	Z	27.650			
	2	JOINTLOAD	X	-.500			
		JOINTLOAD	Y	-5.820			
		JOINTLOAD	Z	-17.650			

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

No. 201

MIX DATA

MIX NUMBER 27

LOAD	SS	N	S1	K1	S2	K2	S3	K3	S4	K4	S5	K5	S6	K6	S7	K7	S8	K8
10	1.0000	1	1.0000	1														
11	1.0000	2	1.0000	1	1.0000	2												
12	1.0000	2	1.0000	1	1.0000	3												
13	.8696	3	1.0000	1	1.0000	2	1.0000	4										
14	.8696	3	1.0000	1	1.0000	3	1.0000	4										
15	.8696	3	1.0000	1	1.0000	2	-1.0000	4										
16	.8696	3	1.0000	1	1.0000	3	-1.0000	4										
17	.8696	2	1.0000	1	1.0000	5												
18	.8696	2	1.0000	1	1.0000	6												
19	.6667	2	1.0000	1	1.0000	7												
20	.6667	2	1.0000	1	-1.0000	7												
21	1.0000	2	1.0000	1	1.0000	8												
22	1.0000	2	1.0000	1	1.0000	9												
23	1.0000	3	1.0000	1	1.0000	2	1.0000	8										
24	1.0000	3	1.0000	1	1.0000	3	1.0000	8										
25	1.0000	3	1.0000	1	1.0000	2	1.0000	9										
26	1.0000	3	1.0000	1	1.0000	3	1.0000	9										
27	.8696	4	1.0000	1	1.0000	2	1.0000	4	1.0000	8								
28	.8696	4	1.0000	1	1.0000	3	1.0000	4	1.0000	8								
29	.8696	4	1.0000	1	1.0000	2	-1.0000	4	1.0000	9								
30	.8696	4	1.0000	1	1.0000	3	-1.0000	4	1.0000	9								
31	.8696	3	1.0000	1	1.0000	5	1.0000	8										
32	.8696	3	1.0000	1	1.0000	6	1.0000	8										
33	.8696	3	1.0000	1	1.0000	5	1.0000	9										
34	.8696	3	1.0000	1	1.0000	6	1.0000	9										
35	.6667	3	1.0000	1	1.0000	7	1.0000	8										
36	.6667	3	1.0000	1	-1.0000	7	1.0000	9										

PICK UP

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

PICK UP 1

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(10)	-10.445	74.693	-.075
1	.150	(10)	.715	74.106	-.075
2	.150	(10)	.715	14.656	-.075
3	.350	(10)	3.563	13.805	-.075
4	1.350	(10)	14.821	8.390	-.075
5	2.500	(10)	19.821	.000	-.075
6	3.650	(10)	14.821	-8.390	-.075
7	4.650	(10)	3.563	-13.805	-.075
8	4.850	(10)	.715	-14.656	-.075
9	4.850	(10)	.715	-74.106	-.075
JTAN	5.000	(10)	-10.445	-74.693	-.075
MAX	2.500	(10)	19.821	.000	-.075
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(10)	.355	-.075	-118.253
JTAN	7.056	(10)	-.178	-.075	-126.932
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(10)	-.355	.075	-118.253
JTAN	7.056	(10)	.178	.075	-126.932

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(10)	-10.445	74.693	-.075
1	.150	(10)	.715	74.106	-.075
2	.150	(10)	.715	14.656	-.075
3	.350	(10)	3.563	13.805	-.075
4	1.350	(10)	14.821	8.390	-.075
5	2.500	(10)	19.821	.000	-.075
6	3.650	(10)	14.821	-8.390	-.075
7	4.650	(10)	3.563	-13.805	-.075
8	4.850	(10)	.715	-14.656	-.075
9	4.850	(10)	.715	-74.106	-.075
JTAN	5.000	(10)	-10.445	-74.693	-.075
MAX	2.500	(10)	19.821	.000	-.075
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(10)	.355	-.075	-118.253
JTAN	7.056	(10)	-.178	-.075	-126.932
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(10)	-.355	.075	-118.253
JTAN	7.056	(10)	.178	.075	-126.932

No. 202

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1

CRC-FANSY V6.3

No.203

PICK UP 1

SHEAR MAXIMUM

	-----L---	-CASE-	-----M---	-----Q---	-----N---
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(10)	-10.445	74.693	-.075
1	.150	(10)	.715	74.106	-.075
2	.150	(10)	.715	14.656	-.075
3	.350	(10)	3.563	13.805	-.075
4	1.350	(10)	14.821	8.390	-.075
5	2.500	(10)	19.821	.000	-.075
6	3.650	(10)	14.821	-8.390	-.075
7	4.650	(10)	3.563	-13.805	-.075
8	4.850	(10)	.715	-14.656	-.075
9	4.850	(10)	.715	-74.106	-.075
JTAN	5.000	(10)	-10.445	-74.693	-.075
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(10)	.355	-.075	-118.253
JTAN	7.056	(10)	-.178	-.075	-126.932
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(10)	-.355	.075	-118.253
JTAN	7.056	(10)	.178	.075	-126.932

SHEAR MINIMUM

	-----L---	-CASE-	-----M---	-----Q---	-----N---
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(10)	-10.445	74.693	-.075
1	.150	(10)	.715	74.106	-.075
2	.150	(10)	.715	14.656	-.075
3	.350	(10)	3.563	13.805	-.075
4	1.350	(10)	14.821	8.390	-.075
5	2.500	(10)	19.821	.000	-.075
6	3.650	(10)	14.821	-8.390	-.075
7	4.650	(10)	3.563	-13.805	-.075
8	4.850	(10)	.715	-14.656	-.075
9	4.850	(10)	.715	-74.106	-.075
JTAN	5.000	(10)	-10.445	-74.693	-.075
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(10)	.355	-.075	-118.253
JTAN	7.056	(10)	-.178	-.075	-126.932
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(10)	-.355	.075	-118.253
JTAN	7.056	(10)	.178	.075	-126.932

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1

CRC-FANSY V6.3

PICK UP 1

AXIAL MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(10)	-10.445	74.693	-.075
1	.150	(10)	.715	74.106	-.075
2	.150	(10)	.715	14.656	-.075
3	.350	(10)	3.563	13.805	-.075
4	1.350	(10)	14.821	8.390	-.075
5	2.500	(10)	19.821	.000	-.075
6	3.650	(10)	14.821	-8.390	-.075
7	4.650	(10)	3.563	-13.805	-.075
8	4.850	(10)	.715	-14.656	-.075
9	4.850	(10)	.715	-74.106	-.075
JTAN	5.000	(10)	-10.445	-74.693	-.075
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(10)	.355	-.075	-118.253
JTAN	7.056	(10)	-.178	-.075	-126.932
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(10)	-.355	.075	-118.253
JTAN	7.056	(10)	.178	.075	-126.932

AXIAL MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(10)	-10.445	74.693	-.075
1	.150	(10)	.715	74.106	-.075
2	.150	(10)	.715	14.656	-.075
3	.350	(10)	3.563	13.805	-.075
4	1.350	(10)	14.821	8.390	-.075
5	2.500	(10)	19.821	.000	-.075
6	3.650	(10)	14.821	-8.390	-.075
7	4.650	(10)	3.563	-13.805	-.075
8	4.850	(10)	.715	-14.656	-.075
9	4.850	(10)	.715	-74.106	-.075
JTAN	5.000	(10)	-10.445	-74.693	-.075
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(10)	.355	-.075	-118.253
JTAN	7.056	(10)	-.178	-.075	-126.932
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(10)	-.355	.075	-118.253
JTAN	7.056	(10)	.178	.075	-126.932

No. 204

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

No. 205

PICK UP 2

MOMENT MAXIMUM

	-----L---	-CASE-	-----M---	-----Q---	-----N---
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(19)	21.616	38.366	-.050
1	.150	(14)	29.460	118.953	-.250
2	.150	(14)	29.460	25.889	-.250
3	.350	(14)	34.422	23.721	-.250
4	1.350	(12)	53.259	17.913	-.288
5	2.500	(12)	61.021	.000	-.288
6	3.650	(12)	53.259	-17.913	-.288
7	4.650	(16)	34.422	-23.721	-.250
8	4.850	(16)	29.460	-25.889	-.250
9	4.850	(16)	29.460	-118.953	-.250
JTAN	5.000	(20)	21.616	-38.366	-.050
MAX	2.500	(12)	61.021	.000	-.288
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(20)	28.817	-8.224	-90.271
JTAN	7.056	(19)	28.975	8.123	-73.193
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(20)	28.343	-8.123	-67.407
JTAN	7.056	(19)	29.212	8.224	-96.057

MOMENT MINIMUM

	-----L---	-CASE-	-----M---	-----Q---	-----N---
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(20)	-35.544	61.230	-.050
1	.150	(20)	-26.388	60.838	-.050
2	.150	(20)	-26.388	21.203	-.050
3	.350	(20)	-22.204	20.636	-.050
4	1.350	(20)	-3.266	17.025	-.050
5	2.500	(20)	13.215	11.432	-.050
6	3.650	(19)	-3.266	-17.025	-.050
7	4.650	(19)	-22.204	-20.636	-.050
8	4.850	(19)	-26.388	-21.203	-.050
9	4.850	(19)	-26.388	-60.838	-.050
JTAN	5.000	(19)	-35.544	-61.230	-.050
MAX	2.500	(20)	13.215	11.432	-.050
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(19)	-28.343	8.123	-67.407
JTAN	7.056	(20)	-29.212	-8.224	-95.057
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(19)	-28.817	8.224	-90.271
JTAN	7.056	(20)	-28.975	-8.123	-73.193

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1

CRC-FANSY V6.3

PICK UP 2

No. 206

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(12)	-1.534	144.512	-.288
1	.150	(12)	20.007	142.693	-.288
2	.150	(16)	5.337	36.154	-.250
3	.350	(16)	12.352	33.986	-.250
4	1.350	(16)	40.411	20.710	-.250
5	2.500	(20)	13.215	11.432	-.050
6	3.650	(20)	23.028	5.839	-.050
7	4.650	(20)	26.954	2.228	-.050
8	4.850	(20)	27.342	1.661	-.050
9	4.850	(20)	27.342	-37.974	-.050
JTAN	5.000	(20)	21.616	-38.366	-.050
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(19)	-28.343	8.123	-67.407
JTAN	7.056	(19)	28.975	8.123	-73.193
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(19)	-28.817	8.224	-90.271
JTAN	7.056	(19)	29.212	8.224	-96.057

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(19)	21.616	38.366	-.050
1	.150	(19)	27.342	37.974	-.050
2	.150	(19)	27.342	-1.661	-.050
3	.350	(19)	26.954	-2.228	-.050
4	1.350	(19)	23.028	-5.839	-.050
5	2.500	(19)	13.215	-11.432	-.050
6	3.650	(14)	40.411	-20.710	-.250
7	4.650	(14)	12.352	-33.986	-.250
8	4.850	(14)	5.337	-36.154	-.250
9	4.850	(12)	20.007	-142.693	-.288
JTAN	5.000	(12)	-1.534	-144.512	-.288
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(20)	28.817	-8.224	-90.271
JTAN	7.056	(20)	-29.212	-8.224	-96.057
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(20)	28.343	-8.123	-67.407
JTAN	7.056	(20)	-28.975	-8.123	-73.193

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1　　　　CRC-FANSY　V6.3

PICK UP 2

AXIAL MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(18)	-5.648	64.953	.915
1	.150	(18)	4.057	64.442	.915
2	.150	(18)	4.057	12.744	.915
3	.350	(18)	6.533	12.005	.915
4	1.350	(18)	16.324	7.296	.915
5	2.500	(18)	20.672	-.000	.915
6	3.650	(18)	16.324	-7.296	.915
7	4.650	(18)	6.533	-12.005	.915
8	4.850	(18)	4.057	-12.744	.915
9	4.850	(18)	4.057	-64.442	.915
JTAN	5.000	(18)	-5.648	-64.953	.915
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(19)	-28.343	8.123	-67.407
JTAN	7.056	(19)	28.975	8.123	-73.193
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(20)	28.343	-8.123	-67.407
JTAN	7.056	(20)	-28.975	-8.123	-73.193

AXIAL MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(17)	-10.457	64.953	-.458
1	.150	(17)	-.752	64.442	-.458
2	.150	(17)	-.752	12.744	-.458
3	.350	(17)	1.724	12.005	-.458
4	1.350	(17)	11.514	7.296	-.458
5	2.500	(17)	15.862	.000	-.458
6	3.650	(17)	11.514	-7.296	-.458
7	4.650	(17)	1.724	-12.005	-.458
8	4.850	(17)	-.752	-12.744	-.458
9	4.850	(17)	-.752	-64.442	-.458
JTAN	5.000	(17)	-10.457	-64.953	-.458
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(12)	1.354	-.288	-226.042
JTAN	7.056	(12)	-.677	-.288	-234.721
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(12)	-1.354	.288	-226.042
JTAN	7.056	(12)	.677	.266	-234.721

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

No. 208

PICK UP 3

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(21)	-25.744	72.011	.062
1	.150	(21)	-14.986	71.424	.062
2	.150	(21)	-14.986	11.974	.062
3	.350	(21)	-12.675	11.123	.062
4	1.350	(21)	-4.098	5.708	.062
5	2.500	(21)	-2.182	-2.682	.062
6	3.650	(22)	-4.098	-5.708	.062
7	4.650	(22)	-12.675	-11.123	.062
8	4.850	(22)	-14.986	-11.974	.062
9	4.850	(22)	-14.986	-71.424	.062
JTAN	5.000	(22)	-25.744	-72.011	.062
MAX	2.778	(22)	-1.745	.484	.062
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(22)	1.412	-.438	-126.754
JTAN	7.056	(21)	1.970	.562	-130.070
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(22)	1.996	-.562	-121.391
JTAN	7.056	(21)	1.678	.438	-135.433

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(22)	-39.152	77.374	.062
1	.150	(22)	-27.589	76.787	.062
2	.150	(22)	-27.589	17.337	.062
3	.350	(22)	-24.206	16.486	.062
4	1.350	(22)	-10.266	11.071	.062
5	2.500	(22)	-2.182	2.682	.062
6	3.650	(21)	-10.266	-11.071	.062
7	4.650	(21)	-24.206	-16.486	.062
8	4.850	(21)	-27.589	-17.337	.062
9	4.850	(21)	-27.589	-76.787	.062
JTAN	5.000	(21)	-39.152	-77.374	.062
MAX	2.500	(22)	-2.182	2.682	.062
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(21)	-1.996	.562	-121.391
JTAN	7.056	(22)	-1.678	-.438	-135.433
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(21)	-1.412	.438	-126.754
JTAN	7.056	(22)	-1.970	-.562	-130.070

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

PICK UP 3

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(22)	-39.152	77.374	.062
1	.150	(22)	-27.589	76.787	.062
2	.150	(22)	-27.589	17.337	.062
3	.350	(22)	-24.206	16.486	.062
4	1.350	(22)	-10.266	11.071	.062
5	2.500	(22)	-2.182	2.682	.062
6	3.650	(22)	-4.098	-5.708	.062
7	4.650	(22)	-12.675	-11.123	.062
8	4.850	(22)	-14.986	-11.974	.062
9	4.850	(22)	-14.986	-71.424	.062
JTAN	5.000	(22)	-25.744	-72.011	.062
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(21)	-1.996	.562	-121.391
JTAN	7.056	(21)	1.970	.562	-130.070
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(21)	-1.412	.438	-126.754
JTAN	7.056	(21)	1.678	.438	-135.433

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(21)	-25.744	72.011	.062
1	.150	(21)	-14.986	71.424	.062
2	.150	(21)	-14.986	11.974	.062
3	.350	(21)	-12.675	11.123	.062
4	1.350	(21)	-4.098	5.708	.062
5	2.500	(21)	-2.182	-2.682	.062
6	3.650	(21)	-10.266	-11.071	.062
7	4.650	(21)	-24.206	-16.486	.062
8	4.850	(21)	-27.589	-17.337	.062
9	4.850	(21)	-27.589	-76.787	.062
JTAN	5.000	(21)	-39.152	-77.374	.062
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(22)	1.412	-.438	-126.754
JTAN	7.056	(22)	-1.678	-.438	-135.433
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(22)	1.996	-.562	-121.391
JTAN	7.056	(22)	-1.970	-.562	-130.070

No. 209

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

PICK UP 3

AXIAL MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(21)	-25.744	72.011	.062
1	.150	(21)	-14.986	71.424	.062
2	.150	(21)	-14.986	11.974	.062
3	.350	(21)	-12.675	11.123	.062
4	1.350	(21)	-4.098	5.708	.062
5	2.500	(21)	-2.182	-2.682	.062
6	3.650	(21)	-10.266	-11.071	.062
7	4.650	(21)	-24.206	-16.486	.062
8	4.850	(21)	-27.589	-17.337	.062
9	4.850	(21)	-27.589	-76.787	.062
JTAN	5.000	(21)	-39.152	-77.374	.062
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(21)	-1.996	.562	-121.391
JTAN	7.056	(21)	1.970	.562	-130.070
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(22)	1.996	-.562	-121.391
JTAN	7.056	(22)	-1.970	-.562	-130.070

AXIAL MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(22)	-39.152	77.374	.062
1	.150	(22)	-27.589	76.787	.062
2	.150	(22)	-27.589	17.337	.062
3	.350	(22)	-24.206	16.486	.062
4	1.350	(22)	-10.266	11.071	.062
5	2.500	(22)	-2.182	2.682	.062
6	3.650	(22)	-4.098	-5.708	.062
7	4.650	(22)	-12.675	-11.123	.062
8	4.650	(22)	-14.986	-11.974	.062
9	4.850	(22)	-14.986	-71.424	.062
JTAN	5.000	(22)	-25.744	-72.011	.062
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(22)	1.412	-.438	-126.754
JTAN	7.056	(22)	-1.678	-.438	-135.433
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(21)	-1.412	.438	-126.754
JTAN	7.056	(21)	1.678	.438	-135.433

No. 210

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

PICK UP 4

No.211

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(35)	11.416	36.578	.041
1	.150	(35)	16.874	36.186	.041
2	.150	(35)	16.874	-3.449	.041
3	.350	(28)	20.302	21.389	-.131
4	1.350	(28)	35.764	8.113	-.131
5	2.500	(24)	39.018	-2.682	-.150
6	3.650	(30)	35.764	-8.113	-.131
7	4.650	(30)	20.302	-21.389	-.131
8	4.850	(35)	16.874	3.449	.041
9	4.850	(36)	16.874	-36.186	.041
JTAN	5.000	(36)	11.416	-36.578	.041
MAX	2.778	(26)	39.454	.484	-.150
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(36)	29.521	-8.466	-95.939
JTAN	7.056	(35)	30.407	8.548	-75.266
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(36)	29.911	-8.548	-69.500
JTAN	7.056	(35)	30.213	8.466	-101.725

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(36)	-54.683	63.018	.041
1	.150	(36)	-45.259	62.626	.041
2	.150	(36)	-45.259	22.991	.041
3	.350	(36)	-40.717	22.423	.041
4	1.350	(36)	-19.991	18.813	.041
5	2.500	(31)	-3.271	-2.332	-.338
6	3.650	(35)	-19.991	-18.813	.041
7	4.650	(35)	-40.717	-22.423	.041
8	4.850	(35)	-45.259	-22.991	.041
9	4.850	(35)	-45.259	-62.626	.041
JTAN	5.000	(35)	-54.683	-63.018	.041
MAX	2.500	(31)	-3.271	-2.332	-.336
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(35)	-29.911	8.548	-69.500
JTAN	7.056	(36)	-30.213	-8.466	-101.725
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(35)	-29.521	8.466	-95.939
JTAN	7.056	(36)	-30.407	-8.548	-75.286

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

PICK UP 4

SHEAR MAXIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(26)	-30.240	147.193	-.150
1	.150	(26)	-8.297	145.375	-.150
2	.150	(30)	-19.277	38.486	-.131
3	.350	(30)	-11.795	36.318	-.131
4	1.350	(30)	18.596	23.042	-.131
5	2.500	(36)	-1.455	13.220	.041
6	3.650	(36)	10.415	7.626	.041
7	4.650	(36)	16.128	4.016	.041
8	4.850	(36)	16.874	3.449	.041
9	4.850	(36)	16.874	-36.186	.041
JTAN	5.000	(36)	11.416	-36.578	.041

= = MEMBER 2 (1 - 3) C = =

	L	CASE	M	Q	N
ITAN	0.000	(35)	-29.911	8.548	-69.500
JTAN	7.056	(35)	30.407	8.548	-75.286

= = MEMBER 3 (2 - 4) C = =

	L	CASE	M	Q	N
ITAN	0.000	(35)	-29.521	8.466	-95.939
JTAN	7.056	(35)	30.213	8.466	-101.725

SHEAR MINIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(35)	11.416	36.578	.041
1	.150	(35)	16.874	36.186	.041
2	.150	(35)	16.874	-3.449	.041
3	.350	(35)	16.128	-4.016	.041
4	1.350	(35)	10.415	-7.626	.041
5	2.500	(35)	-1.455	-13.220	.041
6	3.650	(28)	18.596	-23.042	-.131
7	4.650	(28)	-11.795	-36.318	-.131
8	4.850	(28)	-19.277	-38.486	-.131
9	4.850	(24)	-8.297	-145.375	-.150
JTAN	5.000	(24)	-30.240	-147.193	-.150

= = MEMBER 2 (1 - 3) C = =

	L	CASE	M	Q	N
ITAN	0.000	(36)	29.521	-8.466	-95.939
JTAN	7.056	(36)	-30.213	-8.466	-101.725

= = MEMBER 3 (2 - 4) C = =

	L	CASE	M	Q	N
ITAN	0.000	(36)	29.911	-8.548	-69.500
JTAN	7.056	(36)	-30.407	-8.548	-75.286

No. 212

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

PICK UP 4

AXIAL MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(32)	-18.952	62.621	1.035
1	.150	(32)	-9.597	62.110	1.035
2	.150	(32)	-9.596	10.413	1.035
3	.350	(32)	-7.587	9.673	1.035
4	1.350	(32)	-.128	4.964	1.035
5	2.500	(32)	1.538	-2.332	1.035
6	3.650	(32)	-5.492	-9.627	1.035
7	4.650	(32)	-17.614	-14.336	1.035
8	4.850	(32)	-20.556	-15.076	1.035
9	4.850	(32)	-20.556	-66.774	1.035
JTAN	5.000	(32)	-30.611	-67.285	1.035
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(35)	-29.911	8.548	-69.500
JTAN	7.056	(35)	30.407	8.548	-75.286
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(36)	29.911	-6.548	-69.500
JTAN	7.056	(36)	-30.407	-8.548	-75.286

AXIAL MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(33)	-35.421	67.285	-.338
1	.150	(33)	-25.366	66.774	-.338
2	.150	(33)	-25.366	15.076	-.338
3	.350	(33)	-22.423	14.336	-.338
4	1.350	(33)	-10.301	9.627	-.338
5	2.500	(33)	-3.271	2.332	-.338
6	3.650	(33)	-4.938	-4.964	-.338
7	4.650	(33)	-12.396	-9.673	-.338
8	4.850	(33)	-14.406	-10.413	-.338
9	4.850	(33)	-14.406	-62.110	-.338
JTAN	5.000	(33)	-23.761	-62.621	-.338
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(26)	2.410	-.650	-234.543
JTAN	7.056	(26)	-2.177	-.650	-243.222
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(24)	-2.410	.650	-234.543
JTAN	7.056	(24)	2.177	.650	-243.222

No.213

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

PICK UP 5

No. 214

MOMENT MAXIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(19)	21.616	38.366	-.050
1	.150	(14)	29.460	118.953	-.250
2	.150	(14)	29.460	25.889	-.250
3	.350	(14)	34.422	23.721	-.250
4	1.350	(12)	53.259	17.913	-.288
5	2.500	(12)	61.021	.000	-.288
6	3.650	(12)	53.259	-17.913	-.288
7	4.650	(16)	34.422	-23.721	-.250
8	4.850	(16)	29.460	-25.889	-.250
5	4.850	(16)	29.460	-118.953	-.250
JTAN	5.000	(20)	21.616	-38.366	-.050
MAX	2.500	(12)	61.021	.000	-.288

= = MEMBER 2 (1 - 3) C = =

	L	CASE	M	Q	N
ITAN	0.000	(36)	29.521	-8.466	-95.939
JTAN	7.056	(35)	30.407	8.548	-75.286

= = MEMBER 3 (2 - 4) C = =

	L	CASE	M	Q	N
ITAN	0.000	(36)	29.911	-8.548	-69.500
JTAN	7.056	(35)	30.213	8.466	-101.725

MOMENT MINIMUM

= = MEMBER 1 (1 - 2) G = =

	L	CASE	M	Q	N
ITAN	0.000	(36)	-54.683	63.018	.041
1	.150	(36)	-45.259	62.626	.041
2	.150	(36)	-45.259	22.991	.041
3	.350	(36)	-40.717	22.423	.041
4	1.350	(36)	-19.991	18.813	.041
5	2.500	(31)	-3.271	-2.332	-.338
6	3.650	(35)	-19.991	-18.813	.041
7	4.650	(35)	-40.717	-22.423	.041
8	4.850	(35)	-45.259	-22.991	.041
9	4.850	(35)	-45.259	-62.626	.041
JTAN	5.000	(35)	-54.683	-63.018	.041
MAX	2.500	(31)	-3.271	-2.332	-.338

= = MEMBER 2 (1 - 3) C = =

	L	CASE	M	Q	N
ITAN	0.000	(35)	-29.911	8.548	-69.500
JTAN	7.056	(36)	-30.213	-8.466	-101.725

= = MEMBER 3 (2 - 4) C = =

	L	CASE	M	Q	N
ITAN	0.000	(35)	-29.521	8.466	-95.939
JTAN	7.056	(36)	-30.407	-8.548	-75.286

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1

CRC-FANSY V6.3

No.215

PICK UP 5

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(26)	-30.240	147.193	-.150
1	.150	(26)	-8.297	145.375	-.150
2	.150	(30)	-19.277	38.486	-.131
3	.350	(30)	-11.795	36.318	-.131
4	1.350	(30)	18.596	23.042	-.131
5	2.500	(36)	-1.455	13.220	.041
6	3.650	(36)	10.415	7.626	.041
7	4.650	(36)	16.128	4.016	.041
8	4.850	(36)	16.874	3.449	.041
9	4.850	(36)	16.874	-36.186	.041
JTAN	5.000	(36)	11.416	-36.578	.041
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(35)	-29.911	8.548	-69.500
JTAN	7.056	(35)	30.407	8.548	-75.286
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(35)	-29.521	8.466	-95.939
JTAN	7.056	(35)	30.213	8.466	-101.725

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(35)	11.416	36.578	.041
1	.150	(35)	16.874	36.186	.041
2	.150	(35)	16.874	-3.449	.041
3	.350	(35)	16.128	-4.016	.041
4	1.350	(35)	10.415	-7.626	.041
5	2.500	(35)	-1.455	-13.220	.041
6	3.650	(28)	18.596	-23.042	-.131
7	4.650	(28)	-11.795	-36.318	-.131
8	4.850	(28)	-19.277	-38.486	-.131
9	4.850	(24)	-8.297	-145.375	-.150
JTAN	5.000	(24)	-30.240	-147.193	-.150
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(36)	29.521	-8.466	-95.939
JTAN	7.056	(36)	-30.213	-8.466	-101.725
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(36)	29.911	-8.548	-69.500
JTAN	7.056	(36)	-30.407	-8.546	-75.286

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

PICK UP 5

AXIAL MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(32)	-18.952	62.621	1.035
1	.150	(32)	-9.597	62.110	1.035
2	.150	(32)	-9.596	10.413	1.035
3	.350	(32)	-7.587	9.673	1.035
4	1.350	(32)	-.128	4.964	1.035
5	2.500	(32)	1.538	-2.332	1.035
6	3.650	(32)	-5.492	-9.627	1.035
7	4.650	(32)	-17.614	-14.336	1.035
8	4.850	(32)	-20.556	-15.076	1.035
9	4.850	(32)	-20.556	-66.774	1.035
JTAN	5.000	(32)	-30.611	-67.285	1.035
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(19)	-28.343	8.123	-67.407
JTAN	7.056	(19)	28.975	8.123	-73.193
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(20)	28.343	-8.123	-67.407
JTAN	7.056	(20)	-28.975	-8.123	-73.193

AXIAL MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(17)	-10.457	64.953	-.458
1	.150	(17)	-.752	64.442	-.458
2	.150	(17)	-.752	12.744	-.458
3	.350	(17)	1.724	12.005	-.458
4	1.350	(17)	11.514	7.296	-.458
5	2.500	(17)	15.862	.000	-.458
6	3.650	(17)	11.514	-7.296	-.458
7	4.650	(17)	1.724	-12.005	-.458
8	4.850	(17)	-.752	-12.744	-.458
9	4.850	(17)	-.752	-64.442	-.458
JTAN	5.000	(17)	-10.457	-64.953	-.456
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(26)	2.410	-.650	-234.543
JTAN	7.056	(26)	-2.177	-.650	-243.222
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(24)	-2.410	.650	-234.543
JTAN	7.056	(24)	2.177	.650	-243.222

No.216

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

PICK UP 6

MOMENT MAXIMUM

-----L---		-CASE-	-----M---	-----Q---	-----N---
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(13)	17.865	64.233	-.158
1	.150	(14)	29.460	118.953	-.250
2	.150	(14)	29.460	25.889	-.250
3	.350	(14)	34.422	23.721	-.250
4	1.350	(12)	53.259	17.913	-.288
5	2.500	(12)	61.021	.000	-.288
6	3.650	(12)	53.259	-17.913	-.288
7	4.650	(16)	34.422	-23.721	-.250
8	4.850	(16)	29.460	-25.889	-.250
9	4.850	(16)	29.460	-118.953	-.250
JTAN	5.000	(16)	11.498	-120.535	-.250
MAX	2.500	(12)	61.021	.000	-.288
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(29)	15.143	-4.143	-123.075
JTAN	7.056	(27)	15.208	4.066	-115.693
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(29)	14.783	-4.066	-186.446
JTAN	7.056	(27)	15.388	4.143	-208.922

MOMENT MINIMUM

-----L---		-CASE-	-----M---	-----Q---	-----N---
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(30)	-39.128	133.132	-.131
1	.150	(29)	-21.275	76.319	-.038
2	.150	(29)	-21.275	21.543	-.038
3	.350	(29)	-17.039	20.803	-.038
4	1.350	(29)	1.550	16.094	-.038
5	2.500	(27)	16.016	-6.130	-.038
6	3.650	(27)	2.217	-21.708	-.038
7	4.650	(27)	-26.841	-34.984	-.038
8	4.850	(27)	-34.055	-37.152	-.038
9	4.850	(27)	-34.055	-127.138	-.038
JTAN	5.000	(27)	-53.245	-128.719	-.038
MAX	2.500	(27)	16.016	-6.130	-.038
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(28)	-13.699	3.974	-194.163
JTAN	7.056	(30)	-14.955	-4.235	-216.639
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(28)	-14.927	4.235	-209.092
JTAN	7.056	(30)	-14.341	-3.974	-231.710

No 218

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1　　CRC-FANSY V6.3

PICK UP 6

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(26)	-30.240	147.193	-.150
1	.150	(26)	-8.297	145.375	-.150
2	.150	(30)	-19.277	38.486	-.131
3	.350	(30)	-11.795	36.318	-.131
4	1.350	(30)	18.596	23.042	-.131
5	2.500	(29)	16.016	8.798	-.038
6	3.650	(29)	19.385	-6.779	-.038
7	4.650	(29)	5.256	-20.055	-.038
8	4.850	(29)	1.028	-22.?23	-.038
9	4.850	(29)	1.027	-112.209	-.038
JTAN	5.000	(29)	-15.923	-113.791	-.038
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(27)	-13.483	4.066	-108.146
JTAN	7.056	(27)	15.208	4.066	-115.693
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(28)	-14.927	4.235	-209.092
JTAN	7.056	(28)	14.955	4.235	-216.639

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(27)	4.561	61.901	-.038
1	.150	(27)	13.808	61.390	-.038
2	.150	(27)	13.808	6.614	-.038
3	.350	(27)	15.058	5.874	-.038
4	1.350	(27)	18.718	1.165	-.038
5	2.500	(28)	33.930	-7.464	-.131
6	3.650	(28)	18.596	-23.042	-.131
7	4.650	(28)	-11.795	-36.318	-.131
8	4.850	(28)	-19.277	-38.486	-.131
9	4.850	(24)	-8.297	-145.375	-.150
JTAN	5.000	(24)	-30.240	-147.193	-.150
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(30)	14.927	-4.235	-209.092
JTAN	7.056	(30)	-14.955	-4.235	-216.639
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(29)	14.783	-4.066	-186.446
JTAN	7.056	(29)	-13.906	-4.066	-193.993

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

No. 219

PICK UP 6

AXIAL MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(27)	4.561	61.901	-.038
1	.150	(27)	13.808	61.390	-.038
2	.150	(27)	13.808	6.614	-.038
3	.350	(27)	15.058	5.874	-.038
4	1.350	(27)	18.718	1.165	-.038
5	2.500	(27)	16.016	-6.130	-.038
6	3.650	(27)	2.217	-21.708	-.038
7	4.650	(27)	-26.841	-34.984	-.038
8	4.850	(27)	-34.055	-37.152	-.038
9	4.850	(27)	-34.055	-127.138	-.038
JTAN	5.000	(27)	-53.245	-128.719	-.038
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(13)	-11.439	3.512	-105.417
JTAN	7.056	(13)	13.341	3.512	-112.964
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(15)	12.738	-3.512	-183.717
JTAN	7.056	(15)	-12.041	-3.512	-191.264

AXIAL MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(12)	-1.534	144.512	-.288
1	.150	(12)	20.007	142.693	-.288
2	.150	(12)	20.007	35.673	-.288
3	.350	(12)	26.894	33.180	-.288
4	1.350	(12)	53.259	17.913	-.288
5	2.500	(12)	61.021	.000	-.288
6	3.650	(12)	53.259	-17.913	-.288
7	4.650	(12)	26.894	-33.180	-.288
8	4.850	(12)	20.007	-35.673	-.288
9	4.850	(12)	20.007	-142.693	-.288
JTAN	5.000	(12)	-1.534	-144.512	-.288
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(26)	2.410	-.650	-234.543
JTAN	7.056	(26)	-2.177	-.650	-243.222
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(24)	-2.410	.650	-234.543
JTAN	7.056	(24)	2.177	.650	-243.222

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

No. 220

PICK UP 7

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(19)	21.616	38.366	-.050
1	.150	(19)	27.342	37.974	-.050
2	.150	(19)	27.342	-1.661	-.050
3	.350	(19)	26.954	-2.228	-.050
4	1.350	(19)	23.028	-5.839	-.050
5	2.500	(19)	13.215	-11.432	-.050
6	3.650	(20)	23.028	5.839	-.050
7	4.650	(20)	26.954	2.228	-.050
8	4.850	(20)	27.342	1.661	-.050
9	4.850	(20)	27.342	-37.974	-.050
JTAN	5.000	(20)	21.616	-38.366	-.050
MAX	4.850	(20)	27.342	1.661	-.050
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(36)	29.521	-8.466	-95.939
JTAN	7.056	(35)	30.407	8.548	-75.286
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(36)	29.911	-8.548	-69.500
JTAN	7.056	(35)	30.213	8.466	-101.725

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(36)	-54.683	63.018	.041
1	.150	(36)	-45.259	62.626	.041
2	.150	(36)	-45.259	22.991	.041
3	.350	(36)	-40.717	22.423	.041
4	1.350	(36)	-19.991	18.813	.041
5	2.500	(36)	-1.455	13.220	.041
6	3.650	(35)	-19.991	-18.813	.041
7	4.650	(35)	-40.717	-22.423	.041
8	4.650	(35)	-45.259	-22.991	.041
9	4.850	(35)	-45.259	-62.626	.041
JTAN	5.000	(35)	-54.683	-63.018	.041
MAX	2.500	(36)	-1.455	13.220	.041
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(35)	-29.911	6.548	-69.500
JTAN	7.056	(36)	-30.213	-8.466	-101.725
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(35)	-29.521	8.466	-95.939
JTAN	7.056	(36)	-30.407	-6.546	-75.286

PICK UP 7

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(36)	-54.683	63.018	.041
1	.150	(36)	-45.259	62.626	.041
2	.150	(36)	-45.259	22.991	.041
3	.350	(36)	-40.717	22.423	.041
4	1.350	(36)	-19.991	18.813	.041
5	2.500	(36)	-1.455	13.220	.041
6	3.650	(36)	10.415	7.626	.041
7	4.650	(36)	16.128	4.016	.041
8	4.850	(36)	16.874	3.449	.041
9	4.850	(36)	16.874	-36.186	.041
JTAN	5.000	(36)	11.416	-36.578	.041
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(35)	-29.911	8.548	-69.500
JTAN	7.056	(35)	30.407	8.548	-75.286
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(35)	-29.521	8.466	-95.939
JTAN	7.056	(35)	30.213	8.466	-101.725

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(35)	11.416	36.578	.041
1	.150	(35)	16.874	36.186	.041
2	.150	(35)	16.874	-3.449	.041
3	.350	(35)	16.128	-4.016	.041
4	1.350	(35)	10.415	-7.626	.041
5	2.500	(35)	-1.455	-13.220	.041
6	3.650	(35)	-19.991	-18.813	.041
7	4.650	(35)	-40.717	-22.423	.041
8	4.850	(35)	-45.259	-22.991	.041
9	4.850	(35)	-45.259	-62.626	.041
JTAN	5.000	(35)	-54.683	-63.018	.041
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(36)	29.521	-8.466	-95.939
JTAN	7.056	(36)	-30.213	-8.466	-101.725
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(36)	29.911	-8.548	-69.500
JTAN	7.056	(36)	-30.407	-8.548	-75.286

No. 221

TITLE..VIADUCT OF DOUBLE TRACK (3*10=30) C1 CRC-FANSY V6.3

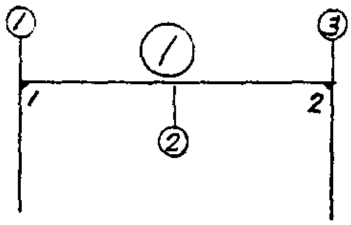
No. 222

PICK UP 7

	AXIAL MAXIMUM						AXIAL MINIMUM				
	L	CASE	M	Q	N		L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =						= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(35)	11.416	36.578	.041	ITAN	0.000	(20)	-35.544	61.230	-.050
1	.150	(35)	16.874	36.186	.041	1	.150	(20)	-26.388	60.838	-.050
2	.150	(35)	16.874	-3.449	.041	2	.150	(20)	-26.388	21.203	-.050
3	.350	(35)	16.128	-4.016	.041	3	.350	(20)	-22.204	20.636	-.050
4	1.350	(35)	10.415	-7.626	.041	4	1.350	(20)	-3.266	17.025	-.050
5	2.500	(35)	-1.455	-13.220	.041	5	2.500	(20)	13.215	11.432	-.050
6	3.650	(35)	-19.991	-18.813	.041	6	3.650	(20)	23.028	5.839	-.050
7	4.650	(35)	-40.717	-22.423	.041	7	4.650	(20)	26.954	2.228	-.050
8	4.850	(35)	-45.259	-22.991	.041	8	4.850	(20)	27.342	1.661	-.050
9	4.850	(35)	-45.259	-62.626	.041	9	4.850	(20)	27.342	-37.974	-.050
JTAN	5.000	(35)	-54.683	-63.018	.041	JTAN	5.000	(20)	21.616	-38.366	-.050
= = MEMBER 2 (1 - 3) C = =						= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(19)	-28.343	8.123	-67.407	ITAN	0.000	(36)	29.521	-8.466	-95.939
JTAN	7.056	(19)	28.975	8.123	-73.193	JTAN	7.056	(36)	-30.213	-8.466	-101.725
= = MEMBER 3 (2 - 4) C = =						= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(20)	28.343	-8.123	-67.407	ITAN	0.000	(35)	-29.521	8.466	-95.939
JTAN	7.056	(20)	-28.975	-8.123	-73.193	JTAN	7.056	(35)	30.213	8.466	-101.725

(6) Calculation of upper beam

1. Stress calculation of upper beam



(1) The case, without electric pole

Bending stress

(a). Summary of stresses

(i) At the support point

Pick up No 2

		(1)			
		①	CO.	③	CO.
Combined Stress	Top	-35.54	20	-35.54	9
	Bottom	34.42	14	34.42	16
Dead load		-10.45	10	-10.45	10

(ii) Span moment

		(1)	
		②	CO.
Combined Stress	Bottom	61.02	12
Dead load	Bottom	19.82	10

(Note 1) Dead load is of Pick-up No. 1

(Note 2) CO. — combination

(b) Allowable stress for upper beam, safe against cracking

(i) At the support point 2

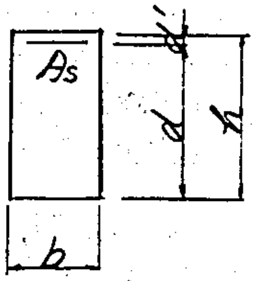
Dead load	M_d	$= -10.45^{tm}$ (case 1)
Train load + Impact	$M_{T \cdot I}$	$= -7.32^{tm}$ (case 2)
	ΣM	$= -17.77^{tm}$

$$\alpha = \frac{-7.32}{-17.77} = 0.41 > 0.25$$

Hence $\sigma_{sa} = 1{,}000\ kg/cm^2$

(C) Cross section used for stress calculation

(i) Cross section at the support point



$b = 70^{cm}$

$h = 200$ "

$d' = 2.5 + 1.9 + 3.2 + 1.5 = 9.1^{cm}$

$d = 200 - 9.1 = 190.9^{cm}$

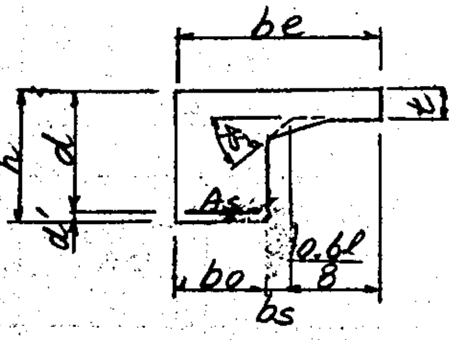
Cross section at the span center point

(ii) Effective width of T-beam at compression fibre

$$b_e = b_0 + b_s + \frac{a_b}{8} l$$

$$b_{e1} = 0.70 + 0.15 + \frac{a_b}{8} \times 5.00$$

= ~~1.225~~ m



$b_0 = 70^{cm}$

$h = 200^{cm}$

$d' = 3.0 + 1.3 + 1.5 = 5.8^{cm}$

$d = 200 - 5.8 \fallingdotseq 194.2^{cm}$

$t = 28^{cm}$

(d) Calculation of bending stress

	③		②	
M (tm)	-10.45	-35.54	61.02	
N (t)				
S (t)				
b (cm)	70		122.5	
h (cm)	200		200	
d (cm)	190.9		194.2	
d' (cm)	9.1		5.8	
As (cm²)	D29-5 = 32.12		D29-5 = 32.12	
p	0.[illegible]		0.00135	
As' (cm²)			t=28 t/d = 0.144	
p'				
e=M/N (cm)				
e=M/N+u (cm)				
e=M/N−u (cm)				
e/h				
d/e				
d' /h				
d' /d				
M/bd² (kg/cm²)	0.41	1.40	1.32	
k			0.108	
c				
j			0.932	
1/Lc	9.24			
1/Ls	451			
β= σs/σc				
σc (kg/cm²)		12.9	15.8	
σs (kg/cm²)	180	630	1040	
τ (kg/cm²)				
σsa (kg/cm²)	1000	1300	1800	
σca (kg/cm²)		90	90	
τa (kg/cm²)				
Nomogram number	M-1	"	M-47.48	
combination	D	D+S	D+T+I	

(e) Required minimum cross section of re-bars

(i) At the top of support point

$$As = \frac{M}{\sigma_{sa} \cdot j \cdot d} \times \frac{4}{3}$$

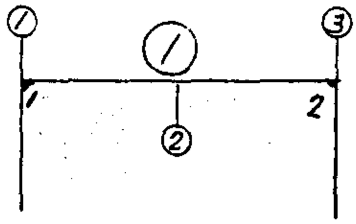
$$= \frac{35.54 \times 10^5}{1800 \times 0.875 \times 190.9} \times \frac{4}{3} = 15.76^{cm^2}$$

Hence D29 − 5 = $32.12^{cm^2} > 15.76^{cm^2}$

(ii) At the span center point

$$As = \frac{61.02 \times 10^5}{1800 \times 0.875 \times 194.2} \times \frac{4}{3} = 26.60^{cm^2}$$

Hence D29 − 5 = $32.12^{cm^2} > 26.60^{cm^2}$



(2) The case, electric pole is equipped allowable compression stress due to bending

(a) Summary of stresses

(i) At the support point

Pick up No 4

		(1)			
		①	CO.	③	CO.
Combined Stress	Top	−54.68	36	−54.68	35
	Bottom	20.30	28	20.30	30
Dead load		−39.15	22	−39.15	21

(ii) Span moment

		(1)	
		②	CO.
Combined Stress	Bottom	39.02	34
Dead load	Bottom	−2.18	21

(Note 1) Dead load is of Pick-up No. 3

(Note 2) CO. — combination

(b) Allowable stress for upper beam, safe against cracking

(i) At the support point 2

Dead load + electric pole load $M_d = -39.15^{tm}$ (case 24)

Train load + Impact $M_{T+I} = -7.32^{"}$ (case 2)

$\Sigma M = -46.47^{tm}$

$$\alpha = \frac{-7.32}{-46.47} = 0.16 < 0.25$$

Hence $\sigma_{sa} = 1200\ kg/cm^2$

(C) Calculation of bending stress

	③		②	
M (tm)	-39.15	-54.68	39.02	
N (t)				
S (t)				
b (cm)	70		122.5	
h (cm)	200		200	
d (cm)	190.9		194.2	
d' (cm)	9.1		5.8	
As (cm²)	D29-5 = 32.12		D29-5 = 32.12	
p	0.00240		0.00135	
As' (cm²)			t = 28 t/d = 0.144	
p'				
e = M/N (cm)				
e = M/N + u (cm)				
e = M/N − u (cm)				
e/h				
d/e				
d'/h				
d'/d				
M/bd² (kg/cm²)	1.53	2.14	0.84	
k			0.186	
c				
j			0.943	
1/Lc	9.24			
1/Ls	451			
β = σs/σc				
σc (kg/cm²)		19.8	10.1	
σs (kg/cm²)	690	970	660	
τ (kg/cm²)				
σsa (kg/cm²)	1200	1800	1800	
σca (kg/cm²)		90	90	
τa (kg/cm²)				
Nomogram number	M-1	〃	M-47.48	
Combination	D+E	D+S+E	D+T+I+E	

(d) Required minimum cross section of re-bars

(i) At the top of support point

$$As = \frac{M}{\sigma_{sa} \cdot j \cdot d} \times \frac{4}{3}$$

$$= \frac{39.15 \times 10^5}{1200 \times 0.875 \times 190.9} \times \frac{4}{3} = 26.04^{cm^2}$$

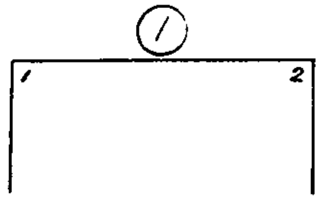
Hence D29 − 5 = $32.12^{cm^2} > 26.04^{cm^2}$

(ii) At the span center point

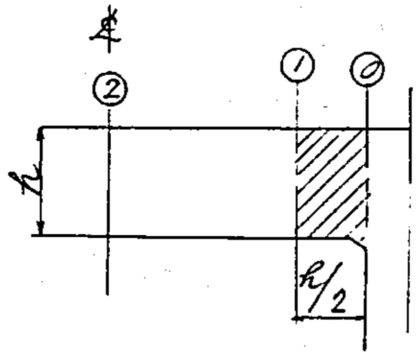
$$As = \frac{39.02 \times 10^5}{1800 \times 0.875 \times 194.2} \times \frac{4}{3} = 17.01^{cm^2}$$

Hence D29 − 5 = $32.12^{cm^2} > 17.01^{cm^2}$

2. Shearing stress of upper beam



(1) Summary of shearing stress



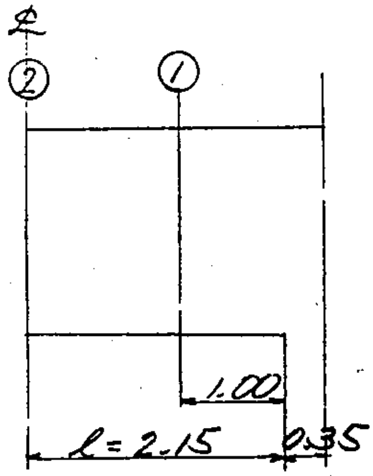
For the design of cross section of beam end, the value of shearing stress at h/2 point is applied.

	①			
	Left support	CO.	Right support	CO.
⓪	36.32	30	-36.32	28
①	23.04		-23.04	
②	7.46		-7.46	

(Note) CO. — combination

(2) Shearing stress

(a) Shearing stress caused by bending



(i) Shearing stress of the member of uniformheight

$$\tau = \frac{S}{b \cdot d}$$

$$\tau_1 = \frac{23.04 \times 10^3}{70 \times 190.9} = 1.72 \ kg/cm^2 < 3.9 \ kg/cm^2$$

$$\tau_2 = \frac{7.46 \times 10^3}{70 \times 190.9} = 0.56 \ " < \ "$$

(b) Torsional moment

a) Torsional moment caused by the loads on Rahmen (rigid frame)

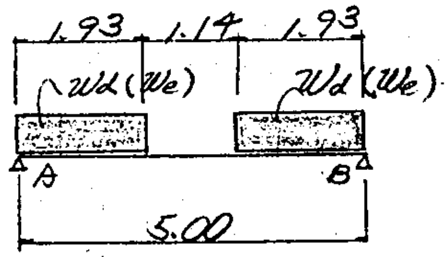
(i) Due to dead load

Derived from slab calculation

Uniformly distributed load

Equivalent uniform load of track weight

$$w_d = 0.45^{t/m} \times 1/2.86 = 0.16^{t/m^2}$$



Width of distribution

$$B = 2.86^{m}$$

$$R_A = 0.16 \times 1.93 = 0.31^{t}$$

At the $\ell/4$ point

$$M_{\ell/4} = 0.31 \times 1.25 - 0.16 \times 1.25^2 \times 1/2 = 0.26^{tm}$$

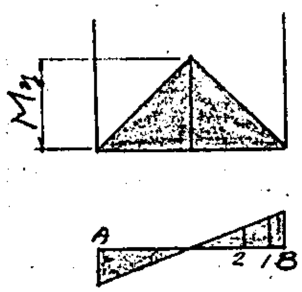
$$W_{e/4} = \frac{32 \cdot M_{1/4}}{3 \cdot \ell^2} = \frac{32 \times 0.26}{3 \times 5.00^2} = 0.11^{t/m^2}$$

Total uniform load

$$\Sigma W_d = 1.78 + 0.11 = 1.89^{t/m^2}$$

Fixed end moment, at negative side

$$M_{y} = -\frac{1}{24} W_d \, l_x^2 = -\frac{1}{24} \times 1.89 \times 5.00^2 = -1.97^{tm}$$



$$M_{TA} = 1.97 \times 2.50 \times 1/2 = 2.46^{tm}$$

$$M_{T1} = 2.46 \times \frac{2.15}{2.50} = 2.12^{tm}$$

$$M_{T2} = 2.46 \times \frac{1.15}{2.50} = 1.13^{tm}$$

(ii) Caused by crain load

From the slab calculation

Equivalent uniform load

$$W_e = \frac{16}{1.5 \times 2.86} = 3.73^{t/m^2}$$

Refer the dead load diagram

$$R_A = 3.73 \times 1.93 = 7.20^{t}$$

At the $l/4$ point

$$M_{l/4} = 7.20 \times 1.25 - 3.73 \times 1.25^2 \times 1/2 = 6.09^{tm}$$

$$W_{l/4} = \frac{32 \times 6.09}{3 \times 5.00^2} = 2.60^{t/m^2}$$

Hence, $W_e = 2.60^{t/m^2}$

Fixed end moment, at negative site

$M_y = -\frac{1}{24} \times 2.60 \times 5.00^2 = 2.71^{tm}$

$M_{TA} = 2.71 \times 2.50 \times 1/2 = 3.39^{tm}$

$M_{T1} = 3.39 \times \frac{2.15}{2.50} = 2.92^{tm}$

$M_{T2} = 3.39 \times \frac{1.15}{2.50} = 1.56^{tm}$

Train load + Impact

$l = 5.00^m$

$i = 0.480 \times (1 - \frac{5.00}{200}) = 0.468$

$M_{TA} = 3.39 \times 1.468 = 4.98^{tm}$

$M_{T1} = 2.92 \times$ 〃 $= 4.29$ 〃

$M_{T2} = 1.56 \times$ 〃 $= 2.29$ 〃

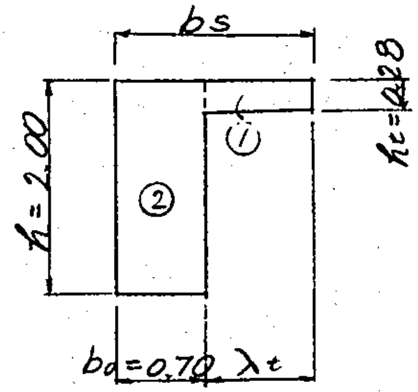
(iii) Dead load + Train load + Impact

$\Sigma M_A = 2.46 + 4.98 = 7.44^{tm}$

$\Sigma M_1 = 2.12 + 4.29 = 6.41$ 〃

$\Sigma M_2 = 1.13 + 2.29 = 3.42$ 〃

b) Torsional moment, beared by cross beam



Effective width

$bs = b_0 + \lambda_t$

$\lambda_t = 3 \cdot h_t$

$= 3 \times 0.28 = 0.84^{m}$

$bs = 0.70 + 0.84 = 1.54^{m}$

$h = 2.00^{m}$

(i) Calculation of distribution ratio

	a	b	a/b	k	$I_t = k \cdot a \cdot b^3$ (m^4)
①	0.840	0.250	3.000	0.263	$0.263 \times 0.840 \times 0.28^3 = 0.00485$
②	2.000	0.700	2.857	0.260	$0.260 \times 2.00 \times 0.70^3 = 0.17836$
Total					$\Sigma I_t = 0.18321$

(ii) Torsional moment beared by the beam
(for re-bar arrangement in axial direction)

Dead load + Train load + Impact

Front face of column $M_{t1} = 6.41 \times \frac{0.17836}{0.18321} = 6.24^{tm}$

At the 1/2 point $M_{t2} = 3.42 \times$ 〃 $= 3.33$ 〃

c) Shearing stress caused by torsion

Shearing stress caused by torsion is calculated followed the equation.

$$\tau_t = \frac{M_t}{I_t} \cdot b \cdot \eta$$

b : Shorther side length

a : longer side length

k : Table − 40.2

(i) Front face of column

$M_{t1} = 6.24^{tm}$

$b = 70^{cm}$ $a = 200^{cm}$

$\frac{a}{b} = \frac{200}{70} = 2.857$ $\eta = 0.980$

$$\tau_{t1} = \frac{6.24 \times 10^5}{18.321 \times 10^6} \times 70 \times 0.980 = 2.34^{kg/cm^2}$$

(ii) At the h/2 point

$M_{t2} = 3.33^{tm}$

$b = 70^{cm}$ $a = 200^{cm}$

$\frac{a}{b} = \frac{200}{70} = 2.857$ $\eta = 0.980$

$$\tau_{t2} = \frac{3.33 \times 10^5}{18.321 \times 10^6} \times 70 \times 0.980 = 1.25^{kg/cm^2}$$

(c) Combined shearing stress

Combined allowable shearing stress

$\tau_a = 17 \times 1.3 = 22.1^{kg/cm^2}$

Combined shearing stress

$\tau_1 = 1.72 + 1.25 = 2.97^{kg/cm^2} < 22.1^{kg/cm^2}$

$\tau_2 = 0.56 + 0 = 0.56$ 〃 $<$ 〃

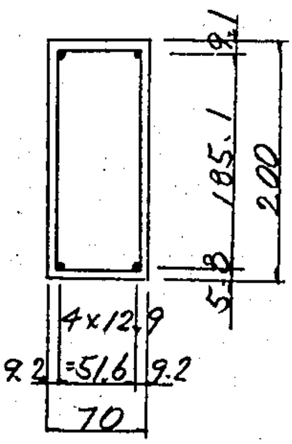
Stirrup D13 - 2 sets are arranged in 25.0^{cm} ctc.

(d) Calculation of axial re-bar arrangement, resisting torsional moment.

Required re-bar arrangement is calculated followed the equation.

$$As = \frac{Mt\,(b_1 + h_1)}{0.8 \cdot \sigma_{sa} \cdot b_1 \cdot h_1}$$

a) Front face of column



$Mt = 6.24^{tm}$

$\sigma_{sa} = 1800^{kg/cm^2}$

$b = 51.6 + 2.9 + 1.3 = 55.8^{cm}$

$h_1 = 185.1 + 2.9 + 1.3 = 189.3$ "

$$As = \frac{6.24 \times 10^5 \times (55.8 + 189.3)}{0.8 \times 1800 \times 55.8 \times 189.3} = 10.05^{cm^2}$$

Required cross section of re-bars arranged at shorter side

$$Asb_1 = 10.05 \times \frac{55.8}{2 \times (55.8 + 189.3)} = 1.14^{cm^2}$$

3. Required cross section of re-bars arranged at longer side

$$Ash_1 = 10.05 \times \frac{189.3}{2(55.8+189.3)} = 3.88^{cm^2}$$

(i) Top and Bottom

Minimum section of re-bare

$As = D29-5 = 32.12^{cm^2} > 0.14^{cm^2}$

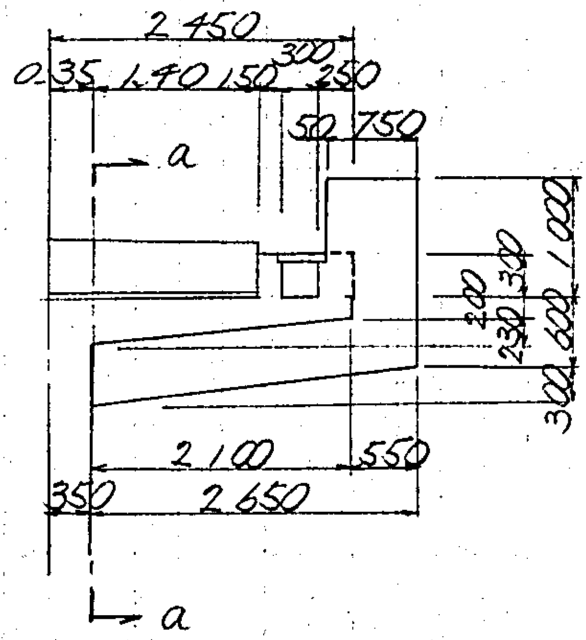
(ii) Side (one side)

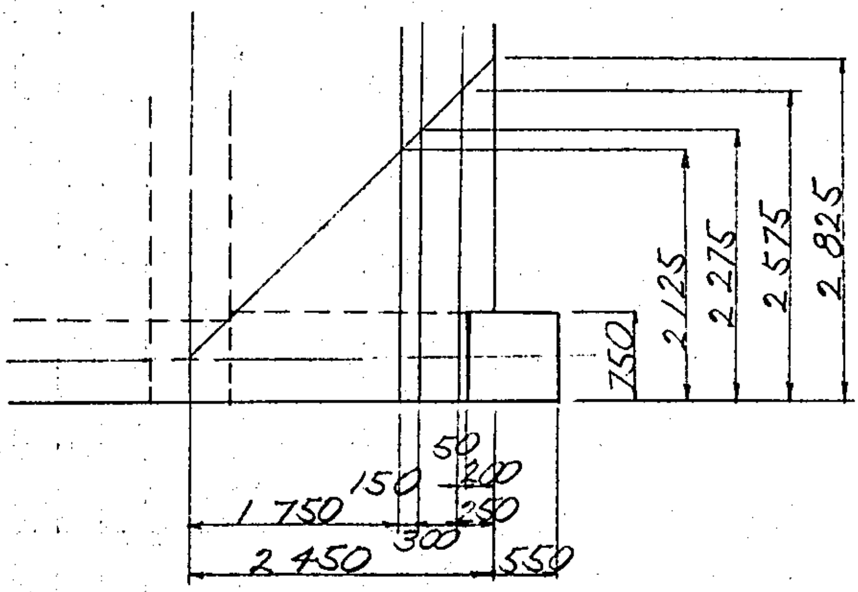
$As = D16 - 4 = 7.94^{cm^2} > 3.88^{cm^2}$

8% of main bars section (both sides)

$As = 32.12 \times 0.08 \times 1/2 = 1.28^{cm^2} < 7.94^{cm^2}$

4. Calculation of electric pole beam





electric pole load

$M = 5.00^{tm}$ $N = 2.00^{t}$

Moment of ⓐ-ⓐ section

a) Dead load

	Calculation	N (t)	x (m)	M (tm)
Electric pole				5.00
		2.00	2.275	4.55
hand rail	0.20 t/m × 1.975	0.40	2.000	0.80
Curb	2.5 t/m3 × 0.30 × 0.25 × 1.95	0.37	1.975	0.73
ballast stopper	2.5 × 0.15 × 0.30 × 2.20	0.25	1.475	0.37
Duct lid	2.5 × 0.05 × 0.30 × 2.425	0.09	1.700	0.15
Cable	0.06 t/m × 2.425	0.15	1.700	0.26
ballast	1.9 × 0.481 × (0.75 + 2.125) × 1/2 × 1.40	1.84	0.812	1.59
Sloping concrete	2.35 × 0.07 × (0.75 + 2.125) × 1/2 × 1.40	0.33	0.812	0.27
Slab	2.5 × 0.20 × (0.75 + 2.825) × 1/2 × 2.10	1.88	1.253	2.36
〃	2.5 × 0.23 × (0.75 + 2.325) × 1/4 × 2.10	1.08	0.977	1.06
Support of electric pole	2.5 × {0.60 × 2.65 − (0.20 + 0.43) × 1/2 × 2.10} × 0.75	1.74	1.888	3.29
〃	2.5 × 0.30 × 2.65 × 1/2 × 0.75	0.75	0.833	0.66
〃	2.5 × 0.75 × 0.75 × 1.00	1.41	2.275	3.21
total		12.29		24.30

b) Train load and Impact load

(1) Train load

KS − 16

$$w = \frac{16}{2.86} = 5.59^{t/m^2}$$

$$M_{a-a} = 5.59 \times 0.58^2 \times 1/2 = 0.94^{tm}$$

(2) Impact coefficient

$l = 0.58^m$ —— $i = 0.587$

(3) Train load + Impact load

$$M_{a-a} = 0.94 \times (1 + 0.587) = 1.49^{tm}$$

$$S = 5.59^{t/m} \times 0.58 \times (\quad " \quad) = 5.14^t$$

c) Combination of stress

(Dead + Train + Impact) load

$$M = 24.30 + 1.49 = 25.79^{tm}$$

$$S = 12.29 + 5.14 = 17.43^t$$

d) Allowable stress of safe against cracking

$$\alpha = \frac{1.49}{25.79} = 0.058 < 0.25$$

Therefore, $\sigma_{sad} = 1200^{kg/cm^2}$

(c) Stress calculation

	Ⓐ - Ⓐ section	〃	
M (tm)	24.30	25.79	
N (t)			
S (t)			
b (cm)	75	〃	
h (cm)	90	〃	
d (cm)	80.9	〃	
d' (cm)	9.1	〃	
As (cm²)	D29-5 = 32.12	〃	
p	0.00529	〃	
As' (cm²)			
p'			
e=M/N (cm)			
e=M/N+u (cm)			
e=M/N−u (cm)			
e/h			
d/e			
d'/h			
d'/d			
M/bd² (kg/cm²)	4.95	5.25	
k			
c			
j			
1/Lc		6.86	
1/Ls	212	212	
β=σs/σc			
σc (kg/cm²)		36.0	
σs (kg/cm²)	1,050	1,110	
τ (kg/cm²)			
σsa (kg/cm²)	1,200	1,800	
σca (kg/cm²)		90	
τa (kg/cm²)			
Nomogram number	M-1	〃	
combination	D	D+T+I	

(d) Calculation of shearing stress

$S = 17.43^{t}$ (D+T+I)

$\tau = \frac{17.43 \times 10^3}{75 \times 80.9} = 2.87^{kg/cm^2} < 3.9^{kg/cm^2}$

Therefore

Stirrup

Use D13 - 2 set 25 cm ctc.

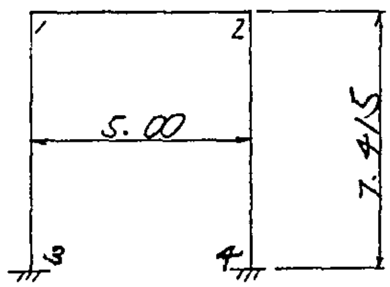
Bar arrangemet in axial direction

Use D16 - 2 bars (one side)

§ 7. Rigid frame analysis on transversal section (②-②) of elevated structure

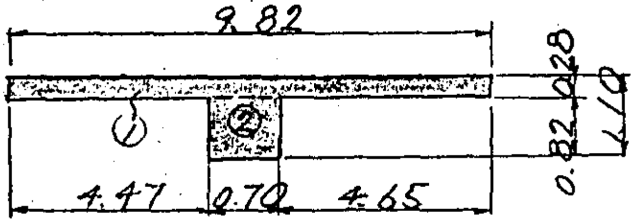
(1) Elements for rigid frame analysis

1. Configulation and dimension of rigid frame



2. Cross-sectional area and moment of Inertia of the member

(1) Member (1 ~ 2)



	b (m)	h (m)	A (m²)	y (m)	A·y (m³)
①	9.820	0.280	2.750	0.140	0.38500
②	0.700	0.820	0.574	0.690	0.39606
Σ			3.324		0.78106

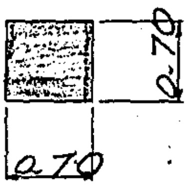
$$y = \frac{0.78106}{3.324} = 0.235^{m}$$

	$b^{(m)}$	$h^{(m)}$	$A^{(m^2)}$	$y_0^{(m)}$	$I_0\ (m^4)$	$A \cdot y_0^2\ (m^4)$	$I_0 + A \cdot y_0^2\ (m^4)$
①	9.820	0.280	2.750	0.095	0.01796	0.02482	0.04278
②	0.700	0.820	0.574	0.455	0.03216	0.11883	0.15099
Σ			3.324		0.05012	0.14365	0.19377

Cross-Sectional Area $A = 3.324^{m^2}$

Moment of Inertia $I = 0.19377^{m^4}$

(2) Member (1~3. 2~4)



$A = 0.70 \times 0.70 = 0.490^{m^2}$

$I = 1/12 \times 0.70 \times 0.70^3 = 0.02001^{m^4}$

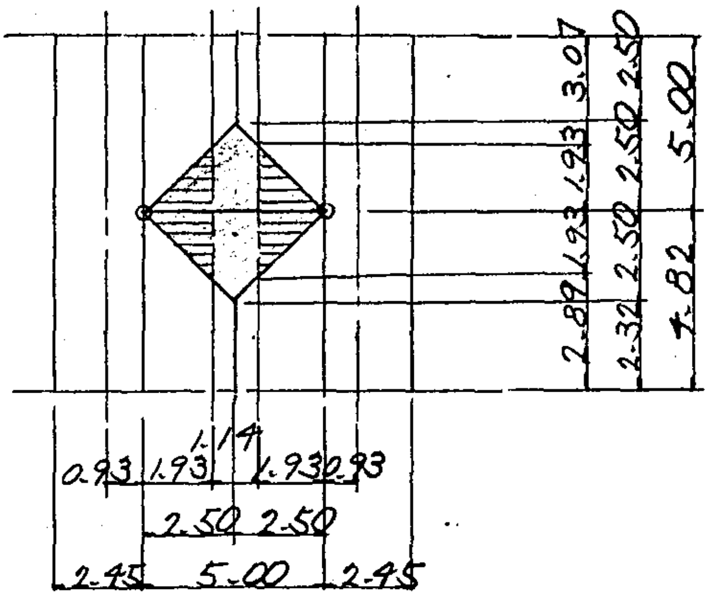
(3) axial height

$h_1 = 7.650 - 0.235 = 7.415^{m}$

(2) Calculation of loads

1. Dead Load

(1) Member (1 - 2)



(a) Distribuled Load (A)

Weight of slab grading concrete ant Ballast

Slab	2.5 t/m³ × 0.28	=	0.700 t/m²
Grading concrete	2.35 " × 0.07	=	0.165 "
Ballast	1.9 " × 0.481	=	0.914 "
	Wd	=	1.78 t/m²

Wd1 = 1.78 t/m² × 2.50 × 2 = 8.90 t/m

(b) Distributed load (B) Caused by Track weight

Distributed width

$b = 2.00 + 1.5 \times (0.316 + 0.07) + 0.28 = 2.86^{m}$

$w = 0.45\ t/m \times \frac{1}{2.86} = 0.16\ t/m^2$

$wd = 0.16\ t/m^2 \times 1.93 \times 2 = 0.62\ t/m$

(c) Distributed load (c) of cross beam and haunche of Slab

Beam	$2.5\ t/m^3 \times 0.70 \times 0.82$	$= 1.44\ t/m$
Haunch	$2.5'' \times 0.45 \times 0.15 \times 1/2 \times 2$	$= 0.17''$
	wd	$= 1.61\ t/m$

(d) concentrated load of elements acting at joint P1. P2 as shown beam

joint P1. P2

1) Weight of elements on the slub except track weight

$(2.94 - 0.45\ ^{t/m}) \times (4.82 + 5.00) = 24.45^{t}$

2) Distribut load (A)

$1.78^{t/m^2} \times (2.32 + 4.82) \times 1/2 \times 2.50 = 15.89^{t}$

3) Distributed load (B)

$1.78^{t} \times (2.50 + 5.00) \times 1/2 \times 2.50 = 16.69^{t}$

4) Distributed load (C)

$0.16^{t} \times (2.89 + 4.82) \times 1/2 \times 1.93 = 1.19^{t}$

5) Distributed load (D)

$0.16^{t} \times (3.07 + 5.00) \times 1/2 \times 1.93 = 1.25^{t}$

6) Distributed load (E)

$0.16^{t} \times (4.82 + 5.00) \times 0.93 = 1.46^{t}$

7) Contilever slab

$2.5^{t/m^3} \times (0.20 + 0.43) \times 1/2 \times 2.10 \times 9.82 = 16.24^{t}$

8) Haunch of slab

$2.5^{t} \times 0.45 \times 0.15 \times 1/2 \times 8.22 = 0.69^{t}$

9) Longitudinal beam

$2.5^{t/m^3} \times 0.35 \times (1.20 + 0.92) \times 9.12 = 16.92^t$

10) Haunch of longitudinal beam

$2.5^t \times 1.20 \times 0.40 \times 1/2 \times 0.70 \times 2 = 0.84^t$

11) Subtraction from Distributed load

$-1.52^{t/m} \times 0.35 = -0.53^t$

12) Deficit of column weight

$-2.5^{t/m^3} \times 0.70 \times 0.70 \times (0.28 - 0.235) = -0.06^t$

$P_1 = P_2 = 95.03^t$

column weight

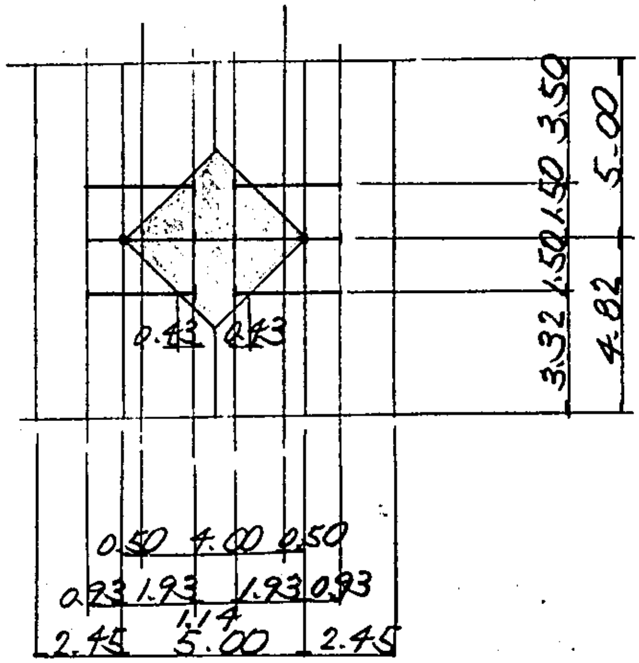
$g = 2.5^{t/m^3} \times 0.70 \times 0.70 = 1.23^{t/m}$

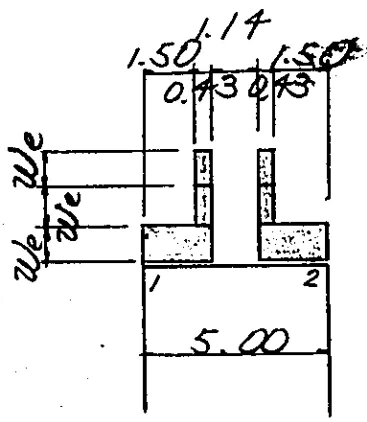
2. Train Load and Impact Load

(1) Train Load (Single track)

KS -16

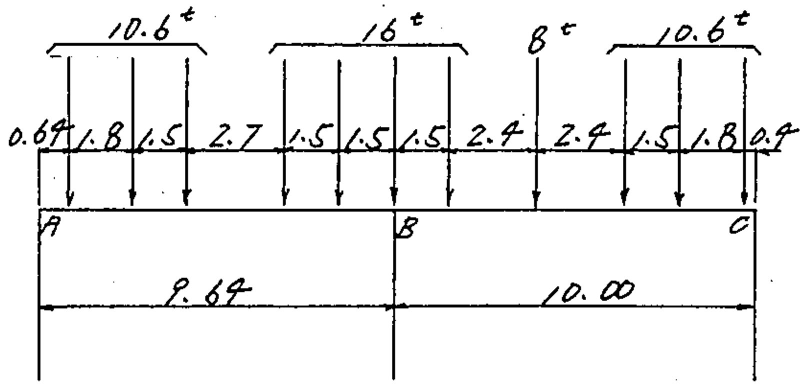
(a) Distributed load acting on rigid-frame





$w = \frac{16}{2.86} = 5.59\ ^{t}/_{m}$

(i) Concentrated load caused by axial load acting on longitudinal beam



$$RB = \frac{1}{9.64} \times \{10.6 \times (0.64 + 2.44 + 3.94) + 16 \times (6.64 + 8.14 + 9.64)\} + \frac{1}{10.00} \times \{10.6 \times (0.40 + 2.20 + 3.70) + 8 \times 6.10 + 16 \times 8.50\} = 73.41^t$$

$$P = 73.41^t - 5.59^{t/m} \times (0.43 \times 3 + 1.50) = 57.81^t$$

(2) Impact coefficient

(a) Within rigid frame section

$l_1 = 5.00^m \longrightarrow i_{01} = 0.480$

$l_2 = 9.73$ " $\longrightarrow i_{02} = 0.433$

For the case of double track reduction is made followed the formula

- Reduction of impact coefficient

$$i_1 = 0.480 \times \left(1 - \frac{5.00}{200}\right) = 0.468$$

$$i_2 = 0.433 \times \left(1 - \frac{9.73}{200}\right) = 0.412$$

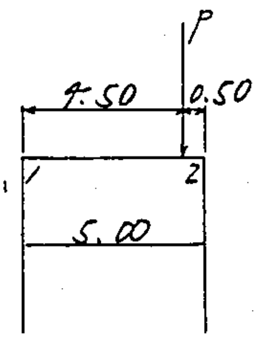
(3) Train Load + Impact

(a) Load acting on rigid frame

$$W_{e+i} = 5.59 \times (1 + 0.468) = 8.21 \ ^{t}/_{m}$$

$$P_{e+i} = 57.81 \times (1 + 0.412) = 81.63^{t}$$

- concentrated load caused by single track loading

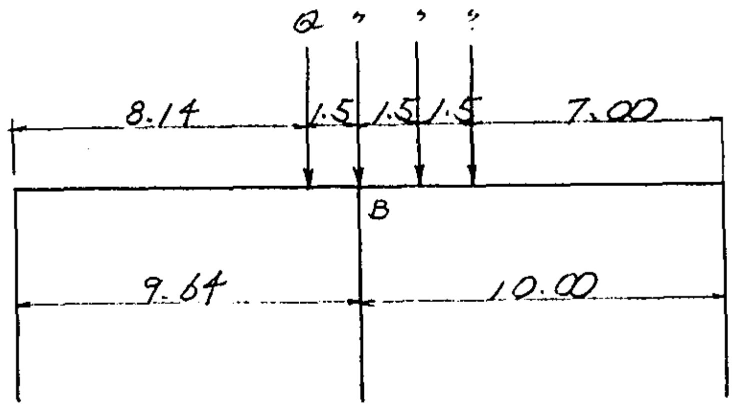


$$P_1 = \frac{1}{5.00} \times 0.50 \times 81.63 = 8.[illegible]$$

$$P_2 = \frac{1}{5.00} \times 4.50 \times 81.63 = 73.47^{t}$$

3. Train lateral load

$$Q = 16 \times 0.15 = 2.40^{t}$$



$$H = \frac{1}{9.64} \times 2.40 \times (8.14 + 9.64) + \frac{1}{10.00} \times 2.40 \times (7.00 + 8.50)$$

$$= 8.15^{t}$$

4. Forces of temperature change and/or Drying

· Temperature rise

+10°C

· Temperature drop + Drying contraction

−15°C

5. Dead load + Seismic force

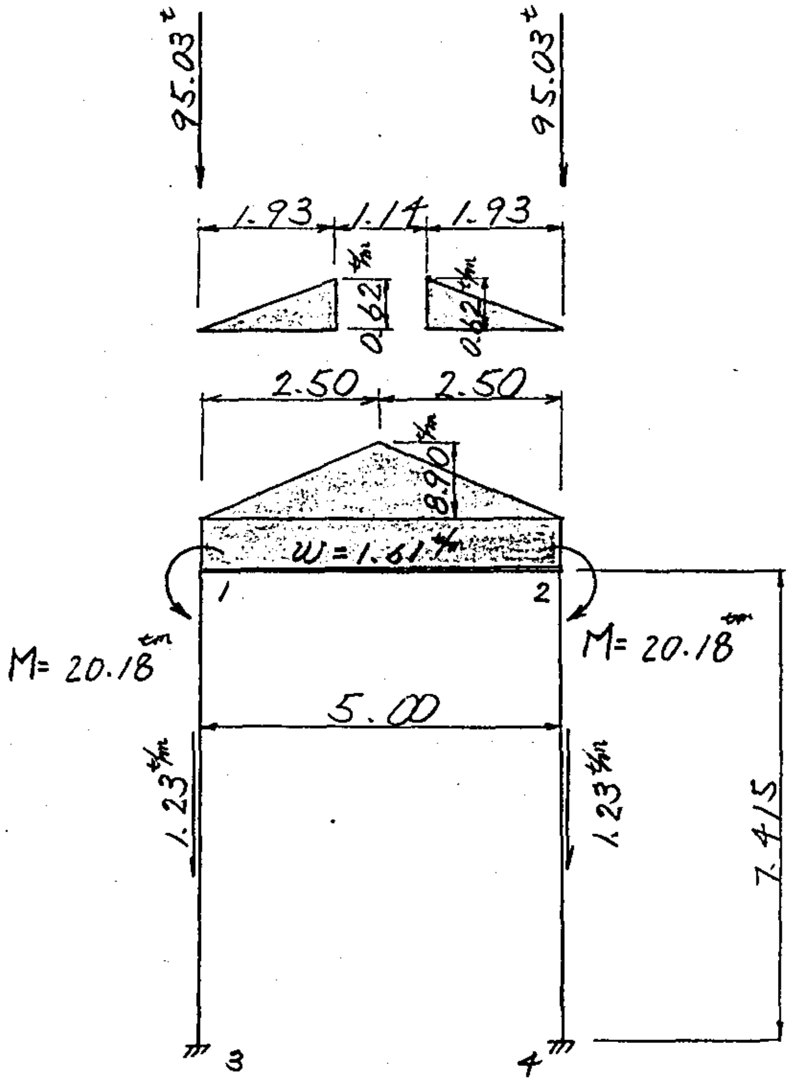
$K_h = 0.1$

$$H = \{1.61^{t/m} \times 5.00 + 5.00 \times 8.90^{t/m} \times 1/2 + 0.62^{t/m} \times 1.93 \times 1/2 \times 2 + 95.03^{t} \times 2 + 1.23^{t/m} \times 7.15 \times 1/2 \times 2\} \times 0.10$$

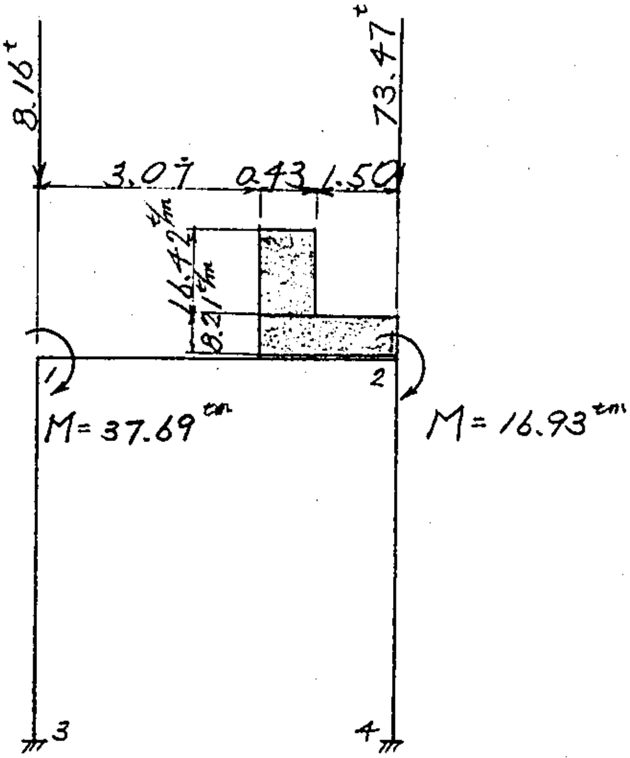
$$= 23.07^{t}$$

(3) Loading diagram

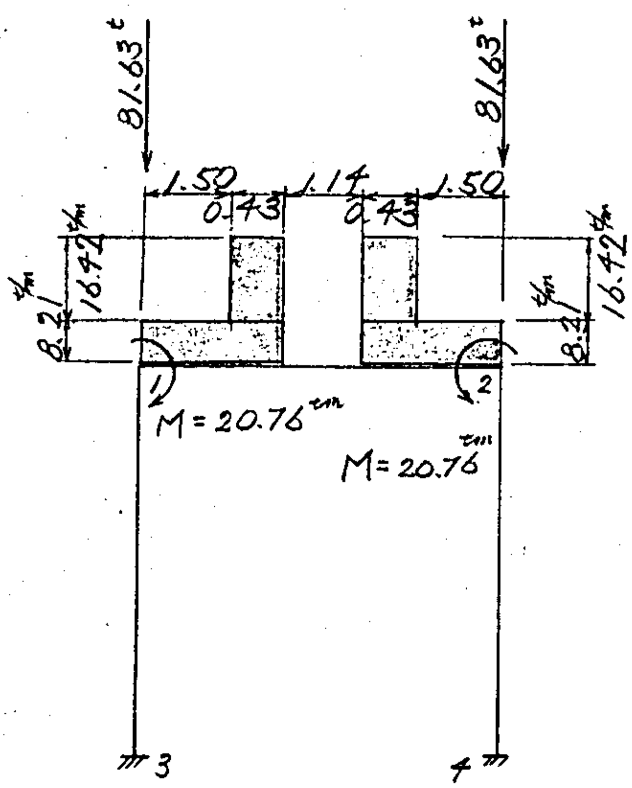
1. case 1 Dead load



2. case 2 Train load + Impact

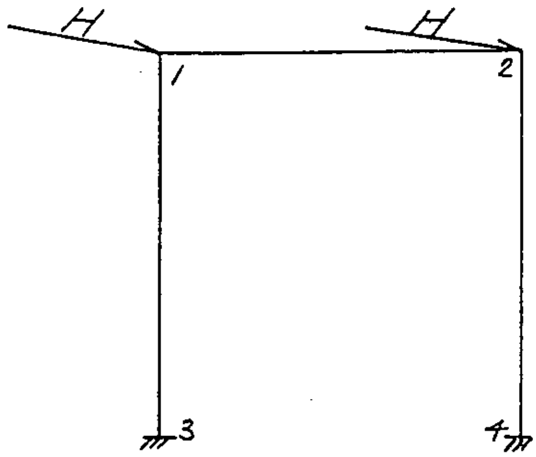


3. case 3 Train load + Impact

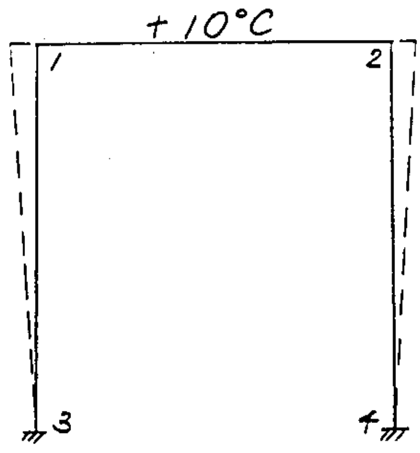


4. case 4 Train lateral load

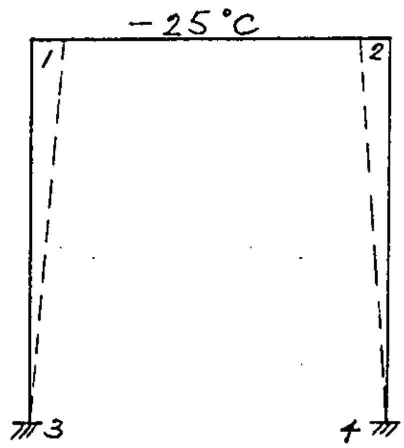
$$H = \frac{8.15}{2} = 4.08^{t}$$



5. case 5 Temperature

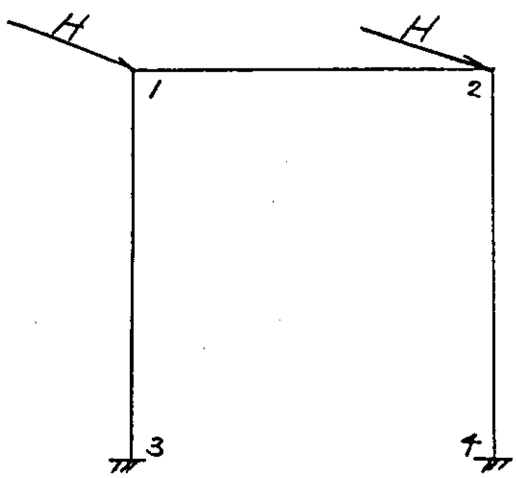


6. case 6 Temperature + Contraction



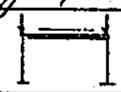
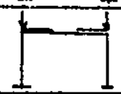
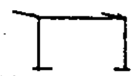
7. case 7 Seismic load

$$H = \frac{23.07}{2} = 11.54^{t}$$



(4) Combination of loads

1. Basic load

Case No.	Kind of load	Loading pattern
1	Dead load	
2	Train load + Impact	
3	Train load + Impact	
4	Train lateral load	
5	Temperature	+ 10°C
6	Temperature + contration	− 25°C
7	Seismic load	

2. Combined load

Case No.	Combination of loads	α
8	1	1.0000
9	1 + 2	〃
10	1 + 3	〃
11	1 + 2 + 4	0.8696
12	1 + 3 + 4	〃
13	1 + 2 − 4	〃
14	1 + 3 − 4	〃
15	1 + 5	〃
16	1 + 6	〃
17	1 + 7	0.6667
18	1 − 7	〃

3. Critical case

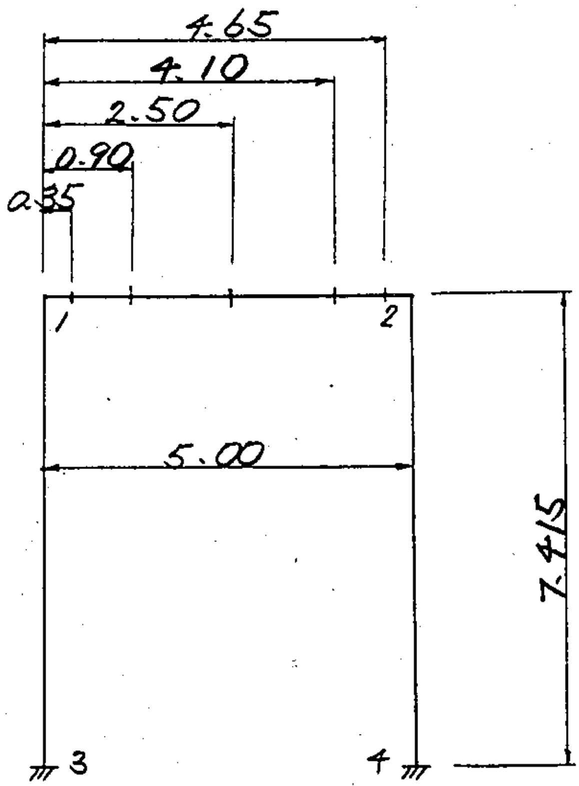
No. 1 case 8 crack

No. 2 case 9 ~ 18 synthetic

No. 3 case 9 ~ 14 footing

No. 4 case 17 ~ 18 〃

4. Points of computing Stresses

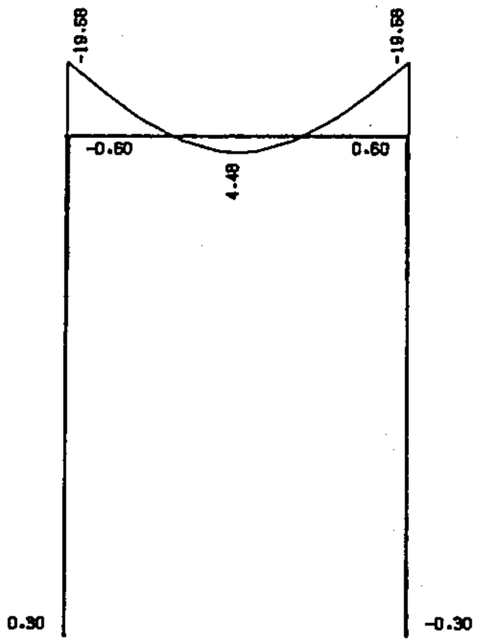


(5) stress diagram

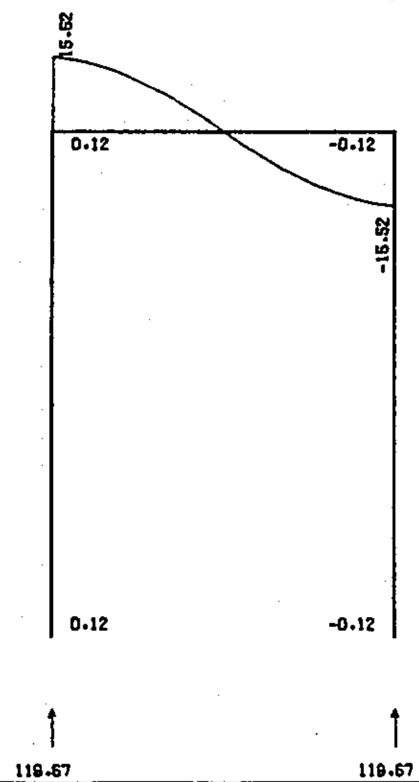
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) C2

CASE 1 (DEAD LOAD)

BENDING MOMENT



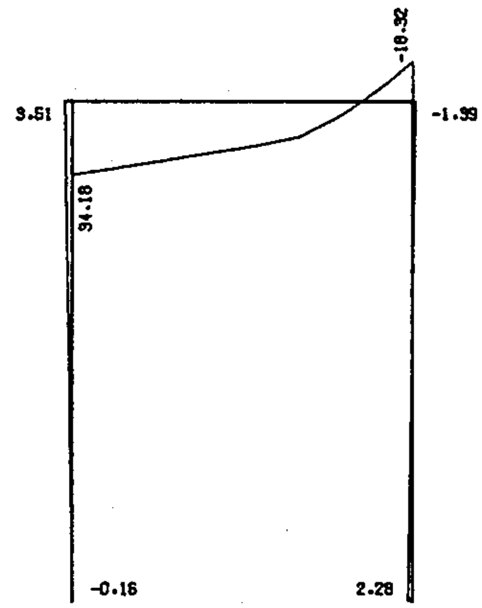
SHEARING FORCE



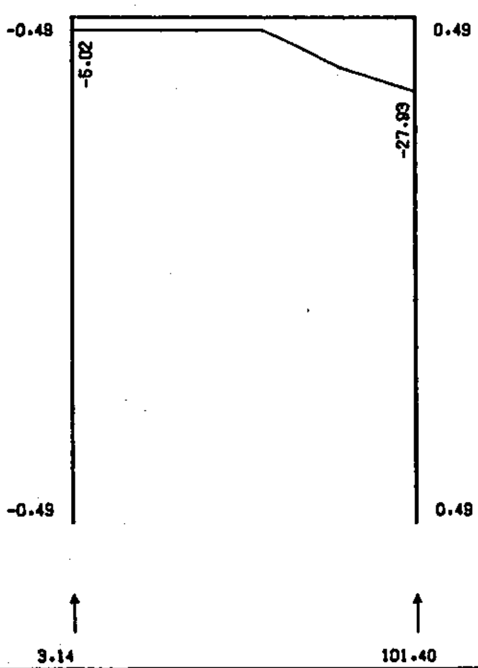
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) C2

CASE 2 (TRAIN LOAD + IMPACT 1)

BENDING MOMENT



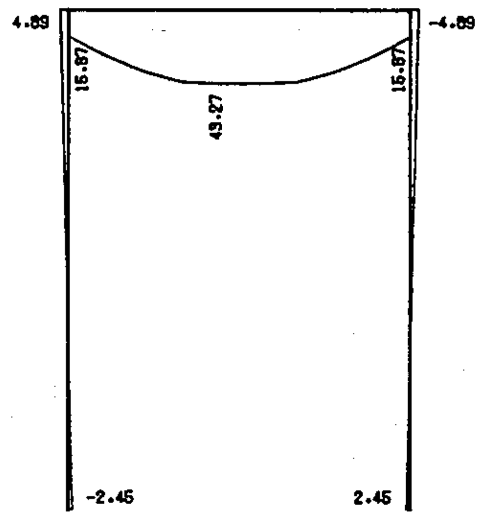
SHEARING FORCE



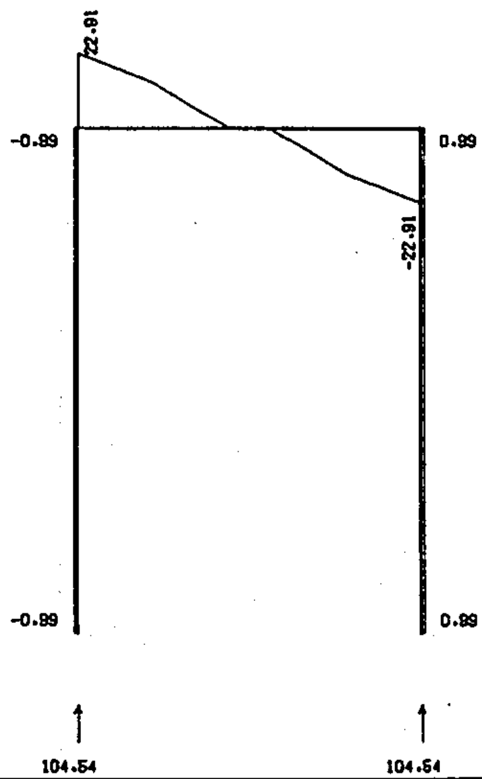
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) C2

CASE 3 (TRAIN LOAD + IMPACT 2)

BENDING MOMENT



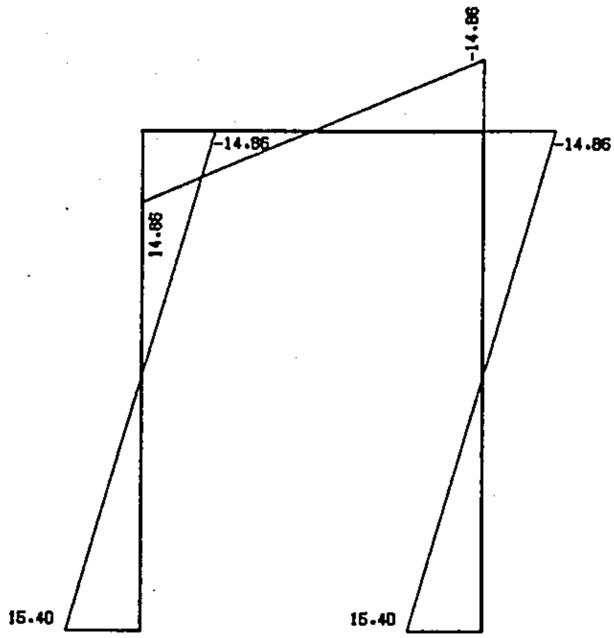
SHEARING FORCE



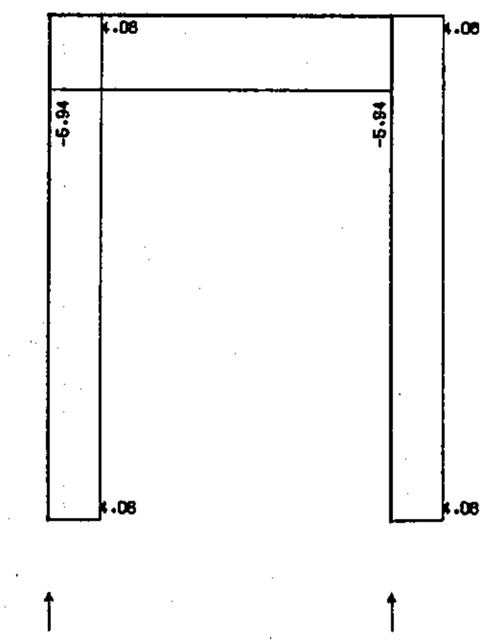
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) C2

CASE 4 (TRAIN LATERAL LOAD)

BENDING MOMENT



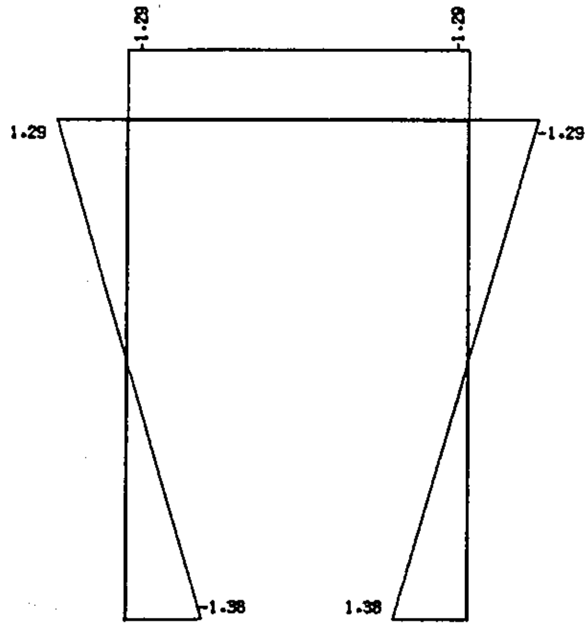
SHEARING FORCE



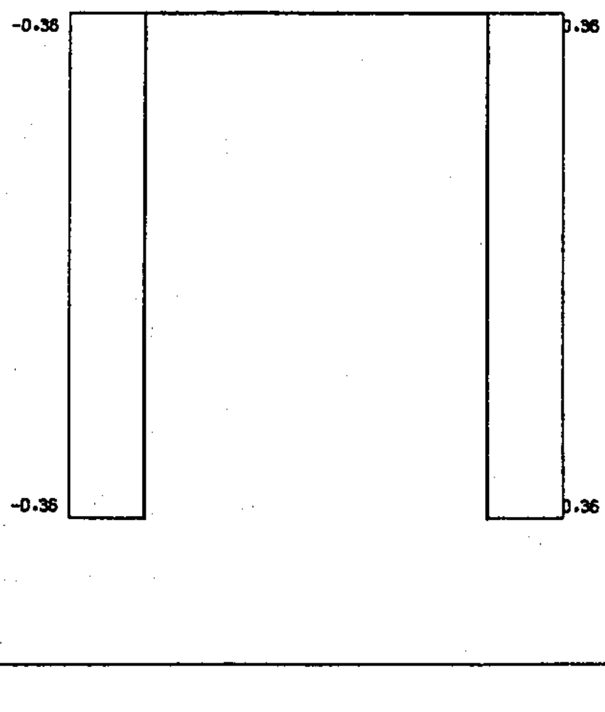
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) C2

CASE 5 (TEMPERATURE)

BENDING MOMENT



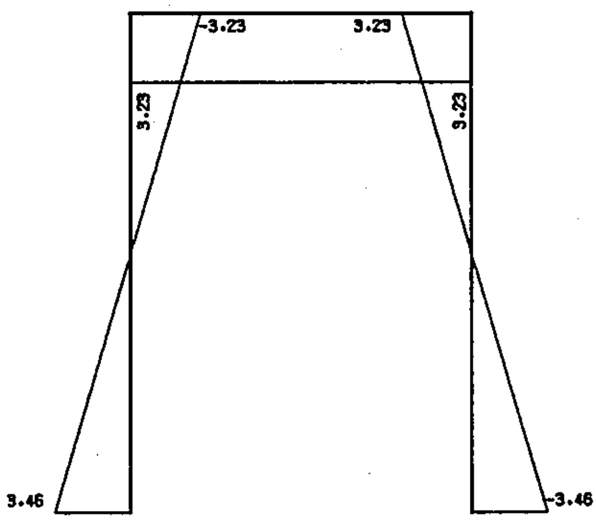
SHEARING FORCE



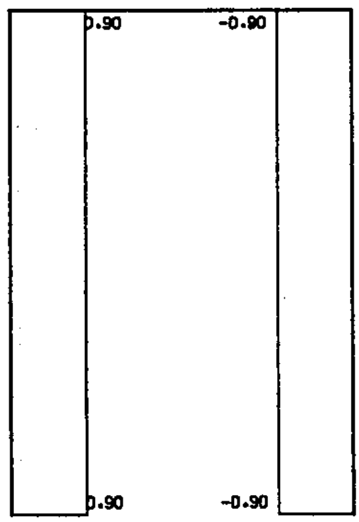
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) C2

CASE 6 (TEMPERATURE + CONTRACTION)

BENDING MOMENT



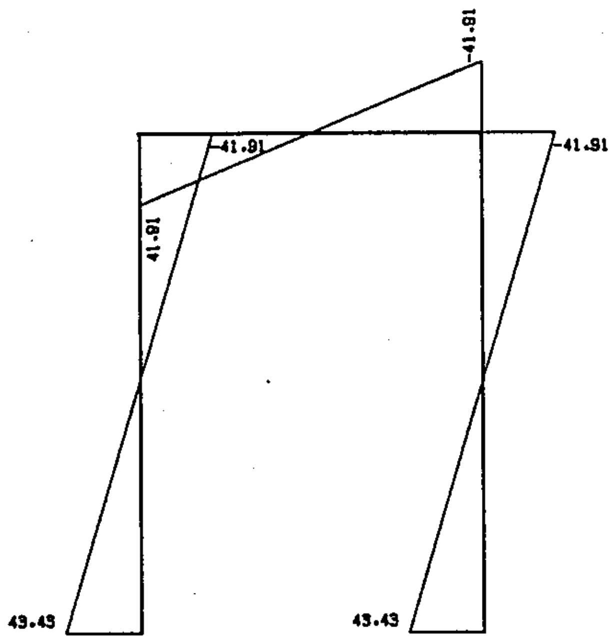
SHEARING FORCE



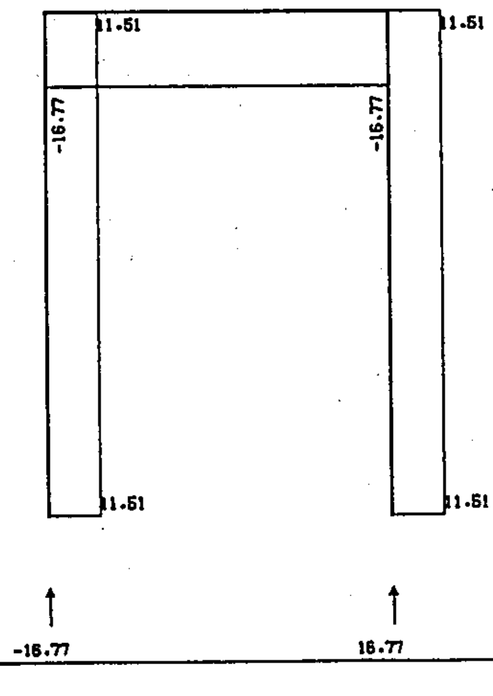
VIADUCT OF DOUBLE TRACK (3 * 10 = 30) C2

CASE 7 (SEISMIC LOAD)

BENDING MOMENT



SHEARING FORCE



T

INPUT DATA

```
=== INPUT DATA ===                                                                CRC-FANSY   V6.3

    5    10        20        30        40        50        60        70        80      CARD NUMBER
*****************************************************************************

TITLE                                                                                      1
PLOT          1      2                      6.0                                            2
TYPE1-1-1 L=5.0     H=7.415   M1=3.324,0.19377   M2-3=0.49,0.02001                          3
          P=2.7E+6,1.0E-5     S=0                                                          4
POINT    1 0.35       0.9       2.5       4.1       4.65                                   5
PICKUP       1    1    8                                                                   6
             2    1    9   18                                                              7
             3    1    9   14                                                              8
             4    1   17   18                                                              9
LOAD         10                                                                           10
J            1                 -95.03    20.18                                            11
             2                 -95.03   -20.18                                            12
D            1  3 2            -0.62     1.93                          1.14               13
                    -0.62                1.93                                             14
DL           1    2-8.9         2.5      2.5                                              15
             1    2-1.52                                                                  16
             2    2-1.23                                       3                          17
END                                                                                       18
LOAD         2RI  1                                                                       19
J            1                 -8.16    -37.69                                            20
             2                 -73.47   -16.93                                            21
L            1    2-16.42      -16.42    3.07       1.5                                   22
             1    2-8.21       -8.21     3.07                                             23
END                                                                                       24
LOAD         3RI  2                                                                       25
J            1                 -81.63   -20.76                                            26
             2                 -81.63    20.76                                            27
D            1  4 2                      1.5      -16.42    -16.42    0.43                28
                                         1.14     -16.42    -16.42    0.43                29
             1  3 2-8.21       -8.21     1.93                         1.14                30
                    -8.21      -8.21     1.93                                             31
END                                                                                       32
LOAD         4RS                                                                          33
J            1      4.08                                       2                          34
END                                                                                       35
LOAD         5TU                                                                          36
T            1      10.0                                                                  37
END                                                                                       38
LOAD         6TC                                                                          39
T            1     -25.0                                                                  40
END                                                                                       41
LOAD         7ED                                                                          42
J            1      11.51                                      2                          43
END                                                                                       44
MT2       8              1                                                                45
          9              1    2                                                           46
         10              1    3                                                           47
         110.8696        1    2    4                                                      48
         120.8696        1    3    4                                                      49
         130.8696        1    2   -4                                                      50
         140.8696        1    3   -4                                                      51
         150.8696        1    5                                                           52
         160.8696        1    6                                                           53
         170.6667        1    7                                                           54
         180.6667        1   -7                                                           55
FINISH                                                                                    56
```

No. 272

No. 273

CONTROL DATA

METHOD	STRUCTURE	J.RENUMBER	M.RENUMBER	S.F. DIS.	UNI.SPRING	STAN.STIF.	BARA	SKEW MEM.
DIS	*RAHMEN*	*OFF*	*OFF*	*OFF*	*OFF*	*OFF*	*OFF*	*OFF*

LOAD TITLE

LOAD 1	CASE 1	LOAD 2	CASE 2
LOAD 3	CASE 3	LOAD 4	CASE 4
LOAD 5	CASE 5	LOAD 6	CASE 6
LOAD 7	CASE 7		
MIX 8	CASE 8 (1.0000 * 1)	MIX 9	CASE 9 (1+2)
MIX 10	CASE 10 (1+3)	MIX 11	CASE 11 (1+2+4)
MIX 12	CASE 12 (1+3+4)	MIX 13	CASE 13 (1+2-4)
MIX 14	CASE 14 (1+3-4)	MIX 15	CASE 15 (1+5)
MIX 16	CASE 16 (1+6)	MIX 17	CASE 17 (1+7)
MIX 18	CASE 18 (1-7)		

PICK UP LOAD CASE

PICK 1	8									
PICK 2	9	10	11	12	13	14	15	16	17	18
PICK 3	9	10	11	12	13	14				
PICK 4	17	18								

No. 274

JOINT DATA

JOINT NUMBER 4

JOINT	X	Y
1	0.0000	7.4150
2	5.0000	7.4150
3	0.0000	0.0000
4	5.0000	0.0000

MEMBER DATA

MEMBER NUMBER 3

MEMBER	ITAN	JTAN	CONNECT. ITAN	JTAN	LENGTH	A	I	PRO.NUM
1	1	2	FIX	FIX	5.0000	3.32400	.1937700	1
2	1	3	FIX	FIX	7.4150	.49000	.0200100	1
3	2	4	FIX	FIX	7.4150	.49000	.0200100	1

PROPERTY DATA

PROPERTY NUMBER 1

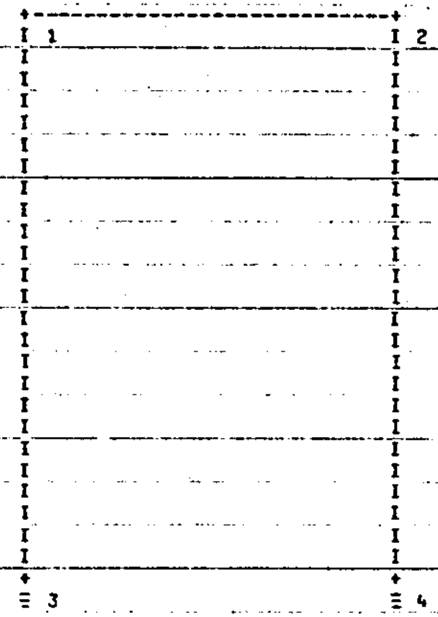
PROPERTY	E	G	EPS
1	2.700E+06	0.	1.000E-05

SUPPORT DATA

SUPPORT NUMBER 2

SUPPORT	X	Y	THET Z
3	FIX	FIX	FIX
4	FIX	FIX	FIX

STRUCTURAL FIGURE



No. 275

MOVE DATA

MEMBER	GOIKI ITAN	GOIKI JTAN	POINT 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	......	......	.350	.900	2.500	4.100	4.650									
2	......	......														
3	......	......														

No. 276

MIX DATA

MIX NUMBER 11

LOAD	SS	N	S1	K1	S2	K2	S3	K3	S4	K4	S5	K5	S6	K6	S7	K7	S6	K8
8	1.0000	1	1.0000	1														
9	1.0000	2	1.0000	1	1.0000	2												
10	1.0000	2	1.0000	1	1.0000	3												
11	.8696	3	1.0000	1	1.0000	2	1.0000	4										
12	.8696	3	1.0000	1	1.0000	3	1.0000	4										
13	.8696	3	1.0000	1	1.0000	2	-1.0000	4										
14	.8696	3	1.0000	1	1.0000	3	-1.0000	4										
15	.8696	2	1.0000	1	1.0000	5												
16	.8696	2	1.0000	1	1.0000	6												
17	.6667	2	1.0000	1	1.0000	7												
18	.6667	2	1.0000	1	-1.0000	7												

No. 277

PICK UP

CRC-FANSY V6.3

No.278

PICK UP 1

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(8)	-19.584	15.523	.121
1	.350	(8)	-14.272	14.754	.121
2	.900	(8)	-6.700	12.583	.121
3	2.500	(8)	4.478	.000	.121
4	4.100	(8)	-6.700	-12.583	.121
5	4.650	(8)	-14.272	-14.754	.121
JTAN	5.000	(8)	-19.584	-15.523	.121
MAX	2.500	(8)	4.478	.000	.121
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(8)	-.596	.121	-110.553
JTAN	7.415	(8)	.298	.121	-119.674
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(8)	.596	-.121	-110.553
JTAN	7.415	(8)	-.298	-.121	-119.674

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(8)	-19.584	15.523	.121
1	.350	(8)	-14.272	14.754	.121
2	.900	(8)	-6.700	12.583	.121
3	2.500	(8)	4.478	.000	.121
4	4.100	(8)	-6.700	-12.583	.121
5	4.650	(8)	-14.272	-14.754	.121
JTAN	5.000	(8)	-19.584	-15.523	.121
MAX	2.500	(8)	4.478	.000	.121
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(8)	-.596	.121	-110.553
JTAN	7.415	(8)	.298	.121	-119.674
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(8)	.596	-.121	-110.553
JTAN	7.415	(8)	-.298	-.121	-119.674

PICK UP 1

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(8)	-19.584	15.523	.121
1	.350	(8)	-14.272	14.754	.121
2	.900	(8)	-6.700	12.583	.121
3	2.500	(8)	4.478	.000	.121
4	4.100	(8)	-6.700	-12.583	.121
5	4.650	(8)	-14.272	-14.754	.121
JTAN	5.000	(8)	-19.584	-15.523	.121
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(8)	-.596	.121	-110.553
JTAN	7.415	(8)	.298	.121	-119.674
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(8)	.596	-.121	-110.553
JTAN	7.415	(8)	-.298	-.121	-119.674

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(8)	-19.584	15.523	.121
1	.350	(8)	-14.272	14.754	.121
2	.900	(8)	-6.700	12.583	.121
3	2.500	(8)	4.478	.000	.121
4	4.100	(8)	-6.700	-12.583	.121
5	4.650	(8)	-14.272	-14.754	.121
JTAN	5.000	(8)	-19.584	-15.523	.121
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(8)	-.596	.121	-110.553
JTAN	7.415	(8)	.298	.121	-119.674
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(8)	.596	-.121	-110.553
JTAN	7.415	(8)	-.298	-.121	-119.674

No.279

No. 230

PICK UP 1

AXIAL MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(8)	-19.584	15.523	.121
1	.350	(8)	-14.272	14.754	.121
2	.900	(8)	-6.700	12.583	.121
3	2.500	(8)	4.478	.000	.121
4	4.100	(8)	-6.700	-12.583	.121
5	4.650	(8)	-14.272	-14.754	.121
JTAN	5.000	(8)	-19.584	-15.523	.121
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(8)	-.596	.121	-110.553
JTAN	7.415	(8)	.298	.121	-119.674
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(8)	.596	-.121	-110.553
JTAN	7.415	(8)	-.298	-.121	-119.674

AXIAL MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(8)	-19.584	15.523	.121
1	.350	(8)	-14.272	14.754	.121
2	.900	(8)	-6.700	12.583	.121
3	2.500	(8)	4.478	.000	.121
4	4.100	(8)	-6.700	-12.583	.121
5	4.650	(8)	-14.272	-14.754	.121
JTAN	5.000	(8)	-19.584	-15.523	.121
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(8)	-.596	.121	-110.553
JTAN	7.415	(8)	.298	.121	-119.674
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(8)	.596	-.121	-110.553
JTAN	7.415	(8)	-.298	-.121	-119.674

PICK UP 2

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(11)	25.616	3.965	-.326
1	.350	(11)	26.898	3.296	-.326
2	.900	(12)	31.275	19.268	-.756
3	2.500	(10)	47.743	.000	-.869
4	4.100	(14)	31.275	-19.268	-.756
5	4.650	(14)	19.032	-25.082	-.756
JTAN	5.000	(18)	14.887	.828	.080
MAX	2.500	(10)	47.743	.000	-.869
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(18)	27.546	-7.593	-84.883
JTAN	7.415	(17)	29.156	7.754	-68.609
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(18)	28.341	-7.754	-62.529
JTAN	7.415	(17)	28.759	7.593	-90.964

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(18)	-41.000	21.527	.080
1	.350	(18)	-33.546	21.614	.080
2	.900	(18)	-22.351	19.567	.080
3	2.500	(15)	2.769	-.000	-.209
4	4.100	(17)	-22.351	-19.567	.080
5	4.650	(17)	-33.546	-21.014	.080
JTAN	5.000	(11)	-45.879	-42.952	-.326
MAX	2.500	(15)	2.769	-.000	-.209
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(17)	-26.341	7.754	-62.529
JTAN	7.415	(18)	-26.759	-7.593	-90.964
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(17)	-27.546	7.593	-84.883
JTAN	7.415	(18)	-29.156	-7.754	-68.609

No. 281

PICK UP 2

	SHEAR MAXIMUM						SHEAR MINIMUM				
	L	CASE	M	Q	N		L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =						= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(14)	-16.153	38.586	-.756	ITAN	0.000	(17)	14.887	-.828	.080
1	.350	(14)	-3.190	35.418	-.756	1	.350	(17)	14.516	-1.341	.080
2	.900	(14)	14.737	29.604	-.756	2	.900	(17)	13.417	-2.786	.080
3	2.500	(18)	2.985	11.177	.080	3	2.500	(17)	2.985	-11.177	.080
4	4.100	(18)	13.417	2.788	.080	4	4.100	(11)	-11.060	-33.970	-.326
5	4.650	(18)	14.516	1.341	.080	5	4.650	(9)	-23.318	-39.806	-.374
JTAN	5.000	(18)	14.887	.828	.080	JTAN	5.000	(9)	-37.902	-43.456	-.374
= = MEMBER 2 (1 - 3) C = =						= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(17)	-28.341	7.754	-62.529	ITAN	0.000	(18)	27.546	-7.593	-84.883
JTAN	7.415	(17)	29.156	7.754	-68.609	JTAN	7.415	(18)	-28.759	-7.593	-90.964
= = MEMBER 3 (2 - 4) C = =						= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(17)	-27.546	7.593	-84.883	ITAN	0.000	(18)	28.341	-7.754	-62.529
JTAN	7.415	(17)	28.759	7.593	-90.964	JTAN	7.415	(18)	-29.156	-7.754	-68.609

No 282

PICK UP 2

	AXIAL MAXIMUM						AXIAL MINIMUM				
	L	CASE	M	Q	N		L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =						= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(16)	-14.219	13.499	.890	ITAN	0.000	(10)	-3.718	38.429	-.869
1	.350	(16)	-9.599	12.830	.890	1	.350	(10)	9.108	34.786	-.869
2	.900	(16)	-3.015	10.943	.890	2	.900	(10)	26.456	28.100	-.869
3	2.500	(16)	6.705	.000	.890	3	2.500	(10)	47.743	.006	-.869
4	4.100	(16)	-3.015	-10.943	.890	4	4.100	(10)	26.456	-28.100	-.869
5	4.650	(16)	-9.599	-12.830	.890	5	4.650	(10)	9.108	-34.786	-.869
JTAN	5.000	(16)	-14.219	-13.499	.890	JTAN	5.000	(10)	-3.718	-38.429	-.869
= = MEMBER 2 (1 - 3) C = =						= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(17)	-28.341	7.754	-62.529	ITAN	0.000	(10)	4.296	-.869	-215.089
JTAN	7.415	(17)	29.156	7.754	-68.609	JTAN	7.415	(10)	-2.148	-.869	-224.210
= = MEMBER 3 (2 - 4) C = =						= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(18)	28.341	-7.754	-62.529	ITAN	0.000	(10)	-4.298	.869	-215.089
JTAN	7.415	(18)	-29.156	-7.754	-68.609	JTAN	7.415	(10)	2.148	.869	-224.210

No.283

PICK UP 3

MOMENT MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(11)	25.616	3.965	-.326
1	.350	(11)	26.898	3.296	-.326
2	.900	(12)	31.275	19.268	-.756
3	2.500	(10)	47.743	.000	-.869
4	4.100	(14)	31.275	-19.268	-.756
5	4.650	(14)	19.032	-25.082	-.756
JTAN	5.000	(14)	9.686	-28.250	-.756
MAX	2.500	(10)	47.743	.000	-.869
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(14)	16.658	-4.304	-192.209
JTAN	7.415	(11)	13.505	3.222	-101.631
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(13)	12.231	-3.222	-179.143
JTAN	7.415	(12)	15.257	4.304	-200.141

MOMENT MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(14)	-16.153	38.586	-.756
1	.350	(14)	-3.190	35.418	-.756
2	.900	(13)	11.702	11.745	-.326
3	2.500	(11)	22.705	-9.534	-.326
4	4.100	(11)	-11.060	-33.970	-.326
5	4.650	(11)	-31.388	-39.783	-.326
JTAN	5.000	(11)	-45.879	-42.952	-.326
MAX	2.500	(11)	22.705	-3.534	-.326
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(11)	-10.389	3.222	-93.700
JTAN	7.415	(14)	-15.257	-4.304	-200.141
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(12)	-16.658	4.304	-192.209
JTAN	7.415	(13)	-11.663	-3.222	-187.075

No.284

PICK UP 3

SHEAR MAXIMUM

	-----L---	-CASE-	-----M---	-----Q---	-----N---
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(14)	-16.153	38.586	-.756
1	.350	(14)	-3.190	35.418	-.756
2	.900	(14)	14.737	29.604	-.756
3	2.500	(14)	41.517	5.168	-.756
4	4.100	(14)	31.275	-19.268	-.756
5	4.650	(14)	19.032	-25.082	-.756
JTAN	5.000	(14)	9.686	-28.250	-.756
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(11)	-10.389	3.222	-93.700
JTAN	7.415	(11)	13.505	3.222	-101.631
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(12)	-16.658	4.304	-192.209
JTAN	7.415	(12)	15.257	4.304	-200.141

SHEAR MINIMUM

	-----L---	-CASE-	-----M---	-----Q---	-----N---
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(11)	25.616	3.965	-.326
1	.350	(11)	26.898	3.296	-.326
2	.900	(11)	28.239	1.409	-.326
3	2.500	(11)	22.705	-9.534	-.326
4	4.100	(11)	-11.060	-33.970	-.326
5	4.650	(9)	-23.318	-39.806	-.374
JTAN	5.000	(9)	-37.902	-43.450	-.374
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(14)	16.658	-4.304	-192.209
JTAN	7.415	(14)	-15.257	-4.304	-200.141
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(13)	12.231	-3.222	-179.143
JTAN	7.415	(13)	-11.663	-3.222	-167.075

No. 285

PICK UP 3

	AXIAL MAXIMUM					AXIAL MINIMUM				
	L	CASE	M	Q	N	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =										
ITAN	0.000	(11)	25.616	3.965	-.326	0.000	(10)	-3.718	38.429	-.869
1	.350	(11)	26.898	3.296	-.326	.350	(10)	9.108	34.786	-.869
2	.900	(11)	28.239	1.409	-.326	.900	(10)	26.456	28.100	-.869
3	2.500	(11)	22.705	-9.534	-.326	2.500	(10)	47.743	.000	-.869
4	4.100	(11)	-11.060	-33.970	-.326	4.100	(10)	26.456	-28.100	-.869
5	4.650	(11)	-31.388	-39.783	-.326	4.650	(10)	9.108	-34.786	-.869
JTAN	5.000	(11)	-45.879	-42.952	-.326	5.000	(10)	-3.716	-38.429	-.869
= = MEMBER 2 (1 - 3) C = =										
ITAN	0.000	(11)	-10.389	3.222	-93.700	0.000	(10)	4.296	-.869	-215.089
JTAN	7.415	(11)	13.505	3.222	-101.631	7.415	(10)	-2.148	-.869	-224.210
= = MEMBER 3 (2 - 4) C = =										
ITAN	0.000	(13)	12.231	-3.222	-179.143	0.000	(10)	-4.298	.869	-215.089
JTAN	7.415	(13)	-11.663	-3.222	-187.075	7.415	(10)	2.148	.869	-224.210

No.286

PICK UP 4

	MOMENT MAXIMUM						MOMENT MINIMUM				
	L	CASE	M	Q	N		L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =						= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(17)	14.887	-.828	.080	ITAN	0.000	(18)	-41.000	21.527	.080
1	.350	(17)	14.516	-1.341	.080	1	.350	(18)	-33.546	21.014	.080
2	.900	(17)	13.417	-2.788	.080	2	.900	(18)	-22.351	19.567	.080
3	2.500	(18)	2.985	11.177	.080	3	2.500	(17)	2.985	-11.177	.080
4	4.100	(18)	13.417	2.788	.080	4	4.100	(17)	-22.351	-19.567	.080
5	4.650	(18)	14.516	1.341	.080	5	4.650	(17)	-33.546	-21.014	.080
JTAN	5.000	(18)	14.887	.828	.080	JTAN	5.000	(17)	-41.000	-21.527	.080
MAX	2.500	(18)	2.985	11.177	.080	MAX	2.500	(17)	2.985	-11.177	.080
= = MEMBER 2 (1 - 3) C = =						= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(18)	27.546	-7.593	-84.883	ITAN	0.000	(17)	-28.341	7.754	-62.529
JTAN	7.415	(17)	29.156	7.754	-68.609	JTAN	7.415	(18)	-28.759	-7.593	-90.964
= = MEMBER 3 (2 - 4) C = =						= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(18)	28.341	-7.754	-62.529	ITAN	0.000	(17)	-27.546	7.593	-84.883
JTAN	7.415	(17)	28.759	7.593	-90.964	JTAN	7.415	(18)	-29.156	-7.754	-68.609

No. 287

PICK UP 4

SHEAR MAXIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(18)	-41.000	21.527	.080
1	.350	(18)	-33.546	21.014	.080
2	.900	(18)	-22.351	19.567	.080
3	2.500	(18)	2.985	11.177	.080
4	4.100	(18)	13.417	2.788	.080
5	4.650	(18)	14.516	1.341	.080
JTAN	5.000	(18)	14.887	.828	.080
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(17)	-28.341	7.754	-62.529
JTAN	7.415	(17)	29.156	7.754	-68.609
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(17)	-27.546	7.593	-84.883
JTAN	7.415	(17)	28.759	7.593	-90.964

SHEAR MINIMUM

	L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(17)	14.887	-.828	.080
1	.350	(17)	14.516	-1.341	.080
2	.900	(17)	13.417	-2.788	.080
3	2.500	(17)	2.985	-11.177	.080
4	4.100	(17)	-22.351	-19.567	.080
5	4.650	(17)	-33.546	-21.014	.080
JTAN	5.000	(17)	-41.000	-21.527	.080
= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(18)	27.546	-7.593	-84.883
JTAN	7.415	(18)	-28.759	-7.593	-90.964
= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(18)	28.341	-7.754	-62.529
JTAN	7.415	(18)	-29.156	-7.754	-68.609

No. 288

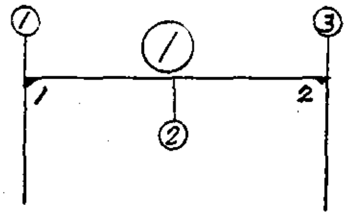
PICK UP 4

AXIAL MAXIMUM						AXIAL MINIMUM					
	L	CASE	M	Q	N		L	CASE	M	Q	N
= = MEMBER 1 (1 - 2) G = =						= = MEMBER 1 (1 - 2) G = =					
ITAN	0.000	(17)	14.887	-.828	.080	ITAN	0.000	(18)	-41.000	21.527	.080
1	.350	(17)	14.516	-1.341	.080	1	.350	(18)	-33.546	21.014	.080
2	.900	(17)	13.417	-2.788	.080	2	.900	(18)	-22.351	19.567	.080
3	2.500	(17)	2.985	-11.177	.080	3	2.500	(18)	2.985	11.177	.080
4	4.100	(17)	-22.351	-19.567	.080	4	4.100	(18)	13.417	2.788	.080
5	4.650	(17)	-33.546	-21.014	.080	5	4.650	(18)	14.516	1.341	.080
JTAN	5.000	(17)	-41.000	-21.527	.080	JTAN	5.000	(18)	14.887	.828	.080
= = MEMBER 2 (1 - 3) C = =						= = MEMBER 2 (1 - 3) C = =					
ITAN	0.000	(17)	-28.341	7.754	-62.529	ITAN	0.000	(18)	27.546	-7.593	-84.883
JTAN	7.415	(17)	29.156	7.754	-68.609	JTAN	7.415	(18)	-28.759	-7.593	-90.964
= = MEMBER 3 (2 - 4) C = =						= = MEMBER 3 (2 - 4) C = =					
ITAN	0.000	(18)	28.341	-7.754	-62.529	ITAN	0.000	(17)	-27.546	7.593	-84.883
JTAN	7.415	(18)	-29.156	-7.754	-68.609	JTAN	7.415	(17)	28.759	7.593	-90.964

No.289

(b). Calculation of upper beam

1. Stress calculation of upper beam



(a) Summary of stresses

(i) At the support point

Pick up No 2

		⓵			
		①	CO.	③	CO.
Combined Stress	Top	-41.00	18	-45.88	11
	Bottom	26.90	11	19.03	14
Dead load		-19.58	8	-19.58	8

(ii) Span momet

		⓵	
		②	CO.
Combined Stress	Bottom	42.74	10
Dead load	Bottom	4.48	8

(Note 1) Dead load is of Pick-up No. 1

(Note 2) CO. — combination

(b) Allowable stress for upper beam, safe against cracking

(i) At the support point 2

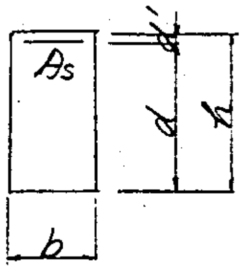
Dead load	M_d	$= -19.58^{tm}$ (case 1)
Train load + Impact	M_{T+I}	$= -18.32^{tm}$ (case 2)
	ΣM	$= -37.90^{tm}$

$$\alpha = \frac{-18.32}{-37.90} = 0.48 > 0.25$$

Hence $\sigma_{sa} = 1000\ kg/cm^2$

(C) Cross section used for stress calculation

(i) Cross section at the support point



$b = 70^{cm}$

$h = 110$ "

$d' = 2.5 + 1.9 + 3.2 + 1.5 = 9.1^{cm}$

$d = 110 - 9.1 = 100.9^{cm}$

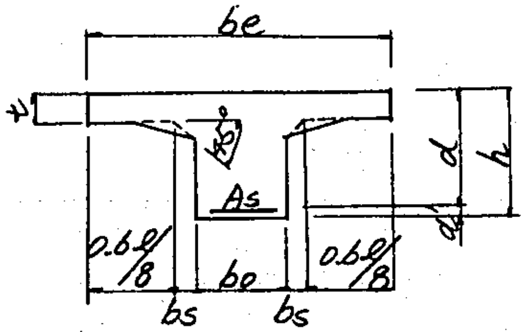
Cross section at the span center point

(ii) Effective width of T-beam at compression fibre

$$be = b_o + 2\left(bs + \frac{0.6}{8} \cdot l\right)$$

$$be_1 = 0.70 + 2 \times \left(0.15 + \frac{0.60}{8} \times 5.00\right)$$

$$= 1.75^{m}$$



$b_o = 70^{cm}$

$h = 110$ "

$d' = 3.0 + 1.3 + 1.5 ~~+ 1.6~~ = 5.8^{cm}$

$d = 110 - 5.8 = 104.2^{cm}$

$t = 28^{cm}$

(d) Calculation of bending stress

	③		②	
M (tm)	19.58	45.88	47.74	
N (t)				
S (t)				
b (cm)	70		175	
h (cm)	110		110	
d (cm)	100.9		104.2	
d' (cm)	9.1		5.8	
As (cm²)	D29-6 = 38.54		D29-7 44.97	
p	0.00546		0.00247	
As' (cm²)			t = 28 t/d = 0.269	
p'				
e = M/N (cm)				
e = M/N + u (cm)				
e = M/N − u (cm)				
e/h				
d/e				
d'/h				
d'/d				
~~N~~M/bd² (kg/cm²)	2.74	6.44	2.51	
k				
c				
j				
1/Lc	6.79		414	
1/Ls	206		440	
β = σs/σc				
σc (kg/cm²)		43.7	23.0	
σs (kg/cm²)	570	1330	1110	
τ (kg/cm²)				
σsa (kg/cm²)	1000	1800	1800	
σca (kg/cm²)		90	90	
τa (kg/cm²)				
Nomogram number	M-1	M-1	M-47.48	
Combination	D	D+T+I	D+T+I	

(e) Required minimum cross section of re-bars

(i) At the top of support point

$$As = \frac{M}{\sigma_{sa} \cdot j \cdot d} \times \frac{4}{3}$$

$$= \frac{45.88 \times 10^5}{1800 \times 0.875 \times 100.9} \times \frac{4}{3} = 38.49^{cm^2}$$

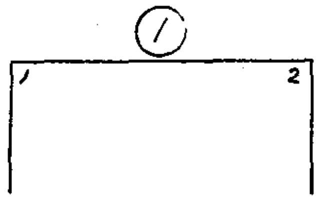
Hence $D29 - 6 = 38.54^{cm^2} > 38.49^{cm^2}$

(ii) At the span center point

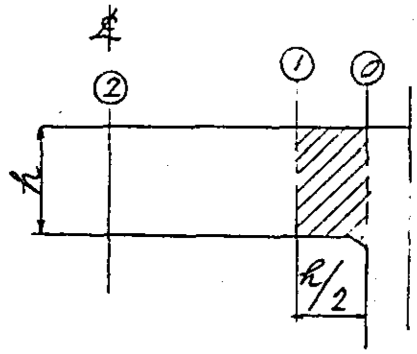
$$As = \frac{47.74 \times 10^5}{1800 \times 0.875 \times 104.2} \times \frac{4}{3} = 38.79^{cm^2}$$

Hence $D29 - 7 = 44.97^{cm^2} > 38.79^{cm^2}$

2. Shearing stress of upper beam



(1) Summary of shearing stress



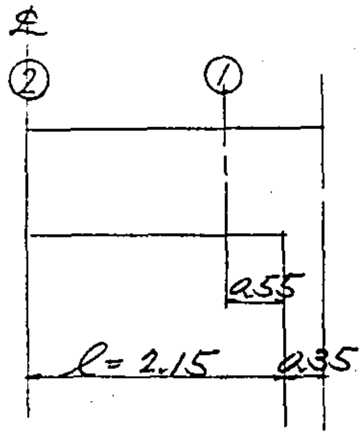
For the design of cross section of beam end, the value of shearing stress at h/2 point is applied.

	①			
	Left support	CO.	Right support	CO.
⓪	35.42	14	-39.78	11
①	29.60		-33.97	
②	5.17		-9.53	

(Note) CO. — combination

(2) Shearing stress

(a) Shearing stress caused by bending



(i) Shearing stress of the member of uniform height

$$\tau = \frac{S}{b \cdot d}$$

$$\tau_1 = \frac{33.97 \times 10^3}{70 \times 100.9} = 4.81 \,kg/cm^2 > 3.9 \,kg/cm^2$$

$$\tau_2 = \frac{9.53 \times 10^3}{70 \times 100.9} = 1.35 \,\text{"} < \text{"}$$

· Torsional moment

Torsional moment is disregarded, because that is acting symmetrically

Therefore, stirrup calculation is made.

(b) Calculation of diagonal tension bar

i) Calculation of total shear

Referr R.C. standard 39, (2), (a).

$$\Sigma S_R = S_c + S_u + S_b$$

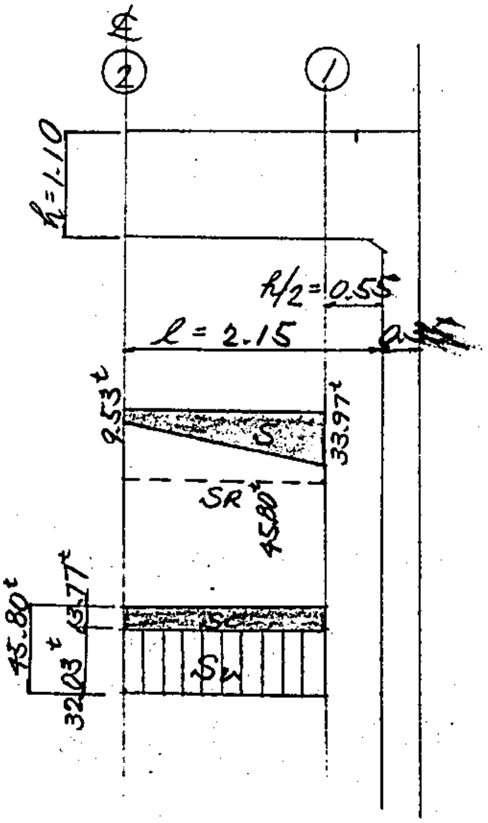
where

S_c : shearing stress beared by concrete (t)

S_v : Shearing stress beared by stirrup (t)

S_b : Shearing stress beared by turned up bars (t)

Assumed $S_v \geqq S_b$



Shearing force diagram

Resisting shearing force diagram

(i) Shearing stress beared by concrete

$$S_c = 1/2 \cdot \tau_c \cdot b \cdot d$$

Where, τ_c : $3.9^{kg/cm^2}$

b : Width of member (cm)

d : Effective height of member at the examining section.

$$S_{c1} = 1/2 \times 3.9 \times 70 \times 100.9 \times 10^{-3} = 13.77^{t}$$

(ii) Shearing force beared by stirrup

$$S_v = \frac{A_v \cdot \sigma_{sa} \cdot d}{1.15 \cdot s}$$

Where, A_v : Total cross section (cm^2) of stirrup with the section s.

σ_{sa} : Allowable tensile stress of re-bar

$\sigma_{sa} = 1800^{kg/cm^2}$

s : Interval of stirrups measured along the member axis (cm)

Arranged stirrups D13 - 2 sets 25 cm ctc,

$$A_v = 1.267 \times 4 = 5.07^{cm^2}$$

$$S_{v1} = \frac{5.07 \times 1800 \times 100.9}{1.15 \times 25 \times 10^3} = 32.03\ t$$

(iii) Shearing stress beared by turned up bars

Disregarded the turned up bars for calculation.

(iv) Total shear

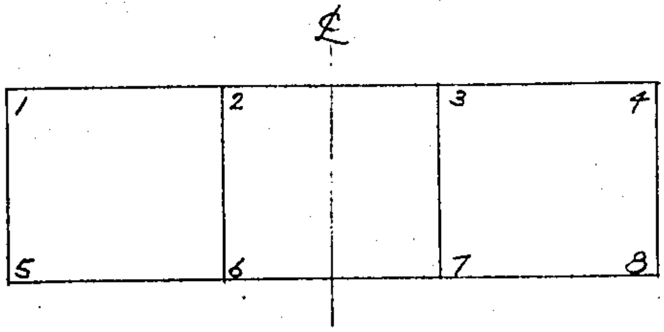
$$\Sigma S_R = S_c + S_u + S_b$$

$$\Sigma S_R = 13.77 + 32.03 + 0$$
$$= 45.80^t > S_1 = 33.97^t$$

Re-bars D16 - 2 sets (one side) in axial direction

§8. Calculation of column

1) Rahmen (Rigid frame) calculation in railway profile

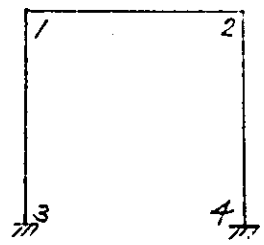


Critical cases No.2

Member	M (tm)	N (t)	case number
1 - 5	36.75	83.76	21
1 - 5	26.49	72.54	20
2 - 6	38.88	79.14	20
6 - 2	34.81	85.64	20

(Refer the result of computor analysis on stress calculation)

2) ①-① Ralmen (Rigid frame) calculation in the direction of railway cross section



Critical cases No. 5

Member	M (tm)	N (t)	case number
1 − 3	28.34	67.41	19
3 − 1	30.41	75.29	35
4 − 2	30.21	101.73	35

3) ②-② Ralmen (Rigid frame) calculation in the direction of railway cross section

Member	M (tm)	N (t)	case number
1 − 3	28.34	62.53	17
3 − 1	29.16	68.61	17
4 − 2	28.76	90.96	17

Critical cases No 2

Stress calculation

	Rahmen in railway profile					
	1 — 5	1 — 5	2 — 6	6 — 2		
M (tm)	36.75	26.49	38.88	34.81		
N (t)	83.76	72.54	79.14	85.64		
S (t)						
b (cm)	70					
h (cm)	70					
d (cm)	63.9					
d' (cm)	6.1					
As (cm^2)	D25 − 5 = 25.34 cm^2					
p	0.00517					
As' (cm^2)	D25 − 5 = 25.34 cm^2					
p'	0.00517					
e = M/N (cm)	43.88	36.52	49.13	40.65		
e = M/N + u (cm)						
e = M/N − u (cm)						
e/h	0.627	0.522	0.702	0.581		
d/e						
d'/h	0.087	0.087	0.087	0.087		
d'/d						
Ne/bd^2 (kg/cm^2)	17.09	14.80	16.15	17.48		
k	0.463	0.513	0.437	0.482		
c	0.219	0.261	0.197	0.235		
j						
1/Lc						
1/Ls						
$\beta = \sigma s/\sigma c$						
σc (kg/cm^2)	78.1	56.8	82.2	74.3		
σs (kg/cm^2)	1,140	660	1,340	1,000		
τ (kg/cm^2)						
σsa (kg/cm^2)	1,800					
σca (kg/cm^2)	90					
τa (kg/cm^2)						
Homogram number	MN-5.6.7	〃	〃	〃	〃	
combination	D + S	〃	〃	〃	〃	

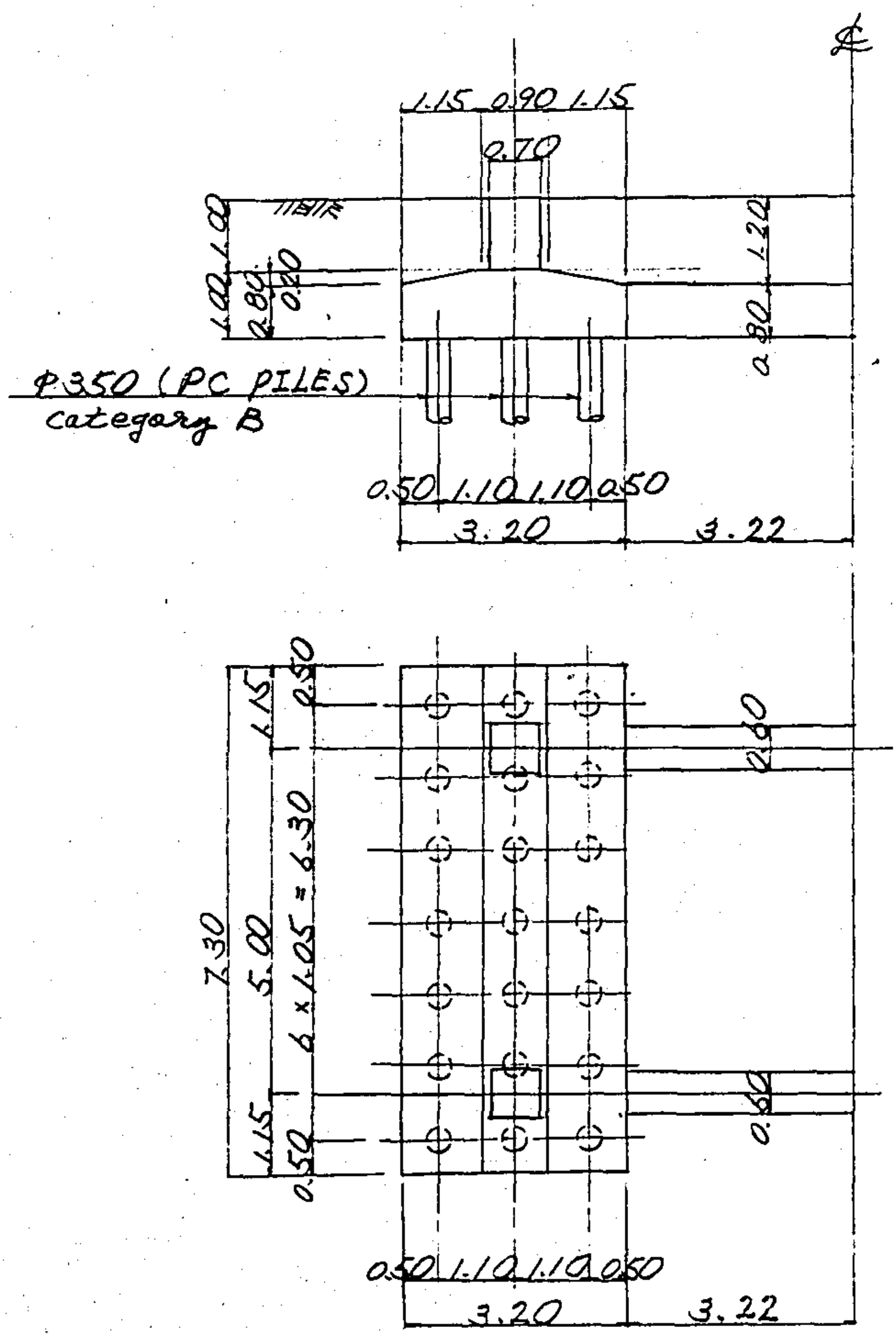
	①-① Rahmen in the direction of railway cross section			②-② Rahmen in the direction of railway cross section		
	1 — 3	3 — 1	4 — 2	1 — 3	3 — 1	4 — 2
M (tm)	28.34	30.41	30.21	28.34	29.16	28.76
N (t)	67.41	75.29	101.73	62.53	68.61	90.96
S (t)						
b (cm)	70			70		
h (cm)	70			70		
d (cm)	63.9			63.9		
d' (cm)	6.1			6.1		
As (cm^2)	D25 - 5 = 25.34			D25 - 5 = 25.34		
p	0.00517			0.00517		
As' (cm^2)	D25 - 5 = 25.34			D25 - 5 = 25.34		
p'	0.00517			0.00517		
e = M/N (cm)	42.04	40.39	30.68	45.32	42.50	31.62
e = M/N + u (cm)						
e = M/N − u (cm)						
e/h	0.601	0.577	0.438	0.647	0.607	0.452
d/e						
d'/h	0.087	0.087	0.087	0.087	0.087	0.087
d'/d						
Ne/bd^2 (kg/cm^2)	13.76	15.37	20.76	12.76	14.00	18.56
k	0.473	0.484	0.574	0.455	0.471	0.563
c	0.228	0.237	0.307	0.212	0.226	0.299
j						
1/Lc						
1/Ls						
$\beta = \sigma s / \sigma c$						
σc (kg/cm^2)	60.4	64.9	67.6	60.1	62.1	62.2
σs (kg/cm^2)	840	860	600	910	880	580
τ (kg/cm^2)						
σsa (kg/cm^2)	1 800			1 800		
σca (kg/cm^2)	90			90		
τa (kg/cm^2)						
Nomogram number	MN-5.6.7			MN-5.6.7		
combination	D+S	D+S+E	〃	D+S	〃	〃

§9. Basic criteria for calculation

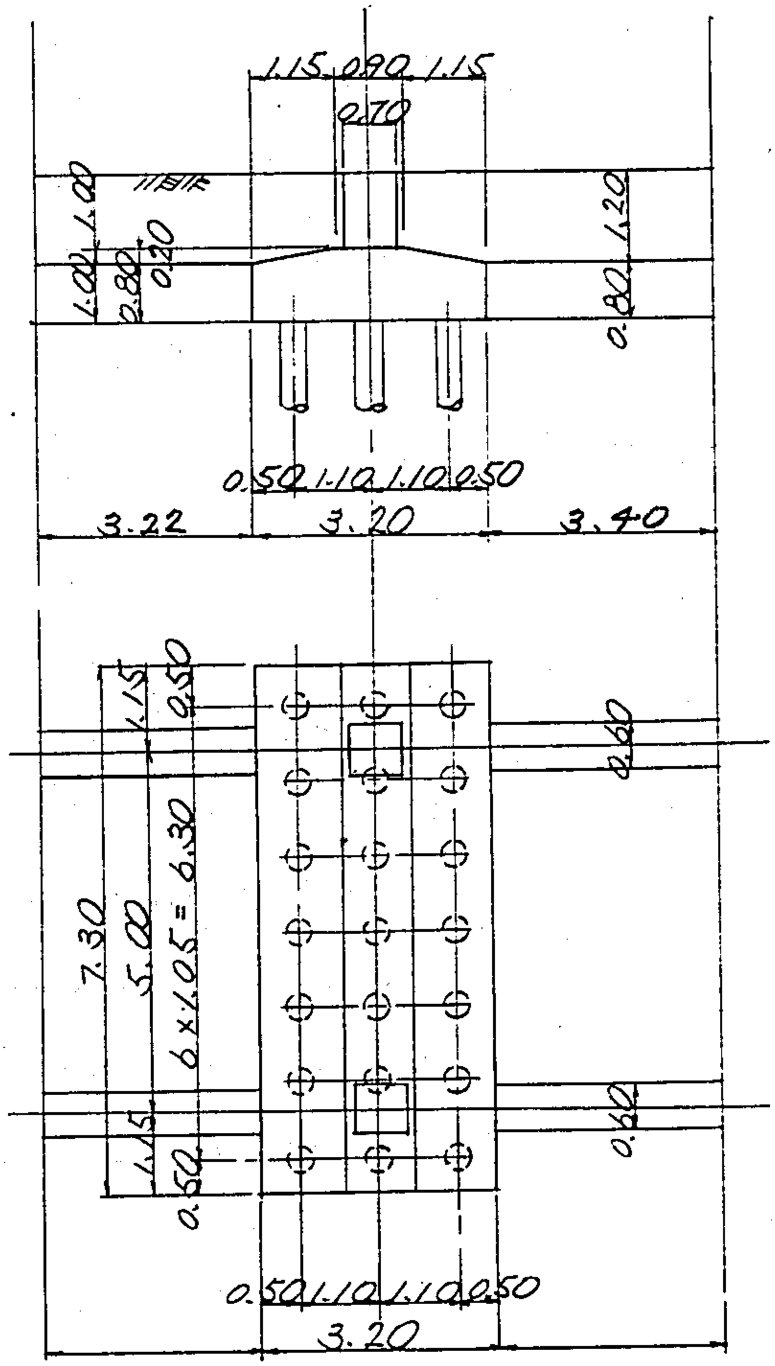
1. Analysis in the direction of railway profile

1) Configulation and dimension

i) End part



ii) Intermediate part



2) Own weight footing and buried beam, and weight of earth (column part)

i) End part

$N_{F1} = (0.90 + 3.20) \times 1/2 \times 0.20 \times 7.30 \times 1/2 \times 2.5^{t/m^3} = 3.74^t$

$N_{F2} = (3.20 + 0.80 \times 7.30 \times 1/2 + 0.60 \times 0.80 \times 3.22)$

$\times 2.5^{t/m^3} - 1.23^{t/m} \times 0.60 \qquad = 26.49^t$

$N_G = \{(3.20 \times 1.00 + 1.15 \times 0.20 \times 1/2 \times 2) \times 7.30 \times 1/2$

$+ 0.60 \times 1.20 \times 3.22 - 0.70 \times 0.70 \times 1.00\} \times 1.8^{t/m^3}$

$= 25.53^t$

$\Sigma N = 55.76^t$

ii) Intermediate part

$N_{F1} = (0.90 + 3.20) \times 1/2 \times 0.20 \times 7.30 \times 1/2 \times 2.5^{t/m^3} = 3.74^t$

$N_{F2} = \{3.20 \times 0.80 \times 7.30 \times 1/2 + 0.60 \times 0.80 \times (3.22 + 3.40)\}$

$\times 2.5^{t/m^3} - 1.23^{t/m} \times 0.60 \qquad = 30.57^t$

$N_G = \{(3.20 \times 1.00 + 1.15 \times 0.20 \times 1/2 \times 2) \times 7.30 \times 1/2$

$+ 0.60 \times 1.20 \times (3.22 + 3.40) - 0.70 \times 0.70 \times 1.00\} \times 1.8^{t/m^3}$

$= 30.23^t$

$\Sigma N = 64.54^t$

3). Supporting power of piles
and calculation of footing

i) End part

- Ordinary case (Dead load) $\alpha = 1.0$ case 1

Axial load at the botton of column = 126.95^t

Weight of footing, buried beam
and earth = 55.76^t

$\Sigma N = 182.71^t$

Reaction beared by one pile

$$P = \frac{\Sigma N}{n} = \frac{182.71}{10.5} = 17.40 \text{ t/Pile} < 24 \text{ t/Pile}$$

- Ordinary case + temporary case (Dead lod
+ Train load and Impact) $\alpha = 1.0$ case 12

Axial laat at the botton of column = 271.90^t

Weight of footing, buried beam
and earth = 55.76^t

$\Sigma N =$ [illegible]^t

Reaction beared by one pile

$$P = \frac{\Sigma N}{n} = \frac{327.66}{10.5} = 31.21 \text{ t/Pile} < 36 \text{ t/Pile}$$

- Earthquake case (Dead load + Seismic load) $\alpha = 1.5$ case 21

Axial load at the bottom of column

$90.25 \times 1.5 \qquad = 135.38^t$

Weight of footing, buried beam and earth $\qquad = 55.76^t$

$\Sigma N = 191.14^t$

Reaction beared by one pile

$$P = \frac{\Sigma N}{n} = \frac{191.14}{10.5} = 18.20 \ ^t/_{Pile} < 48 \ ^t/_{Pile}$$

Horizontal resisting force beared by one pile

Horizontal force at the bottom of column

$8.51 \times 1.5 \qquad = 12.77^t$

Footing and buried beam

$(3.74 + 26.44) \times \frac{3.7}{2.5} \times 0.1 = 0.85^t$

Horizontal force of half portion of column

$2.5 \times 0.70 \times 0.70 \times 7.918 \times 1/2 \times 0.10 = 0.48^t$

$\Sigma H = 14.10^t$

$$H = \frac{14.10}{10.5} = 1.34 \ ^t/_{Pile}$$

ii) Intermediate part

- Ordinary case (Dead load) $\alpha = 1.0$ case 1

Axial load at the botton of column = 124.71^t

Weight of footing, buried beam

and earth = 64.54^t

$\Sigma N = 189.25^t$

Reaction beared by one pile

$$P = \frac{\Sigma N}{n} = \frac{189.25}{10.5} = 18.02\ ^t/_{Pile} < 24\ ^t/_{Pile}$$

- Ordinary case + temporary case (Dead lod + Train load and Impact) $\alpha = 1.0$ case 15

Axial loat at the botton of column = 259.44^t

Weight of footing, buried beam

and earth = $64.54''$

$\Sigma N = 323.98^t$

Reaction beared by one pile

$$P = \frac{\Sigma N}{n} = \frac{323.98}{10.5} = 30.86\ ^t/_{Pile} < 36\ ^t/_{Pile}$$

- Earthquake case (Dead load + Seismic load) $\alpha = 1.5$ case 21

Axial load at the bottom of column

$85.64 \times 1.5 = 128.46^t$

Weight of footing, buried beam and earth $= 64.54^t$

$\Sigma N = 193.00^t$

Reaction beared by one pile

$$P = \frac{\Sigma N}{n} = \frac{193.00}{10.5} = 18.38\ t/Pile < 48\ t/Pile$$

Horizontal resisting force beared by one pile

Horizontal force at the bottom of column

$9.31 \times 1.5 = 13.97^t$

Footing and buried beam

$(3.74 + 30.57) \times \frac{0.7}{2.5} \times 0.10 = 0.96^t$

Horizontal force of half portion of column

$2.5 \times 0.70 \times 0.70 \times 7.918 \times 1/2 \times 0.10 = 0.48^t$

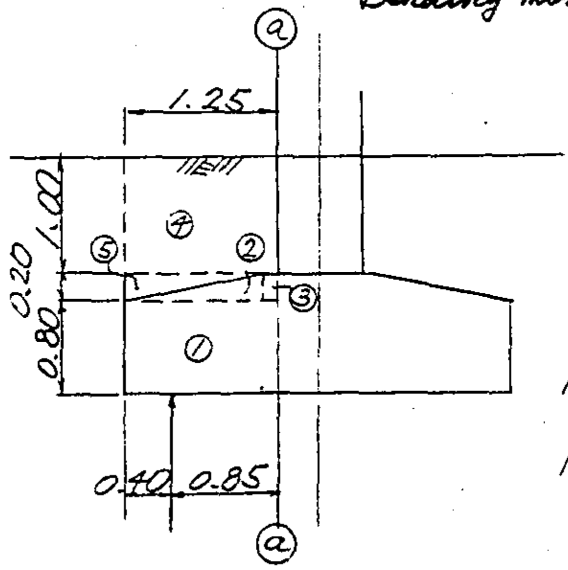
$\Sigma H = 15.41^t$

$$H = \frac{15.41}{10.5} = 1.47\ t/Pile$$

4). Bending moment calculation

Analysis is made calculated bending moment at the column front.

Bending moment caused by own weight of footing



$N_1 = 2.5^{t/m^3} \times 1.25 \times 0.80 \times 3.65 = 9.13^t$

$N_2 = 2.5 \times 1.15 \times 0.20 \times 1/2 \times 3.65 = 1.05$

$N_3 = 2.5 \times 0.10 \times 0.20 \times 3.65 = 0.18$

$N_4 = 1.8 \times 1.25 \times 1.00 \times 3.65 = 8.21$

$N_5 = 1.8 \times 1.15 \times 0.20 \times 1/2 \times 3.65 = 0.76$

$Ma = 9.13 \times 0.625 + 1.05 \times 0.483 + 0.18 \times 0.05 + 8.21 \times 0.625 + 0.76 \times 0.867$

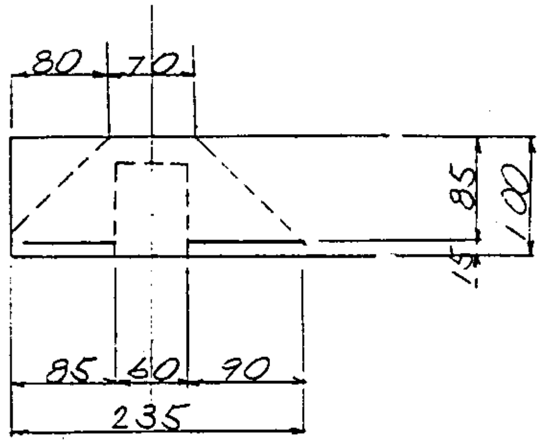
$= 12.01^{tm}$

$$\Sigma Ma = P \cdot n \cdot X - Ma$$

(tm)

		α	Reaction of Pile (P)	Number of piles (n)	Arm (leverage) (X)	P·n·X	−Ma	ΣMa
End part	Ordinary	1.00	17.40	3.50	0.85	51.77	−12.01	39.76
	Ordinary + Temporary	1.00	31.21	〃	〃	92.85	〃	80.84
	Earthquake	1.50	18.20	〃	〃	54.15	〃	42.14
Inter-mediate Part	Ordinary	1.00	18.02	〃	〃	53.61	〃	[illegible]
	Ordinary + Temporary	1.00	30.86	〃	〃	91.81	〃	[illegible]
	Earthquake	1.50	18.38	〃	〃	54.68	〃	[illegible]

5) Stress calculation



$M = 80.84^{tm}$

$B = 80 + 70 + 85 = 235^{cm}$

effective width

$B_0 = 235 - 60 = 175^{cm}$

$A_s = D29 - 15^{cm}\ ctc = 6.424 \times \frac{175}{15} = 74.95^{cm^2}$

$$\rho = \frac{74.95}{175 \times 85} = 0.00504$$

From the Nomogram M-1,

$1/L_c = 6.98 \qquad 1/L_s = 223$

$$\sigma_c = \frac{80.84 \times 10^5}{175 \times 85^2} \times 6.98 = 44.6^{kg/cm^2} < 90^{kg/cm^2}$$

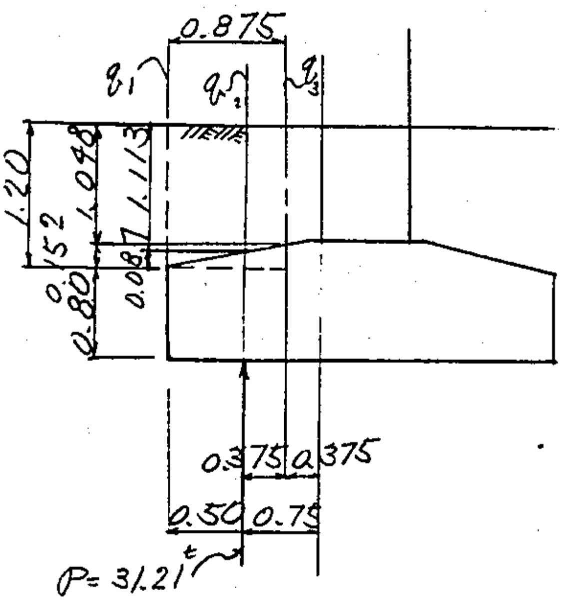
$\sigma_s = \quad " \quad \times 223 = 1430\ " < 1800\ "$

Check, safe against cracking

$M = 41.60^{tm}$

$$\sigma_{sd} = \frac{41.60 \times 10^5}{175 \times 85^2} \times 223 = 730^{kg/cm^2} < 1600^{kg/cm^2}$$

6) Calculation of shearing fore caused by beading



Imposed load

$q_1 = 2.5^{t/m^3} \times 0.80 + 1.8^{t/m^3} \times 1.20 = 4.16^{t/m}$

$q_2 = 2.5'' \times 0.887 + 1.8'' \times 1.113 = 4.22''$

$q_3 = 2.5'' \times 0.952 + 1.8'' \times 1.048 = 4.27''$

$\gamma_0 = \frac{2}{a_0/d} = \frac{2 \times d}{a_0}$

$a_0 = \frac{h}{2} = \frac{1.00}{2} = 0.50^m$

$d = 0.952 - 0.15 = 0.802^m$

$\gamma_0 = \frac{2 \times 0.802}{0.50} = 3.208 < 4$

Therefore, $\gamma_0 = 3.208$

$q_3' = \frac{q_3}{\gamma_0} = \frac{4.27}{3.208} = 1.33^{t/m}$

$w = (4.16 + 4.22)^{t/m} \times 1/2 \times 0.50 + (4.22 + 1.33)$
$\times 1/2 \times 0.375 = 3.14^{t/m}$

Considered the full with,

$P = 31.21 \times 3.50 = 109.24^t$

$a = 0.75^m$

$\gamma_0 = \frac{2}{a/d} = \frac{2 \times 0.802}{0.75} = 2.139 < 4$

Therefore, $\gamma = 2.139$

$$P' = \frac{P}{\gamma} = \frac{109.24}{2.139} = 51.07^{t}$$

$$\Sigma S = 3.14^{t/m} \times 3.65 - 51.07^{t} = -39.61^{t}$$

$$\tau = \frac{39.61 \times 10^{3}}{365 \times 80.2} = 1.35^{kg/cm^2} < 3.9^{kg/cm^2}$$

2. Analysis in the direction of railway cross section

1) Weight of longitudinal buried beam and earth (Per one column)

i) End part

Buried beam $2.5^{t/m^3} \times 0.60 \times 0.80 \times 3.22 = 3.86^{t}$

Earth $1.8^{t} \times 0.60 \times 1.20 \times 3.22 = 4.17^{t}$

$\Sigma N = 8.03^{t}$

Horizontal force of half portion of column

$2.5^{t/m^3} \times 0.70 \times 0.70 \times 3.528 \times 0.10 = 0.43^{t}$

Buried beam $3.86 \times \frac{0.7}{2.5} \times 0.10 = 0.11^{t}$

$\Sigma H = 0.54^{t}$

Intermediate part

Buried beam $2.5^{t/m^3} \times 0.60 \times 0.80 \times (3.22 + 3.40) = 7.94^{t}$

Earth $1.8^{t} \times 0.60 \times 1.20 \times (3.22 + 3.40) = 8.58^{t}$

$\Sigma N = 16.52^{t}$

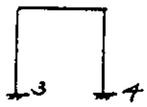
Horizontal force of half portion of column

$2.5^{t/m} \times 0.70 \times 0.70 \times 3.708 \times 0.10 = 0.45^{t}$

Buried beam $7.94 \times \frac{0.7}{2.5} \times 0.10 = 0.22^{t}$

$\Sigma H = 0.67^{t}$

Stress at the bottom of column



End part

Ordinary case (Dead load + Electrification load) $\alpha = 1.00$ case 21

$$\begin{cases} M_3 = 1.97^{tm} \\ N_3 = 130.07 + \overset{\Delta N}{8.03} = 138.10^{t} \\ H_3 = 0.56^{t} \end{cases}$$

$$\begin{cases} M_4 = 1.68^{tm} \\ N_4 = 135.43 + \overset{\Delta N}{8.03} = 143.46^{t} \\ H_4 = 0.44^{t} \end{cases}$$

Ordinary case + Temporary case (Dead load + Train load and Impact + Electrification load) $\alpha = 1.00$ case 24

$$\begin{cases} M_3 = 1.47^{tm} \\ N_3 = 237.86 + \overset{\Delta N}{8.03} = 245.89^{t} \\ H_3 = 0.35^{t} \end{cases}$$

$$\begin{cases} M_4 = 2.18^{tm} \\ N_4 = 243.22 + \overset{\Delta N}{8.03} = 251.25^{t} \\ H_4 = 0.65^{t} \end{cases}$$

Ordinary case + Temporary case (Dead load + Train load and Impact 1 + lateral load + Electrification load) $\alpha = 1.15$ case 27

$$\begin{cases} M_3 = 15.21 \times 1.15 = 17.49^{tm} \\ N_3 = 115.89 \times 1.15 + \overset{\Delta N}{8.03} = 141.07^{t} \\ H_3 = 4.07 \times 1.15 = 4.68^{t} \end{cases}$$

$$\begin{cases} M_4 = 15.39 \times 1.15 = 17.70^{tm} \\ N_4 = 208.92 \times 1.15 + \overset{\Delta N}{8.03} = 248.29^{t} \\ H_4 = 4.14 \times 1.15 = 4.76^{t} \end{cases}$$

Ordinary case + Temporary case (Dead load + Train load and Impact 2 + lateral load + Electrification load) $\alpha = 1.15$ CASE 28

$$\begin{cases} M_3 = 14.34 \times 1.15 = 16.49^{tm} \\ N_3 = 201.71 \times 1.15 + \overset{\Delta N}{8.03} = 240.00^{t} \\ H_3 = 3.97 \times 1.15 = 4.57^{t} \end{cases}$$

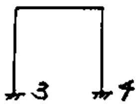
$$\begin{cases} M_4 = 14.96 \times 1.15 = 17.20^{tm} \\ N_4 = 216.64 \times 1.15 + \overset{\Delta N}{8.03} = 257.17^{t} \\ H_4 = 4.24 \times 1.15 = 4.88^{t} \end{cases}$$

Earthquake case (Dead load + Seismic load + Electrification load) $\alpha = 1.50$ CASE 35

$$\begin{cases} M_3 = 30.41 \times 1.50 = 45.62^{tm} \\ N_3 = 75.29 \times 1.50 + \overset{\Delta N}{8.03} = 120.97^{t} \\ H_3 = 8.55 \times 1.50 + \overset{\Delta H}{0.54} = 13.37^{t} \end{cases}$$

$$\begin{cases} M_4 = 30.21 \times 1.50 = 45.32^{tm} \\ N_4 = 101.73 \times 1.50 + \overset{\Delta N}{8.03} = 160.63^{t} \\ H_4 = 8.47 \times 1.50 + \overset{\Delta H}{0.54} = 13.25^{t} \end{cases}$$

ii) Intermediate part



Ordinary case (Dead load) $\alpha = 1.00$ CASE 1

$$\begin{cases} M_3 = 0.30^{tm} \\ N_3 = 119.67 + \overset{\Delta N}{16.52} = 136.19^{t} \\ H_3 = 0.12^{t} \end{cases}$$

$$\begin{cases} M_4 = -0.30^{tm} \\ N_4 = 119.67 + \overset{\Delta N}{16.52} = 136.19^{t} \\ H_4 = -0.12^{t} \end{cases}$$

Ordinary case + Temporary case (Dead load + Train load and Impact 2) $\alpha = 1.00$ CASE 10

$$\begin{cases} M_3 = -2.15^{tm} \\ N_3 = 224.21 + \overset{\Delta N}{16.52} = 240.73^{t} \\ H_3 = -0.87^{t} \end{cases}$$

$$\begin{cases} M_4 = 2.15^{tm} \\ N_4 = 224.21 + \overset{\Delta N}{16.52} = 240.73^{t} \\ H_4 = 0.87^{t} \end{cases}$$

Ordinary case + Temporary case (Dead load + Train load and Impact 1 + lateral load) $\alpha = 1.15$ case 11

$$\begin{cases} M_3 = 13.51 \times 1.15 = 15.54^{tm} \\ N_3 = 101.63 \times 1.15 + \overset{\Delta N}{16.52} = 133.39^{t} \\ H_3 = 3.22 \times 1.15 = 3.70^{t} \end{cases}$$

$$\begin{cases} M_4 = 15.11 \times 1.15 = 17.38^{tm} \\ N_4 = 197.41 \times 1.15 + \overset{\Delta N}{16.52} = 243.54^{t} \\ H_4 = 3.87 \times 1.15 = 4.45^{t} \end{cases}$$

Ordinary case + Temporary case (Dead load + Train load and Impact 2 + lateral load) $\alpha = 1.15$ case 12

$$\begin{cases} M_3 = 11.52 \times 1.15 = 13.25^{tm} \\ N_3 = 189.81 \times 1.15 + \overset{\Delta N}{16.52} = 234.80^{t} \\ H_3 = 2.79 \times 1.15 = 3.21^{t} \end{cases}$$

$$\begin{cases} M_4 = 15.26 \times 1.15 = 17.55^{tm} \\ N_4 = 200.14 \times 1.15 + \overset{\Delta N}{16.52} = 246.68^{t} \\ H_4 = 4.30 \times 1.15 = 4.95^{t} \end{cases}$$

Earthquake case (Dead load + Seismic load)

$\alpha = 1.50$ CASE 17

$$\begin{cases} M_3 = 29.16 \times 1.50 = 43.74^{tm} \\ N_3 = 68.61 \times 1.50 + \overset{\Delta N}{16.52} = 119.44^{t} \\ H_3 = 7.75 \times 1.50 + \overset{\Delta H}{0.67} = 12.30^{t} \end{cases}$$

$$\begin{cases} M_4 = 28.76 \times 1.50 = 43.14^{tm} \\ N_4 = 90.96 \times 1.50 + \overset{\Delta N}{16.52} = 152.96^{t} \\ H_4 = 7.59 \times 1.50 + \overset{\Delta H}{0.67} = 12.06^{t} \end{cases}$$

2) Stability calculation

		Allowable Supporting power	Case Number	Pmax	Pmin	Hmax
Eand Part	Ordinary	24 t	21	18.67	17.44	0.05
	Ordinary + Temporary	36 t	27	33.82	12.55	0.45
	Earthquake	48 t	35	25.45	10.66	1.33
Intermediate Part	Ordinary	24 t	1	17.61	17.61	0
	Ordinary + Temporary	36 t	11	33.36	11.83	0.39
	Earthquake	48 t	17	24.27	10.96	1.23

Analysis on the body of pile

$\beta = 0.298^{m^{-1}}$

In direction of railway profile

$H = 1.47^{t}$

$M = 0.322 \times \frac{H}{\beta} = 0.322 \times \frac{1.47}{0.298} = 1.59^{tm}$

$N = 18.38^{t}$

In direction of railway cross section

$H = 1.33^{t}$

$M = 0.322 \times \frac{1.33}{0.298} = 1.44^{tm}$

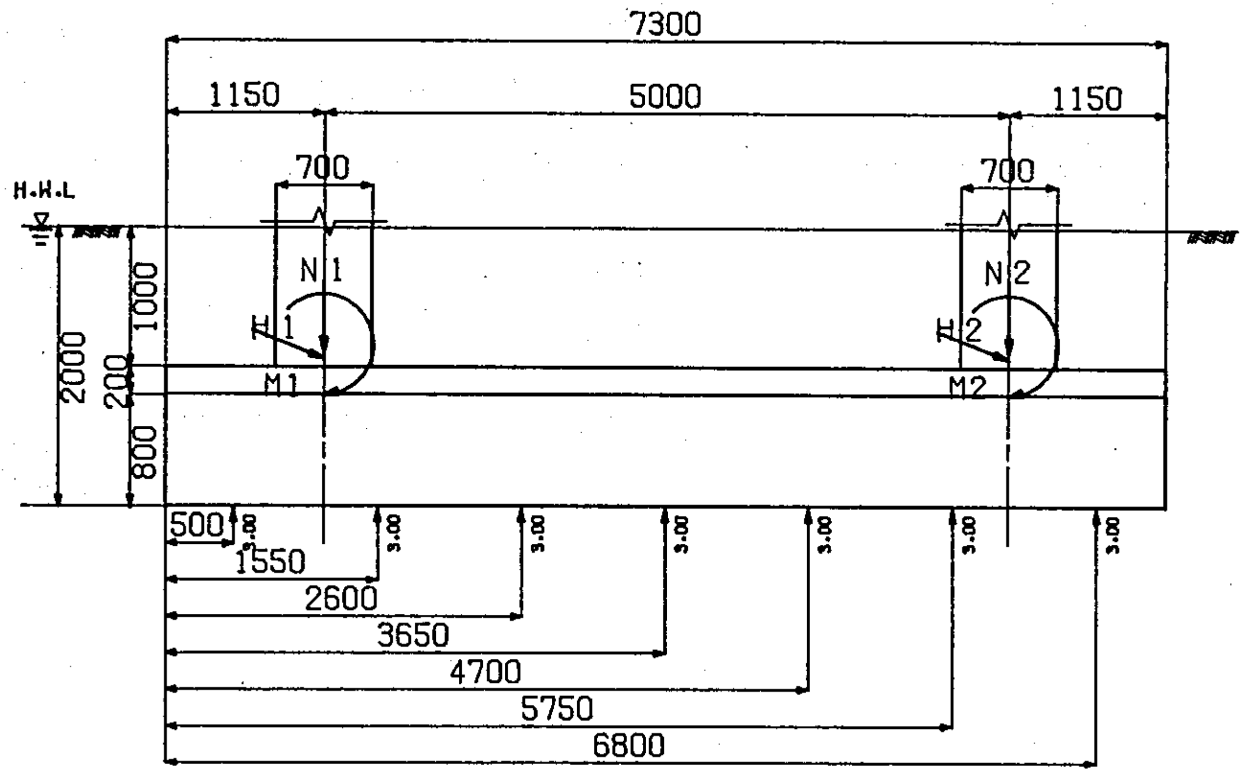
$N_{max} = 22.06^{t}$ (ΔN considered)

N_{min} = 9.05 ^{t} (ΔN considered)

According to the "Interaction curve", Kind B is employed.

3. stress diagram

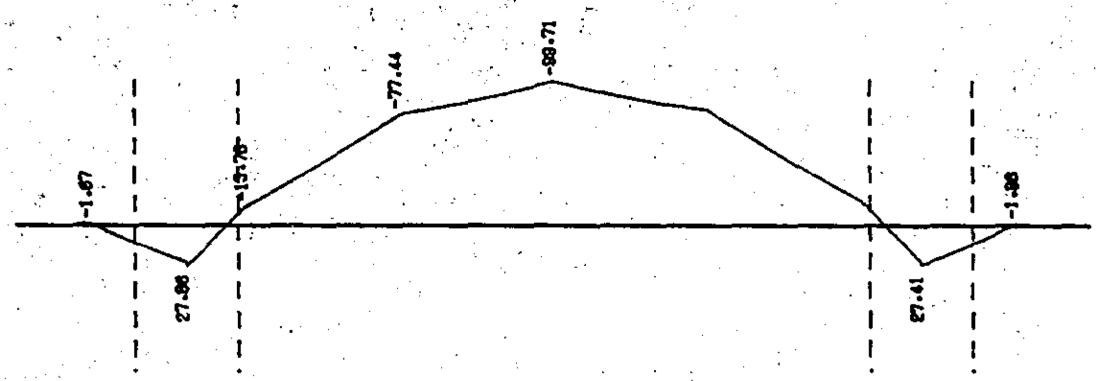
DOUBLE TRACK (3*10=30) C-1



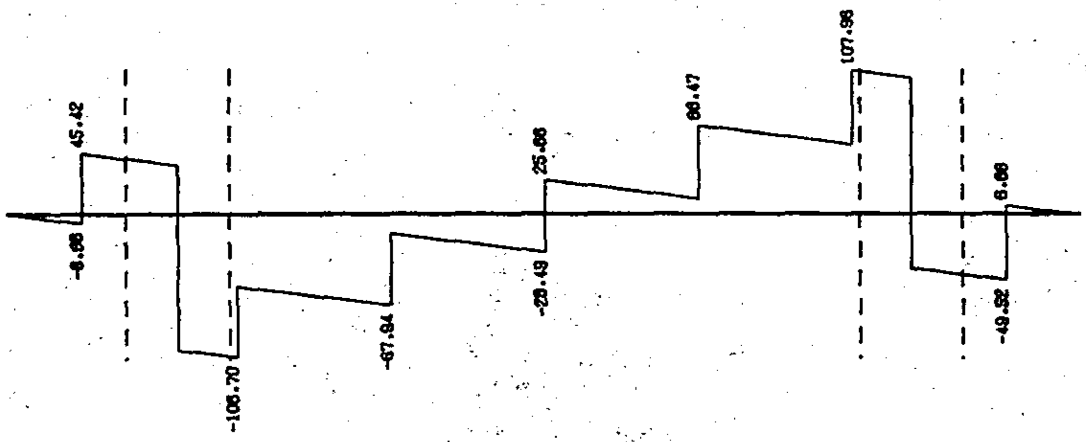
No. 325

DOUBLE TRACK (3*10=30) C-1 | CASE-21

BENDING MOMENT



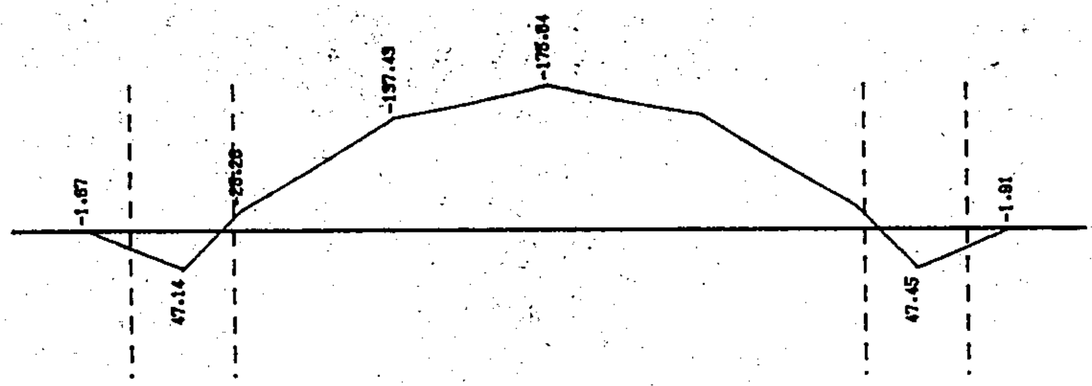
SHEARING FORCE



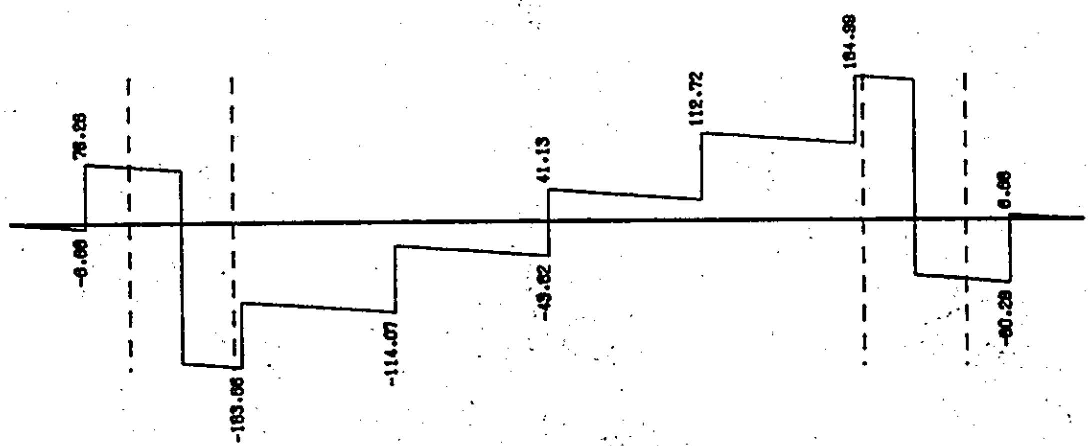
DOUBLE TRACK (3*10=30) C-1

CASE-24

BENDING MOMENT

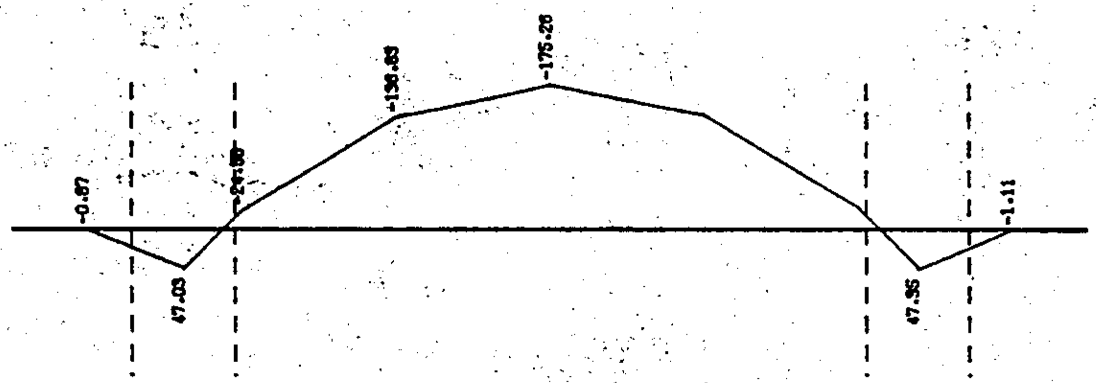


SHEARING FORCE

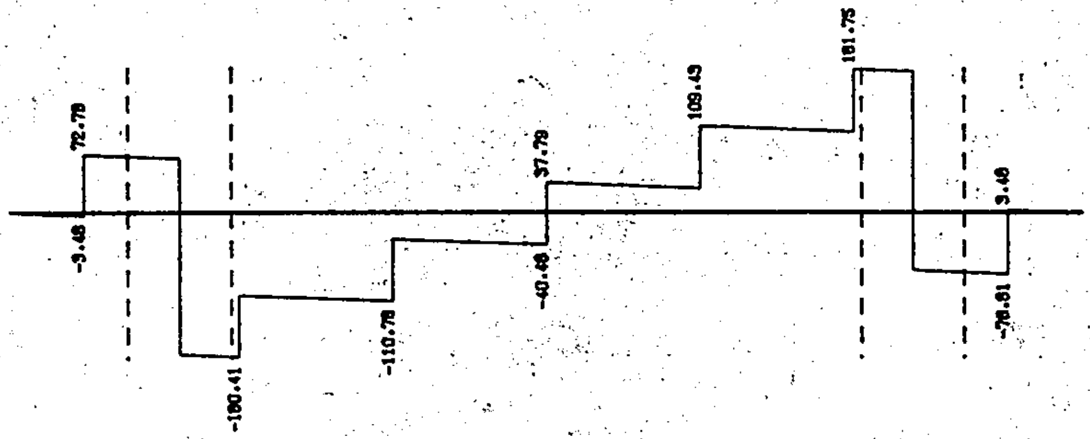


DOUBLE TRACK (3*10=30) C-1 | CASE-24

BENDING MOMENT

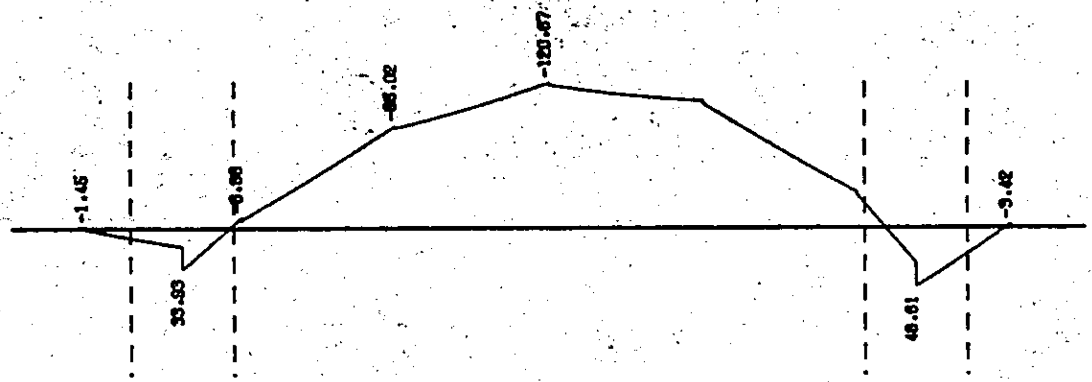


SHEARING FORCE

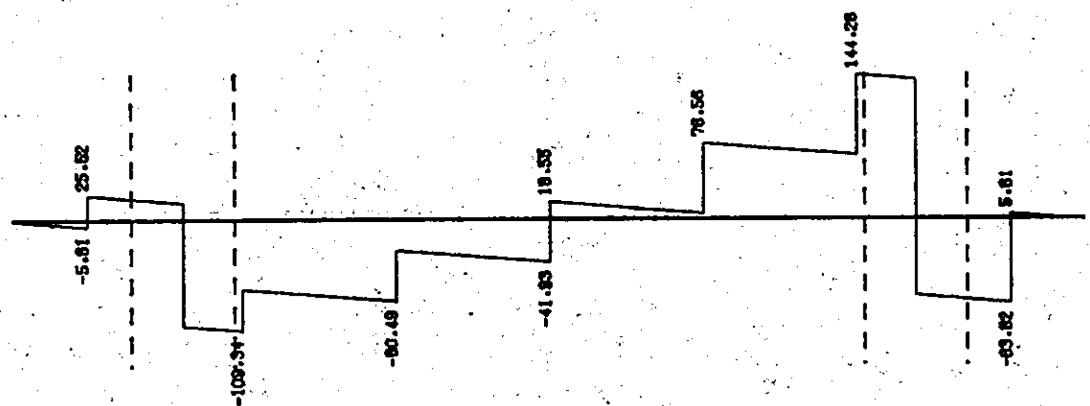


DOUBLE TRACK (3*10=30) C-1 | CASE-27

BENDING MOMENT

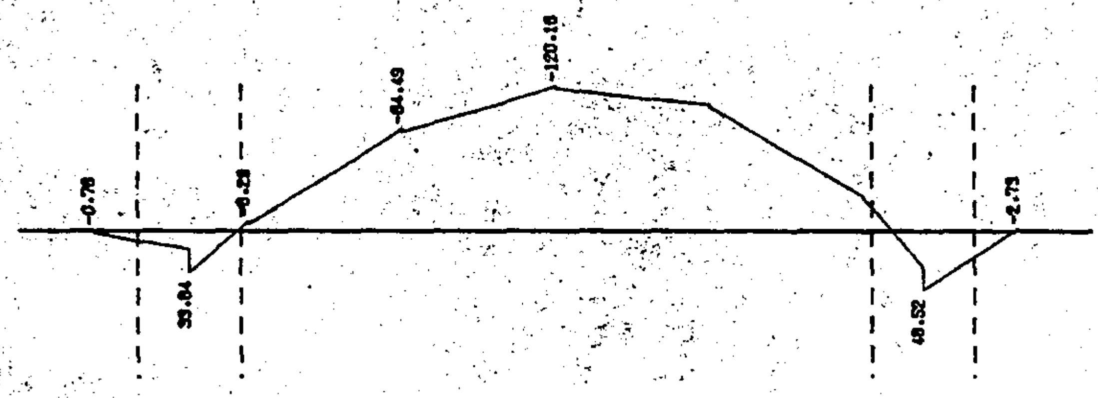


SHEARING FORCE

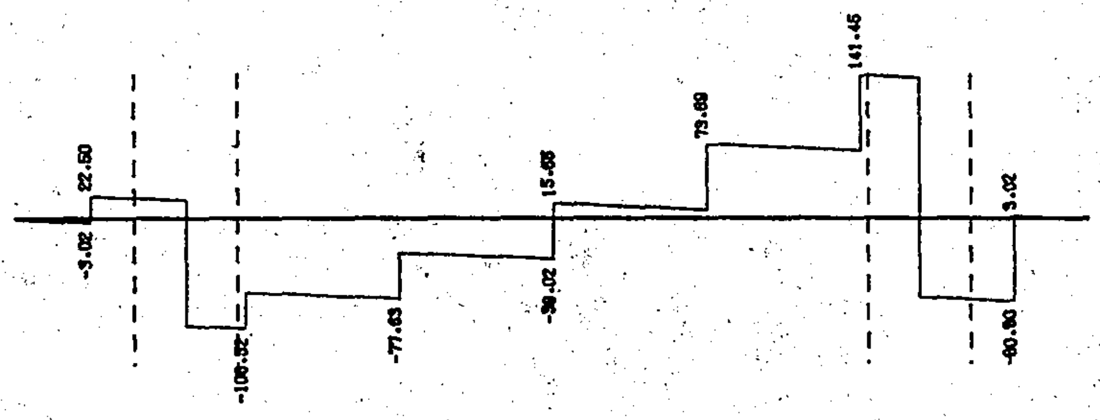


DOUBLE TRACK (3*10=30) C-1 | CASE-27

BENDING MOMENT

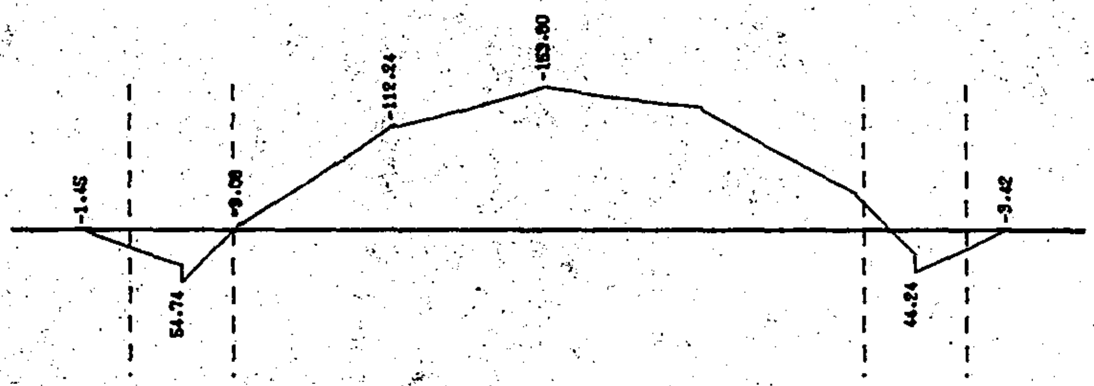


SHEARING FORCE

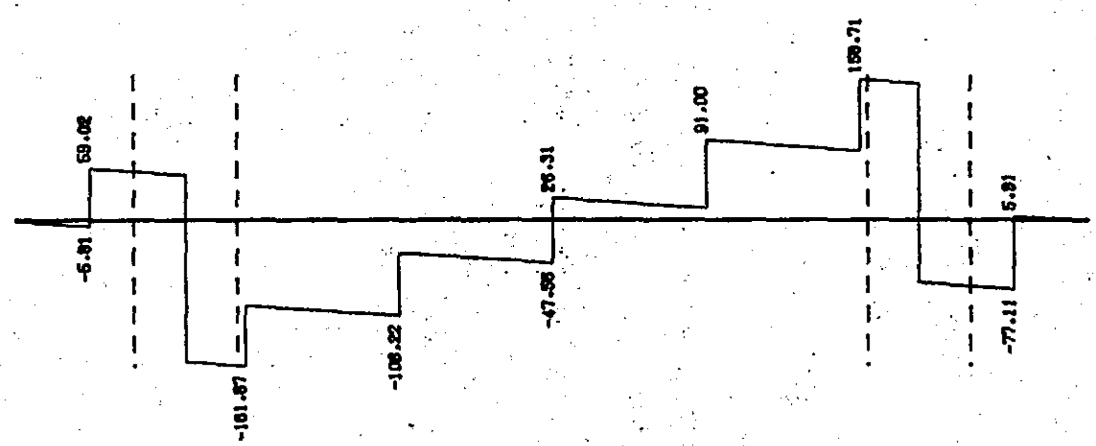


DOUBLE TRACK (3*10=30) C-1 | CASE-28

BENDING MOMENT



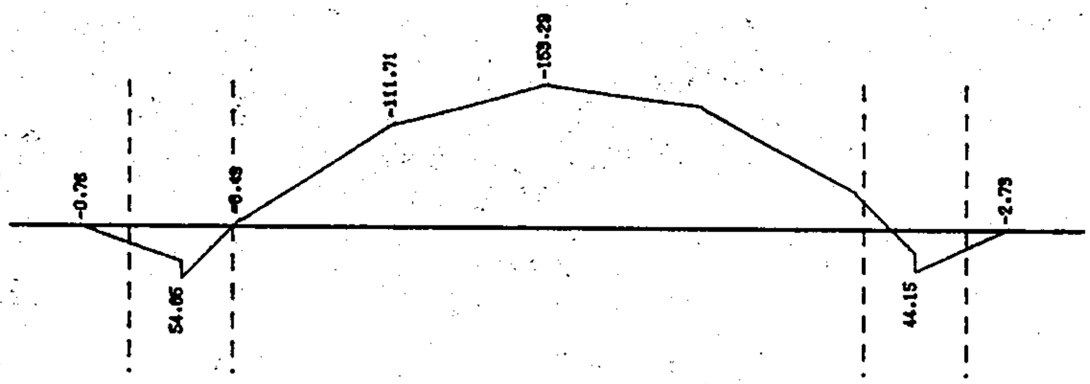
SHEARING FORCE



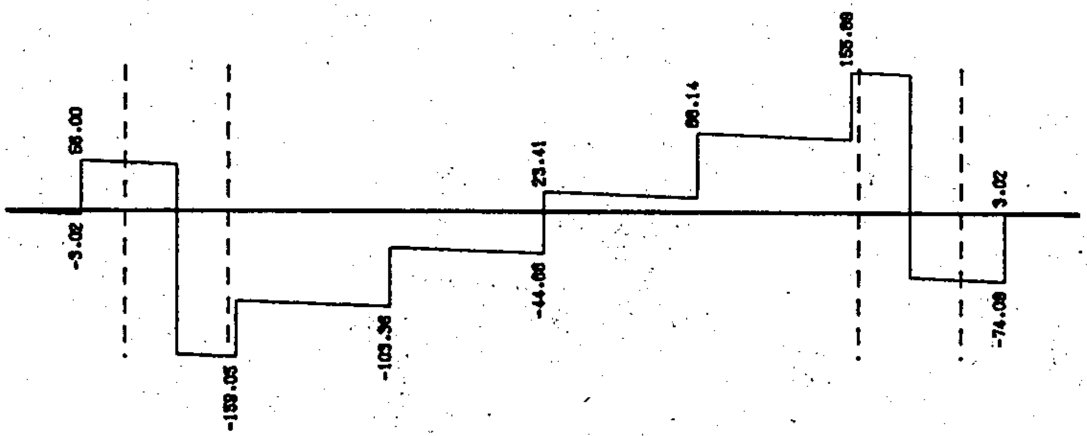
No. 330

DOUBLE TRACK (3*10=30) C-1 | CASE-28

BENDING MOMENT



SHEARING FORCE

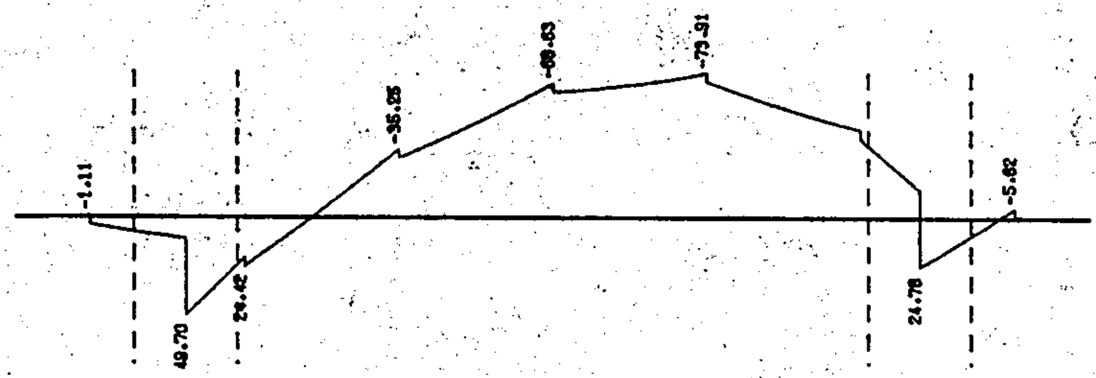


No. 332

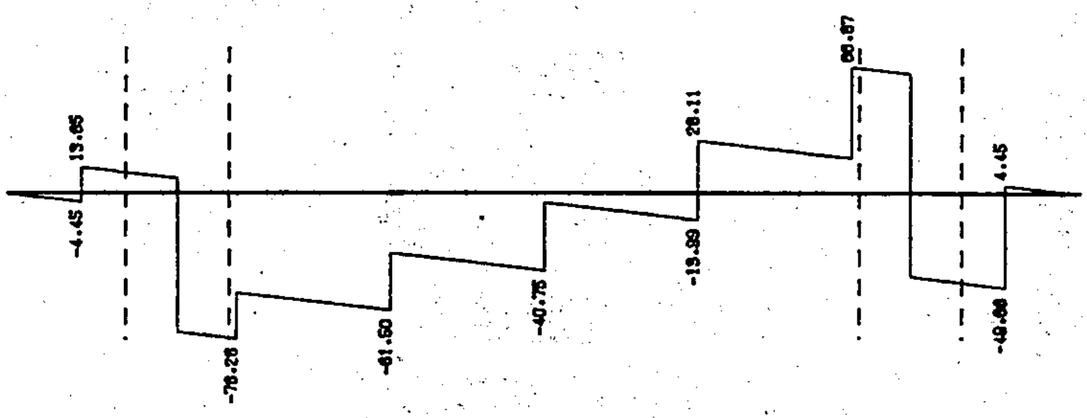
DOUBLE TRACK (3*10=30) C-1

CASE-35

BENDING MOMENT



SHEARING FORCE



INPUT DATA

```
     ===INPUT DATA CARD IMAGE===                                                          CARD
---------1---------2---------3---------4---------5---------6---------7---------8         NUMBER
TITLE     DOUBLE TRACK (3*10=30)  C-1                                                        1
CONST        2    7      7.3         0       1.0       2.0         0     0.028               2
                0.8      0.2         0       7.3         0       2.5                         3
                0.2      0.2      1.15       0.9      1.15       1.8                         4
SWITCH       2    0    1    1    1    1    0    1    0    1    0                             5
COLC           1.15     6.15                                                                 6
COLB            0.7      0.7                                                                 7
COLH            0.7      0.7                                                                 8
KUI            21.0     0.35 0.0006213   3500000        91       195         0               9
KL              0.5     1.55       2.6      3.65       4.7      5.75       6.8              10
KN                3        3         3         3         3         3         3              11
POINT    2      2.0      5.3                                                                12
FORCE    1     1.97     1.68                                                                13
   21    1     0.56     0.44                                                                14
  1.0    1   138.10   143.46                                                                15
FORCE    2     1.47     2.18                                                                16
   24    2     0.35     0.65                                                                17
  1.0    1   245.89   251.25                                                                18
FORCE    3     1.47     2.18                                                                19
   24    2     0.35     0.65                                                                20
  1.0    0   245.89   251.25                                                                21
FORCE    4    17.49    17.70                                                                22
   27    2     4.68     4.76                                                                23
 1.15    1   141.07   248.29                                                                24
FORCE    5    17.49    17.70                                                                25
   27    2     4.68     4.76                                                                26
 1.15    0   141.07   248.29                                                                27
FORCE    6    16.49    17.20                                                                28
   28    2     4.57     4.88                                                                29
 1.15    1   240.00   257.17                                                                30
FORCE    7    16.49    17.20                                                                31
   28    2     4.57     4.88                                                                32
 1.15    0   240.00   257.17                                                                33
FORCE    8    45.62    45.32                                                                34
   35    3    13.37    13.25                                                                35
 1.50    1   120.97   160.63                                                                36
PICKUP   1    1    1                                                                        37
         2    2    8                                                                        38
FINISH                                                                                      39
```

No.333

DOUBLE TRACK (3*10=30) C-1

1) INPUT

*SWITCH

```
A) KISO     =    2          G) FURYOKU =    0
B) KH       =    0          H) E-ANTEI2=    1
C) DELTA-M  =    1          I) SUPPORT =    0
D) KANSAN   =    1          J) E-DANMEN=    1
E) E-ANTEI1=     1          K) OUTPUT  =    0
F) PLOT     =    1
```

```
HASHIRA   =        2 (HON)      KUI      =        7 (HON)

HASHIRA                         DOSYA
   TAKASA=    0.000 ( M )          TAKASA=    1.000 ( M )

KOU-SUII  =   2.000 ( M )       TEI-SUII =    0.000 ( M )

SUIHEI                          TANIJYURYO
   SHINDO =   0.028                (CONC) =   2.500 (T/M**3)
                                TANIJYURYO
ZENCHO    =   7.300 ( M )          (TSUCHI)=  1.800 (T/M**3)
```

*KISO

```
FH1      =    0.800 ( M )       BFH1     =    0.200 ( M )
FH2      =    0.200 ( M )       BFH2     =    0.200 ( M )
SR1      =    0.000 ( M )       BSR1     =    1.150 ( M )
SR2      =    7.300 ( M )       BSR2     =    0.900 ( M )
SR3      =    0.000 ( M )       BSR3     =    1.150 ( M )
```

*HASHIRA

HASHIRA CHUSHIN	HASHIRA HABA	HASHIRA OKUYUKI
1.150	0.700	0.700
6.150	0.700	0.700

No.334

```
DOUBLE TRACK (3*10=30)  C-1

   *KUI

    KUICHO    =   21.000 ( M )   KUIKEI   =     0.350 ( M )

    I         =  0.000621 (M**4)  E        = 0.350E+07 (T/M**2)
                                  KUITOU
    KH1       =    91.000 (T/M**3) HENIRYOU=    0.000 ( M )

    KH2       =   195.000 (T/M**3)


    KUI CHUSHIN          KUI HONSU

         0.500              3.000
         1.550              3.000
         2.600              3.000
         3.650              3.000
         4.700              3.000
         5.750              3.000
         6.800              3.000

 2) LOAD
   *CONCRETE

    W =   54.20 (T)     H =    1.52 (T)     Y =   0.466 (M)

   *DOSHA

    W =   43.31 (T)     H =    1.21 (T)     Y =   1.460 (M)

   *FURYOKU

    W1=   46.72 (T)
    W2=    0.00 (T)
```

No.335

PICK UP

DOUBLE TRACK (3*10=30) C-1

*** PICKUP - 1 *** (21)

C	L	CASE	--------MOMENT MAXIMUM-------- M	S	CASE	--------MOMENT MINIMUM-------- M	S
	0.000	(21)	0.000	0.000	(21)	0.000	0.000
	0.500	(21)	-1.670	-6.679	(21)	-1.670	-6.679
	0.500	(21)	-1.379	45.425	(21)	-1.379	45.425
	0.800	(21)	11.647	41.418	(21)	11.647	41.418
*	1.150	(21)	25.325	36.742	(21)	25.325	36.742
*	1.150	(21)	27.855	-101.358	(21)	27.855	-101.358
	1.500	(21)	-8.438	-106.033	(21)	-8.438	-106.033
	1.550	(21)	-13.757	-106.700	(21)	-13.757	-106.700
	1.550	(21)	-13.466	-53.914	(21)	-13.466	-53.914
	2.000	(21)	-39.080	-59.925	(21)	-39.080	-59.925
	2.600	(21)	-77.439	-67.939	(21)	-77.439	-67.939
	2.600	(21)	-77.149	-14.470	(21)	-77.149	-14.470
	3.650	(21)	-99.705	-28.495	(21)	-99.7[illegible]5	-28.495
	3.650	(21)	-99.415	25.658	(21)	-99.415	25.658
	4.700	(21)	-79.837	11.633	(21)	-79.837	11.633
	4.700	(21)	-79.547	66.468	(21)	-79.547	66.468
	5.300	(21)	-42.070	58.454	(21)	-42.070	58.454
	5.750	(21)	-17.118	52.443	(21)	-17.118	52.443
	5.750	(21)	-16.828	107.962	(21)	-16.828	107.962
	5.800	(21)	-11.446	107.294	(21)	-11.446	107.294
*	6.150	(21)	25.288	102.619	(21)	25.288	102.619
*	6.150	(21)	27.408	-40.841	(21)	27.408	-40.841
	6.500	(21)	12.296	-45.516	(21)	12.296	-45.516
	6.800	(21)	-1.960	-49.523	(21)	-1.960	-49.523
	6.800	(21)	-1.670	6.679	(21)	-1.670	6.679
	7.300	(21)	0.000	0.000	(21)	0.000	0.000

No. 336

DOUBLE TRACK (3*10=30) C-1

C	L	CASE	SHEARING MAXIMUM M	S	CASE	SHEARING MINIMUM M	S
	0.000	(21)	0.000	0.000	(21)	0.000	0.000
	0.500	(21)	-1.670	-6.679	(21)	-1.670	-6.679
	0.500	(21)	-1.379	45.425	(21)	-1.379	45.425
	0.800	(21)	11.647	41.418	(21)	11.647	41.418
*	1.150	(21)	25.325	36.742	(21)	25.325	36.742
*	1.150	(21)	27.855	-101.358	(21)	27.855	-101.358
	1.500	(21)	-8.438	-106.033	(21)	-8.438	-106.033
	1.550	(21)	-13.757	-106.700	(21)	-13.757	-106.700
	1.550	(21)	-13.466	-53.914	(21)	-13.466	-53.914
	2.000	(21)	-39.080	-59.925	(21)	-39.080	-59.925
	2.600	(21)	-77.439	-67.939	(21)	-77.439	-67.939
	2.600	(21)	-77.149	-14.470	(21)	-77.149	-14.470
	3.650	(21)	-99.705	-28.495	(21)	-99.705	-28.495
	3.650	(21)	-99.415	25.658	(21)	-99.415	25.658
	4.700	(21)	-79.837	11.633	(21)	-79.837	11.633
	4.700	(21)	-79.547	66.468	(21)	-79.547	66.468
	5.300	(21)	-42.070	58.454	(21)	-42.070	58.454
	5.750	(21)	-17.118	52.443	(21)	-17.118	52.443
	5.750	(21)	-16.828	107.962	(21)	-16.828	107.962
	5.800	(21)	-11.446	107.294	(21)	-11.446	107.294
*	6.150	(21)	25.288	102.619	(21)	25.288	102.619
*	6.150	(21)	27.408	-40.841	(21)	27.408	-40.841
	6.500	(21)	12.296	-45.516	(21)	12.296	-45.516
	6.800	(21)	-1.960	-49.523	(21)	-1.960	-49.523
	6.800	(21)	-1.670	6.679	(21)	-1.670	6.679
	7.300	(21)	0.000	0.000	(21)	0.000	0.000

No.337

DOUBLE TRACK (3*10=30) C-1

*** PICKUP - 2 *** (24, 24, 27, 27, 28, 28, 35)

C	L	CASE	MOMENT MAXIMUM M	S	CASE	MOMENT MINIMUM M	S
	0.000	(24)	0.000	0.000	(27)	0.000	0.000
	0.500	(27)	-0.756	-3.025	(24)	-1.670	-6.679
	0.500	(35)	3.389	13.647	(24)	-1.430	76.258
	0.800	(24)	20.892	70.696	(35)	7.082	10.976
*	1.150	(24)	45.316	67.576	(35)	10.378	7.859
*	1.150	(28)	54.743	-157.225	(27)	33.839	-104.102
	1.500	(35)	23.717	-75.810	(24)	-16.092	-182.989
	1.550	(35)	19.915	-76.255	(24)	-25.258	-183.657
	1.550	(35)	24.417	-52.154	(24)	-25.018	-100.050
	2.000	(35)	0.046	-56.161	(24)	-71.608	-106.609
	2.600	(35)	-35.253	-61.504	(24)	-137.434	-114.075
	2.600	(35)	-30.751	-31.400	(24)	-137.194	-29.796
	3.650	(35)	-66.630	-40.750	(24)	-175.843	-43.821
	3.650	(35)	-64.128	-4.645	(24)	-175.603	41.128
	4.700	(35)	-73.914	-13.995	(24)	-139.781	27.103
	4.700	(35)	-69.412	28.113	(24)	-139.541	112.724
	5.300	(35)	-54.148	22.770	(28)	-76.309	84.512
	5.750	(24)	-27.864	102.127	(35)	-44.893	18.762
	5.750	(27)	-27.110	141.453	(35)	-40.301	66.872
	5.800	(24)	-18.546	181.397	(35)	-36.968	66.427
*	6.150	(24)	44.623	179.648	(35)	-14.264	63.310
*	6.150	(27)	48.610	-76.275	(35)	24.782	-43.871
	6.500	(24)	21.620	-74.723	(35)	8.882	-46.988
	6.800	(24)	-1.110	-76.810	(35)	-5.615	-49.659
	6.800	(28)	-0.756	3.025	(24)	-1.670	6.679
	7.300	(28)	0.000	0.000	(28)	0.000	0.000

No.338

DOUBLE TRACK (3*10=30) C-1

C	L	CASE	SHEARING MAXIMUM M	SHEARING MAXIMUM S	CASE	SHEARING MINIMUM M	SHEARING MINIMUM S
	0.000	(27)	0.000	0.000	(24)	0.000	0.000
	0.500	(27)	-0.756	-3.025	(24)	-1.670	-6.679
	0.500	(24)	-1.430	76.258	(35)	3.389	13.647
	0.800	(24)	20.847	72.251	(35)	7.082	10.976
*	1.150	(24)	45.210	68.261	(35)	10.378	7.859
*	1.150	(35)	49.785	-72.693	(24)	47.136	-178.314
	1.500	(35)	23.717	-75.810	(24)	-16.092	-182.989
	1.550	(35)	19.915	-76.255	(24)	-25.258	-183.657
	1.550	(35)	24.417	-52.154	(24)	-24.338	-103.478
	2.000	(35)	0.046	-56.161	(24)	-71.608	-106.609
	2.600	(35)	-35.253	-61.504	(24)	-137.434	-114.075
	2.600	(27)	-83.052	-29.730	(28)	-109.736	-38.308
	3.650	(27)	-120.164	-39.024	(28)	-153.802	-47.562
	3.650	(24)	-175.603	41.128	(35)	-64.128	-4.645
	4.700	(24)	-139.173	30.486	(35)	-73.914	-13.995
	4.700	(24)	-139.541	112.724	(35)	-69.412	28.113
	5.300	(24)	-74.526	105.258	(35)	-54.148	22.770
	5.750	(24)	-27.864	102.127	(35)	-44.803	18.762
	5.750	(24)	-28.304	184.991	(35)	-40.301	66.872
	5.800	(24)	-19.071	184.323	(35)	-36.968	66.427
*	6.150	(24)	44.623	179.648	(35)	-14.264	63.310
*	6.150	(35)	24.782	-43.871	(27)	48.518	-76.871
	6.500	(35)	8.882	-46.988	(27)	21.203	-80.340
	6.800	(35)	-5.615	-49.659	(27)	-3.422	-83.825
	6.800	(24)	-1.670	6.679	(28)	-0.756	3.025
	7.300	(24)	C.000	0.000	(28)	0.000	0.000

No. 339

DOUBLE TRACK (3*10=30) C-1

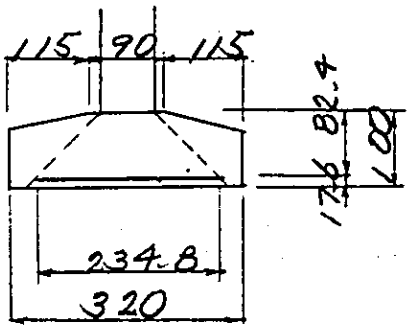
CASE	V MAX	V MIN	DELTA H
21	18.734	17.368	0.048
24	28.988	27.646	0.048
24	26.763	25.421	0.048
27	34.359	12.009	0.450
27	32.134	9.785	0.450
28	31.785	24.851	0.450
28	29.561	22.626	0.450
35	27.056	9.050	1.340

No. 340

1) Stress calculation

a) End part

i) Bottom side



$M = 54.74^{tm}$

$A_s = D19 - 15^{cm}\,ctc$

$= 2.865 \times \frac{234.8}{15} = 44.85^{cm^2}$

$p = \frac{44.85}{234.8 \times 82.4}$

$= 0.00232$

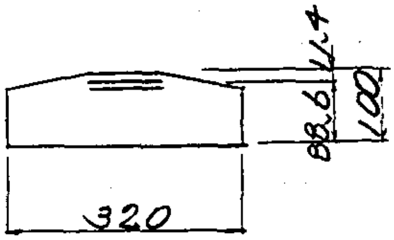
From the Nomogram M-1,

$1/L_c = 9.36 \qquad 1/L_s = 467$

$\sigma_c = \frac{54.74 \times 10^5}{234.8 \times 82.4^2} \times 9.36 = 32.1^{kg/cm^2} < 90^{kg/cm^2}$

$\sigma_s = \qquad \times 467 = 1600'' < 1800''$

ii) Top side



$M = -175.84^{tm}$

$A_s = \phi 32 - \frac{8}{8} = 127.07^{cm^2}$

$p = \dfrac{127.07}{320 \times 88.6}$

$= 0.00448$

From the Nomogram M-1

$1/L_c = 7.29 \qquad 1/L_s = 248$

$\sigma_c = \dfrac{175.84 \times 10^5}{320 \times 88.6^2} \times 7.29 = 51.0^{kg/cm^2} < 90^{kg/cm^2}$

$\sigma_s = \quad " \quad \times 248 = 1740^{"} < 1800^{"}$

Check, safe against cracking

$M = -99.71^{tm}$

$\sigma_{sd} = \dfrac{99.71 \times 10^5}{320 \times 88.6^2} \times 248 = 980^{kg/cm^2} < 1600^{kg/cm^2}$

2) Shearing stress h/2 point from column front

$S = 106.61^t$ (case 24)

$r = \frac{2 \times 82.4}{110} = 1.498 < 4$

$P = 25.87 \times 3 = 77.61^t$

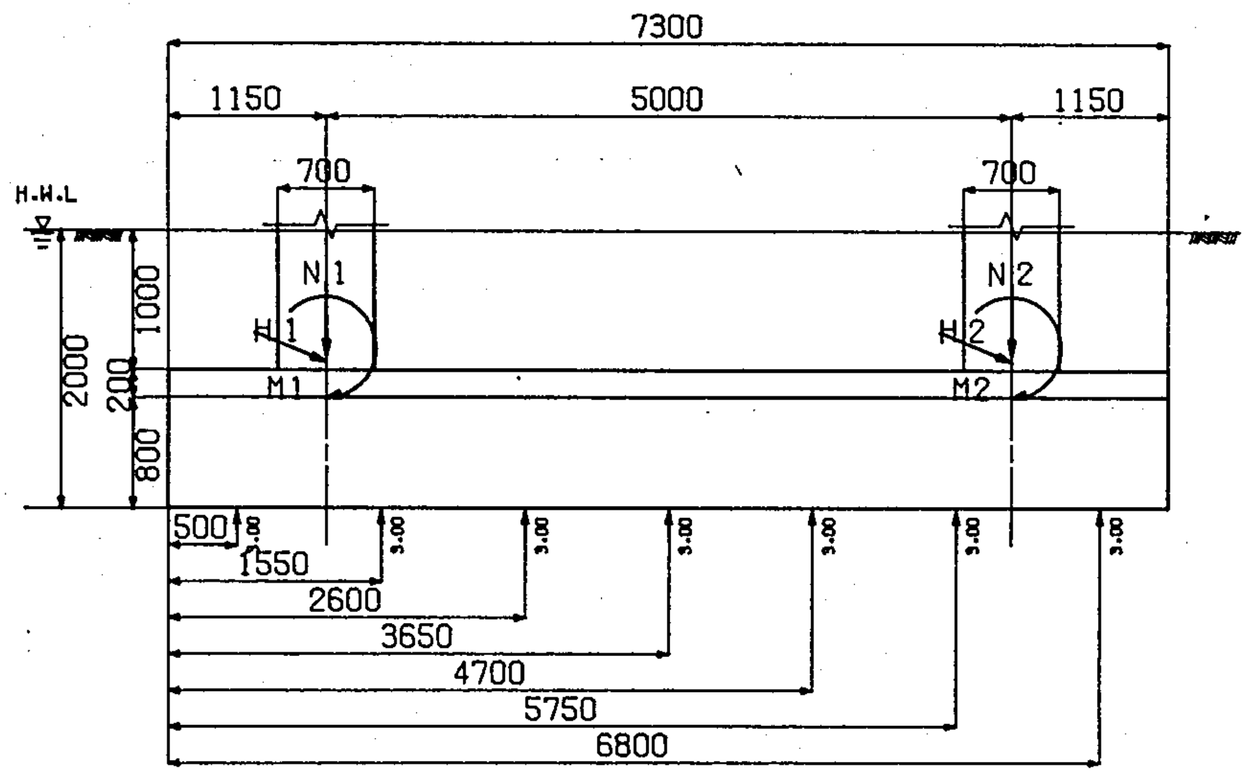
$P' = \frac{77.61}{1.498} = 51.81^t$

$S = 106.61 - (77.61 - 51.81) = 80.81^t$

$\tau = \frac{80.81 \times 10^3}{320 \times 82.4} = 3.06\ kg/cm^2 < 3.9\ kg/cm^2$

4. stress diagram

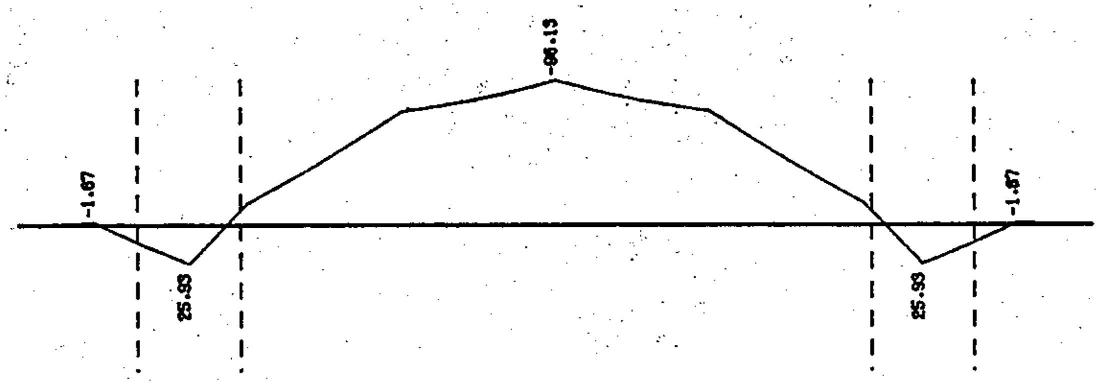
DOUBLE TRACK (3*10=30) C-2



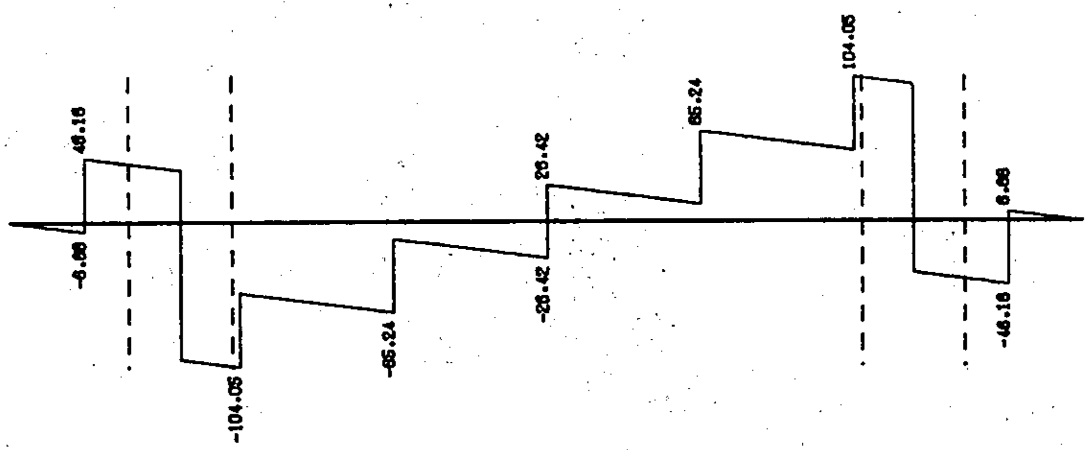
DOUBLE TRACK (3*10=30) C-2

CASE-1

BENDING MOMENT

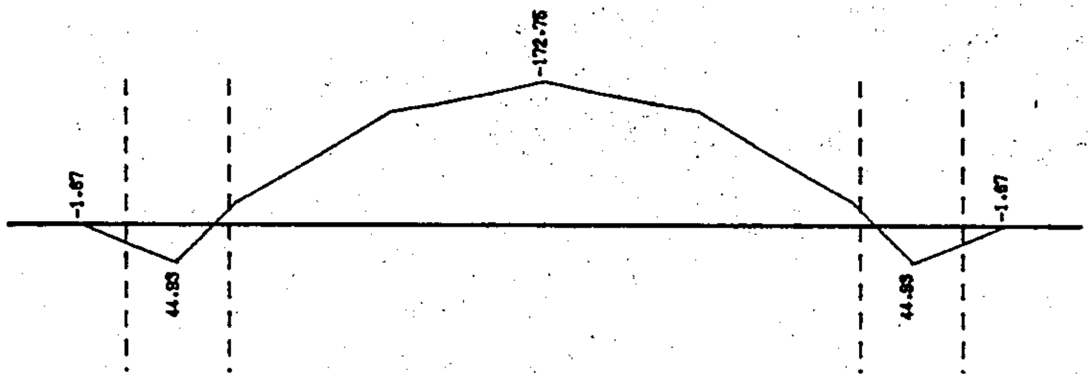


SHEARING FORCE

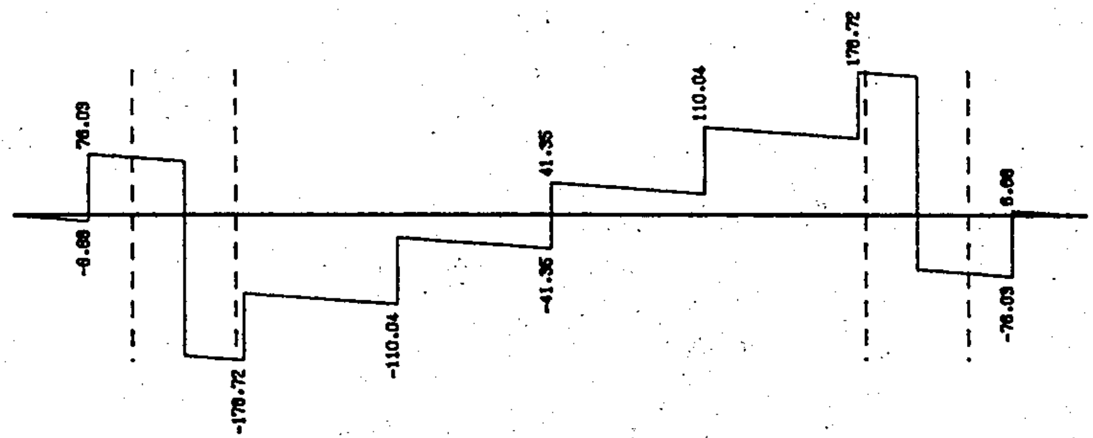


DOUBLE TRACK (3*10=30) C-2 | CASE-10

BENDING MOMENT



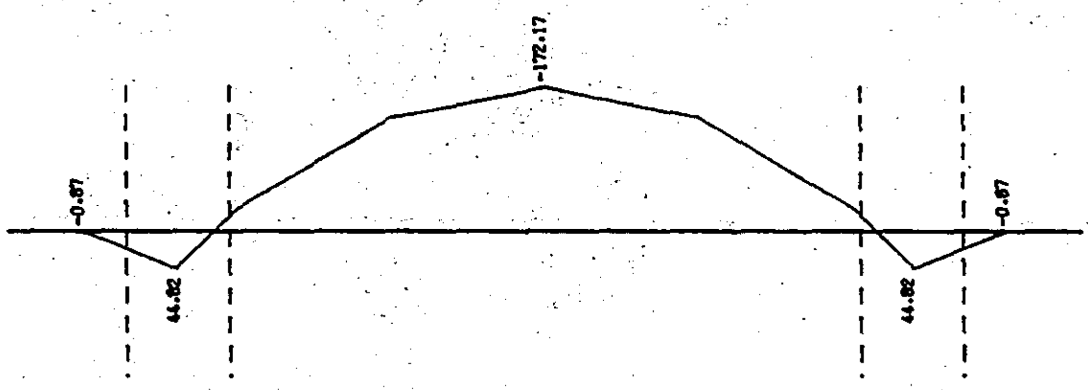
SHEARING FORCE



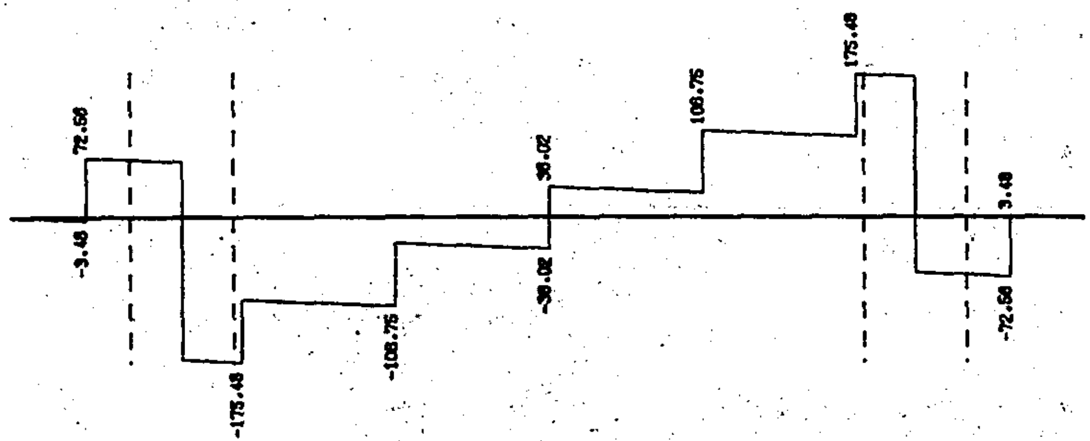
No.347

DOUBLE TRACK (3*10=30) C-2 | CASE-10

BENDING MOMENT



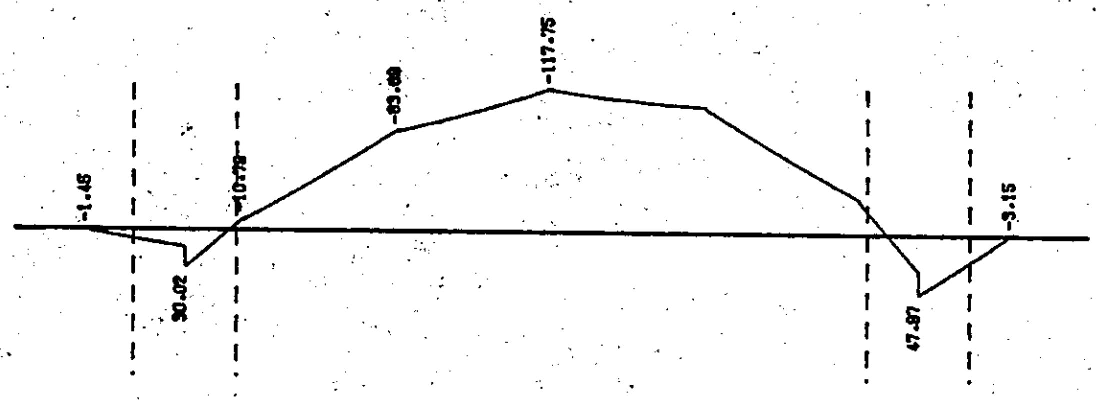
SHEARING FORCE



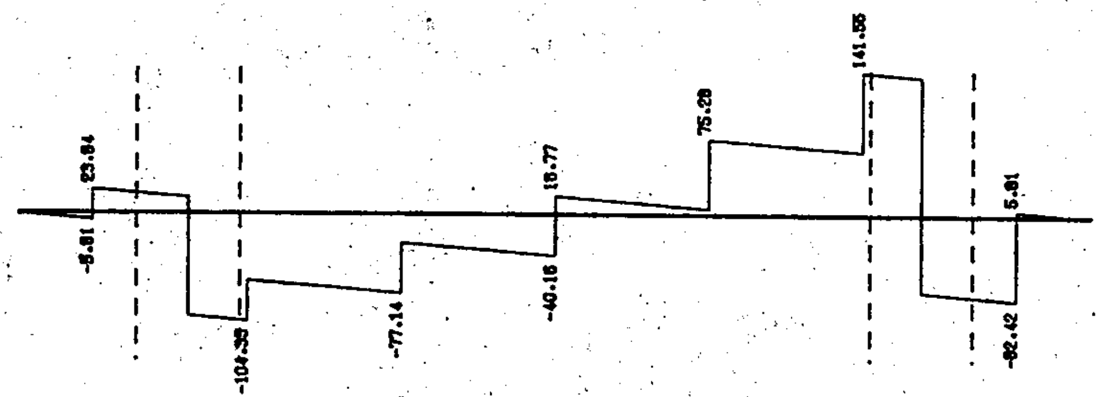
DOUBLE TRACK (3*10=30) C-2

CASE-11

BENDING MOMENT

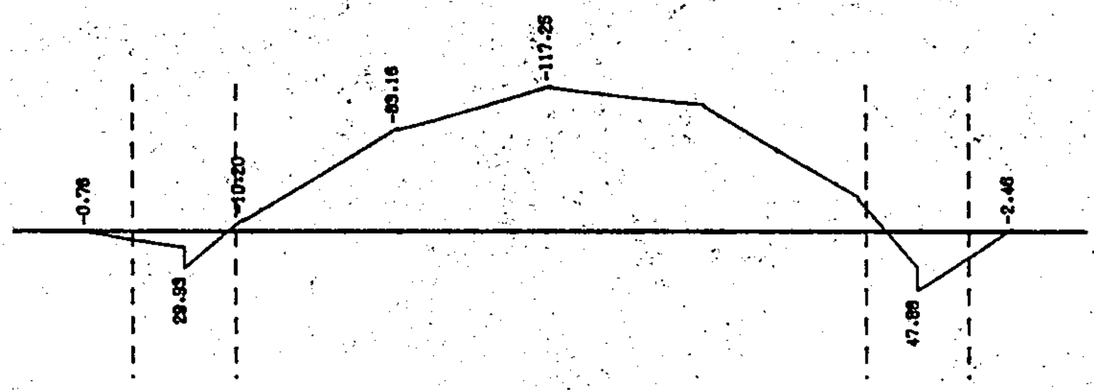


SHEARING FORCE

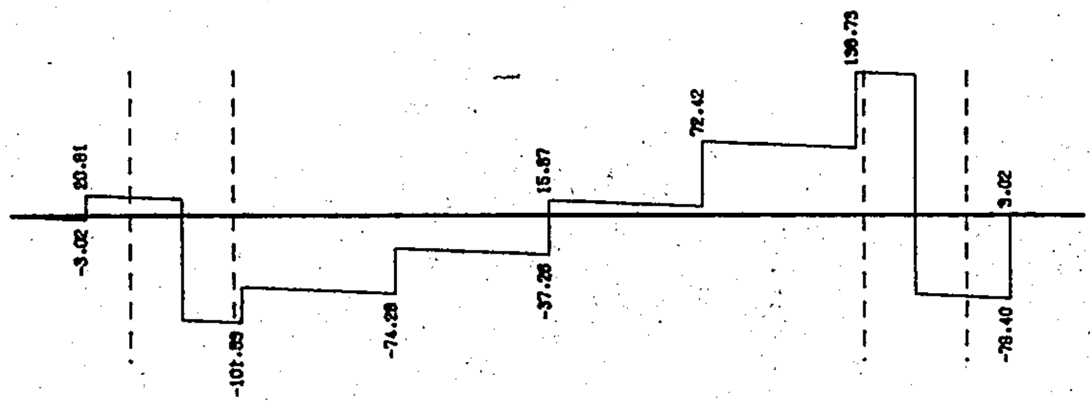


DOUBLE TRACK (3*10=30) C-2 | CASE-11

BENDING MOMENT

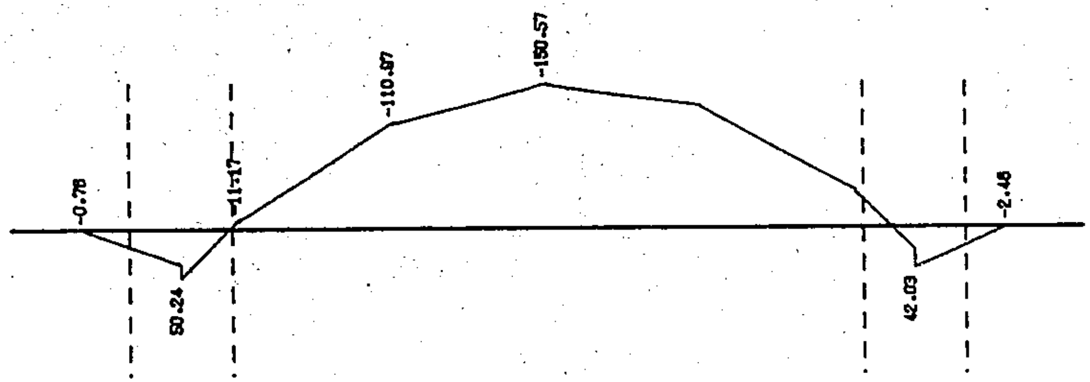


SHEARING FORCE

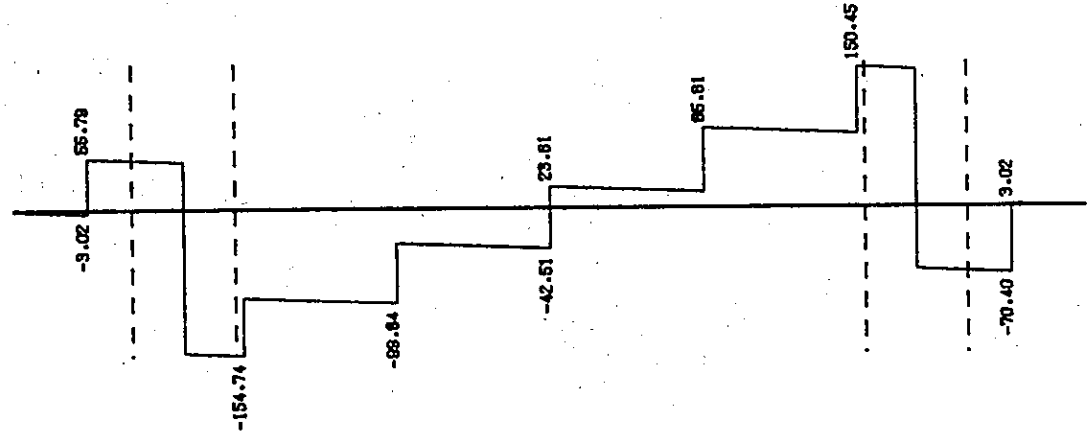


DOUBLE TRACK (3*10=30) C-2 | CASE-12

BENDING MOMENT



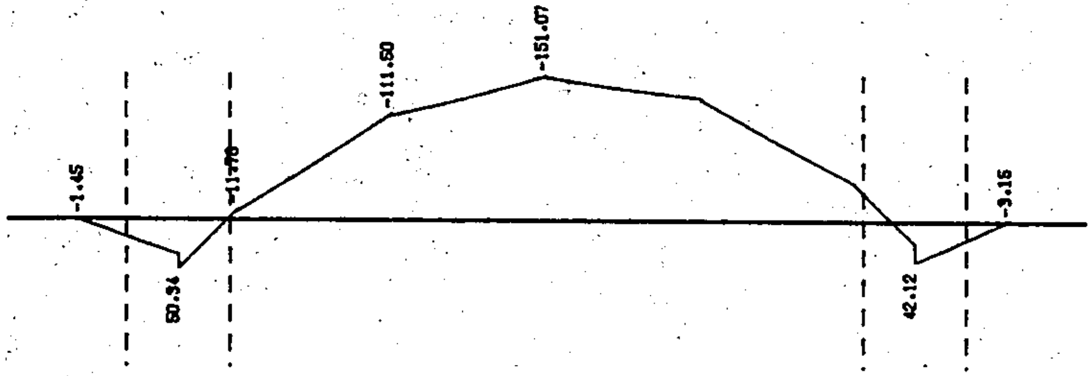
SHEARING FORCE



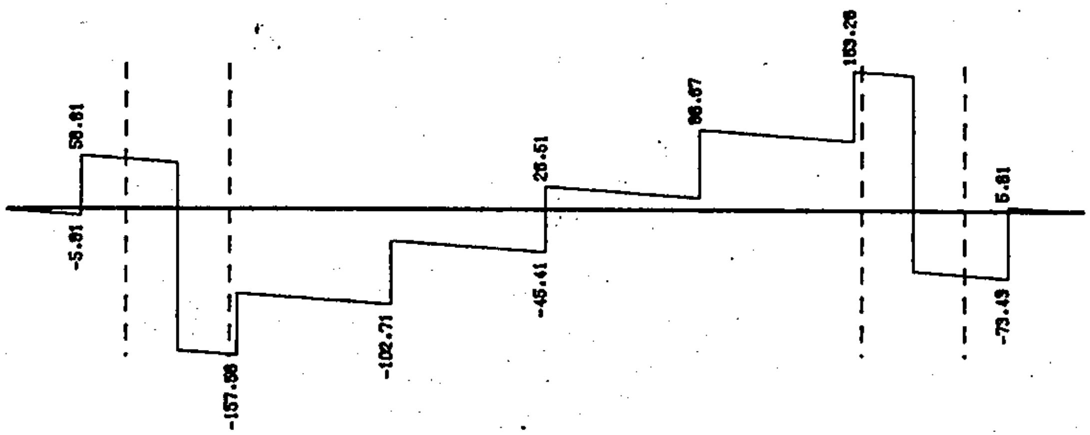
DOUBLE TRACK (3*10=30) C-2

CASE-12

BENDING MOMENT

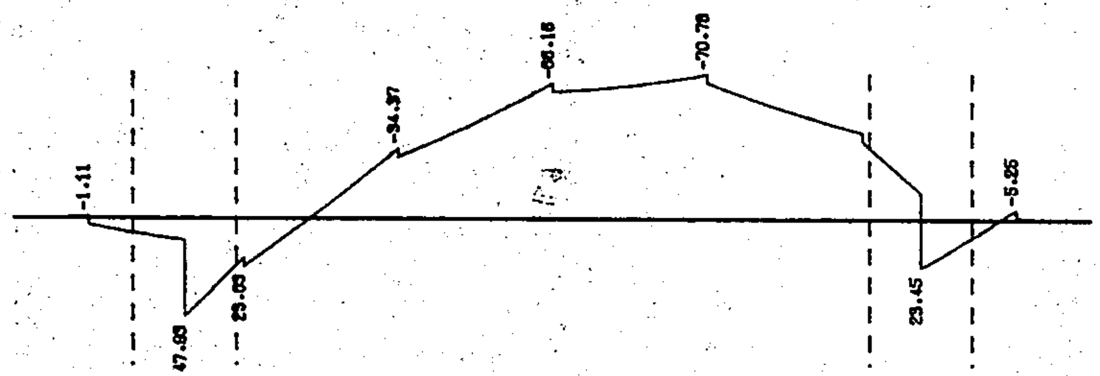


SHEARING FORCE

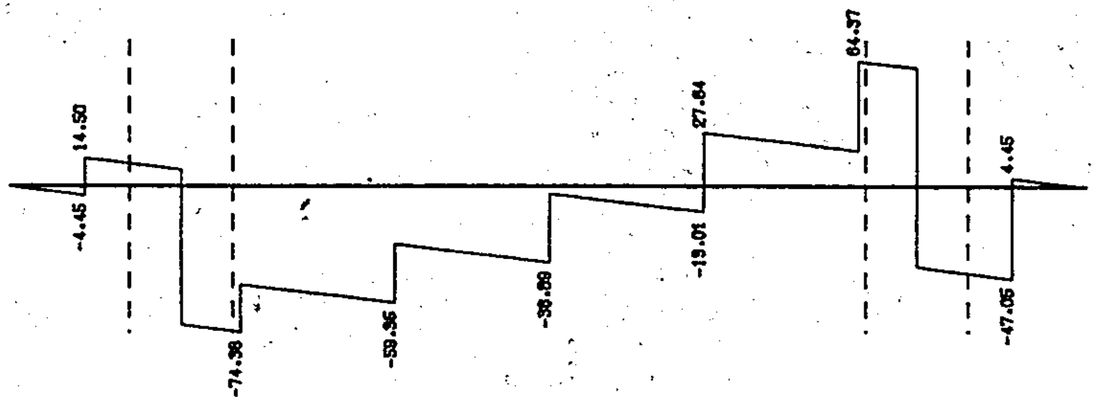


DOUBLE TRACK (3*10=30) C-2 | CASE-17

BENDING MOMENT



SHEARING FORCE



No. 352

INPUT DATA

```
===INPUT DATA CARD IMAGE===                                                    CARD
---------1---------2---------3---------4---------5---------6---------7---------8  NUMBER
TITLE     DOUBLE TRACK (3*10=30)  C-2                                               1
CONST        2    7       7.3         0       1.0       2.0         0     0.028     2
                0.8       0.2         0       7.3         0       2.5               3
                0.8       0.2      1.15       0.9      1.15       1.8               4
SWITCH       2    0    1    1    1    1    0    1    0    1    0                   5
COLC           1.15      6.15                                                       6
COLB            0.7       0.7                                                       7
COLH            0.7       0.7                                                       8
KUI            21.0      0.35 0.0006213   3500000        91       195         0     9
KL              0.5      1.55       2.6      3.65       4.7      5.75       6.8    10
KN                3         3         3         3         3         3         3    11
POINT    2      2.0       5.3                                                      12
FORCE    1     0.30     -0.30                                                      13
    1    1     0.12     -0.12                                                      14
  1.0    1   136.19    136.19                                                      15
FORCE    2    -2.15      2.15                                                      16
   10    2    -0.87      0.87                                                      17
  1.0    1   240.73    240.73                                                      18
FORCE    3    -2.15      2.15                                                      19
   10    2    -0.87      0.87                                                      20
  1.0    0   240.73    240.73                                                      21
FORCE    4    15.54     17.38                                                      22
   11    2     3.70      4.45                                                      23
 1.15    1   133.39    243.54                                                      24
FORCE    5    15.54     17.38                                                      25
   11    2     3.70      4.45                                                      26
 1.15    0   133.39    243.54                                                      27
FORCE    6    13.25     17.55                                                      28
   12    2     3.21      4.95                                                      29
 1.15    1   234.60    246.68                                                      30
FORCE    7    13.25     17.55                                                      31
   12    2     3.21      4.95                                                      32
 1.15    0   234.60    246.68                                                      33
FORCE    8    43.74     43.14                                                      34
   17    3    12.30     12.06                                                      35
 1.50    1   119.44    152.96                                                      36
PICKUP   1    1    1                                                               37
         2    2    8                                                               38
FINISH                                                                             39
```

```
DOUBLE TRACK (3*10=30)  C-2

  1) INPUT

     *SWITCH

      A) KISO     =    2           G) FURYOKU =    0
      B) KH       =    0           H) E-ANTEI2=    1
      C) DELTA-M  =    1           I) SUPPORT =    0
      D) KANSAN   =    1           J) E-DANMEN=    1
      E) E-ANTEI1=    1           K) OUTPUT  =    0
      F) PLOT     =    1

      HASHIRA  =         2 (HON)   KUI      =        7 (HON)

      HASHIRA                      DOSYA
         TAKASA=     0.000 ( M )      TAKASA=    1.000 ( M )

      KOU-SUII =     2.000 ( M )   TEI-SUII =    0.000 ( M )

      SUIHEI                       TANIJYURYO
         SHINDO =    0.028           (CONC) =    2.500 (T/M**3)
                                   TANIJYURYO
      ZENCHO   =     7.300 ( M )     (TSUCHI)=   1.800 (T/M**3)

     *KISO

      FH1      =     0.600 ( M )   BFH1     =    0.800 ( M )
      FH2      =     0.200 ( M )   BFH2     =    0.200 ( M )
      SF1      =     0.000 ( M )   BSR1     =    1.150 ( M )
      SR2      =     7.300 ( M )   BSR2     =    0.900 ( M )
      SR3      =     0.000 ( M )   BSR3     =    1.150 ( M )

     *HASHIRA

      HASHIRA        HASHIRA        HASHIRA
       CHUSHIN          HABA         OKUYUKI

           1.150         0.700          0.700
           6.150         0.700          0.700
```

No.857

DOUBLE TRACK (3*10=30) C-2

*KUI

```
KUICHO   =    21.000 ( M )    KUIKEI   =     0.350 ( M )

I        =  0.000621 (M**4)   E          = 0.350E+07 (T/M**2)
                              KUITOU
KH1      =    91.000 (T/M**3)  HENIRYOU=    0.000 ( M )

KH2      =   195.000 (T/M**3)
```

KUI CHUSHIN	KUI HONSU
0.500	3.000
1.550	3.000
2.600	3.000
3.650	3.000
4.700	3.000
5.750	3.000
6.800	3.000

2) LOAD

*CONCRETE

```
W =  54.20 (T)     H =    1.52 (T)     Y =   0.466 (M)
```

*DOSHA

```
W =  43.31 (T)     H =    1.21 (T)     Y =   1.460 (M)
```

*FURYOKU

```
W1=  46.72 (T)
W2=   0.00 (T)
```

PICK UP

DOUBLE TRACK (3*10=30) C-2

*** PICKUP - 1 *** (1)

C	L	CASE (MOMENT MAXIMUM)	M	S	CASE (MOMENT MINIMUM)	M	S
	0.000	(1)	0.000	0.000	(1)	0.000	0.000
	0.500	(1)	-1.670	-6.679	(1)	-1.670	-6.679
	0.500	(1)	-1.670	46.163	(1)	-1.670	46.163
	0.800	(1)	11.578	42.155	(1)	11.578	42.155
*	1.150	(1)	25.514	37.480	(1)	25.514	37.480
*	1.150	(1)	25.934	-98.710	(1)	25.934	-98.710
	1.500	(1)	-9.432	-103.385	(1)	-9.432	-103.385
	1.550	(1)	-14.618	-104.053	(1)	-14.618	-104.053
	1.550	(1)	-14.618	-51.211	(1)	-14.618	-51.211
	2.000	(1)	-39.016	-57.222	(1)	-39.016	-57.222
	2.600	(1)	-75.753	-65.237	(1)	-75.753	-65.237
	2.600	(1)	-75.753	-12.395	(1)	-75.753	-12.395
	3.650	(1)	-96.132	-26.421	(1)	-96.132	-26.421
	3.650	(1)	-96.132	26.421	(1)	-96.132	26.421
	4.700	(1)	-75.753	12.395	(1)	-75.753	12.395
	4.700	(1)	-75.753	65.237	(1)	-75.753	65.237
	5.300	(1)	-39.016	57.222	(1)	-39.016	57.222
	5.750	(1)	-14.618	51.211	(1)	-14.618	51.211
	5.750	(1)	-14.618	104.053	(1)	-14.618	104.053
	5.800	(1)	-9.432	103.385	(1)	-9.432	103.385
*	6.150	(1)	25.934	98.710	(1)	25.934	98.710
*	6.150	(1)	25.514	-37.480	(1)	25.514	-37.480
	6.500	(1)	11.578	-42.155	(1)	11.578	-42.155
	6.800	(1)	-1.670	-46.163	(1)	-1.670	-46.163
	6.800	(1)	-1.670	6.679	(1)	-1.670	6.679
	7.300	(1)	0.000	0.000	(1)	0.000	0.000

No.356

DOUBLE TRACK (3*10=30) C-2

C	L	CASE	M	S	CASE	M	S
		------SHEARING MAXIMUM-------			------SHEARING MINIMUM-------		
	0.000	(1)	0.000	0.000	(1)	0.000	0.000
	0.500	(1)	-1.670	-6.679	(1)	-1.670	-6.679
	0.500	(1)	-1.670	46.163	(1)	-1.670	46.163
	0.800	(1)	11.578	42.155	(1)	11.578	42.155
*	1.150	(1)	25.514	37.480	(1)	25.514	37.480
*	1.150	(1)	25.934	-98.710	(1)	25.934	-98.710
	1.500	(1)	-9.432	-103.385	(1)	-9.432	-103.385
	1.550	(1)	-14.618	-104.053	(1)	-14.618	-104.053
	1.550	(1)	-14.618	-51.211	(1)	-14.618	-51.211
	2.000	(1)	-39.016	-57.222	(1)	-39.016	-57.222
	2.600	(1)	-75.753	-65.237	(1)	-75.753	-65.237
	2.600	(1)	-75.753	-12.395	(1)	-75.753	-12.395
	3.650	(1)	-96.132	-26.421	(1)	-96.132	-26.421
	3.650	(1)	-96.132	26.421	(1)	-96.132	26.421
	4.700	(1)	-75.753	12.395	(1)	-75.753	12.395
	4.700	(1)	-75.753	65.237	(1)	-75.753	65.237
	5.300	(1)	-39.016	57.222	(1)	-39.016	57.222
	5.750	(1)	-14.618	51.211	(1)	-14.618	51.211
	5.750	(1)	-14.618	104.053	(1)	-14.618	104.053
	5.800	(1)	-9.432	103.385	(1)	-9.432	103.385
*	6.150	(1)	25.934	98.710	(1)	25.934	98.710
*	6.150	(1)	25.514	-37.480	(1)	25.514	-37.480
	6.500	(1)	11.578	-42.155	(1)	11.578	-42.155
	6.800	(1)	-1.670	-46.163	(1)	-1.670	-46.163
	6.800	(1)	-1.670	6.679	(1)	-1.670	6.679
	7.300	(1)	0.000	0.000	(1)	0.000	0.000

No. 357

DOUBLE TRACK (3*10=30) C-2

*** PICKUP - 2 *** (10, 10, 11, 11, 12, 12, 17)

C	L	CASE	MOMENT MAXIMUM M	MOMENT MAXIMUM S	CASE	MOMENT MINIMUM M	MOMENT MINIMUM S
	0.000	(10)	0.000	0.000	(12)	0.000	0.000
	0.500	(11)	-0.756	-3.025	(10)	-1.670	-6.679
	0.500	(17)	3.027	14.503	(10)	-1.670	76.031
	0.800	(10)	20.584	70.470	(11)	6.877	20.351
*	1.150	(10)	44.929	67.349	(17)	10.573	8.715
*	1.150	(12)	50.336	-152.916	(11)	29.926	-99.109
	1.500	(17)	22.602	-73.934	(10)	-19.593	-178.056
	1.550	(17)	16.894	-74.379	(10)	-28.512	-178.724
	1.550	(17)	23.034	-49.999	(10)	-28.512	-96.014
	2.000	(17)	-0.367	-54.006	(10)	-73.286	-102.574
	2.600	(17)	-34.373	-59.349	(10)	-136.690	-110.039
	2.600	(17)	-30.233	-29.544	(10)	-136.690	-27.330
	3.650	(17)	-66.163	-38.894	(10)	-172.750	-41.355
	3.650	(17)	-62.022	-3.665	(10)	-172.750	41.355
	4.700	(17)	-70.779	-13.015	(10)	-136.690	27.330
	4.700	(17)	-66.639	27.639	(10)	-136.690	110.039
	5.300	(17)	-51.658	22.296	(12)	-75.309	82.182
	5.750	(11)	-27.614	66.063	(17)	-42.527	18.289
	5.750	(11)	-26.113	138.725	(17)	-38.386	64.367
	5.800	(10)	-19.067	175.131	(17)	-35.179	63.922
*	6.150	(10)	41.909	173.381	(17)	-13.352	60.805
*	6.150	(11)	47.968	-74.873	(17)	23.448	-41.262
	6.500	(11)	21.091	-77.586	(17)	8.461	-44.379
	6.800	(10)	-0.870	-72.557	(17)	-5.253	-47.051
	6.800	(12)	-0.756	3.025	(10)	-1.670	6.679
	7.300	(12)	0.000	0.000	(10)	0.000	0.000

No. 358

DOUBLE TRACK (3*10=30) C-2

C	L	CASE	M (Shearing Maximum)	S (Shearing Maximum)	CASE	M (Shearing Minimum)	S (Shearing Minimum)
	0.000	(11)	0.000	0.000	(10)	0.000	0.000
	0.500	(11)	-0.756	-3.025	(10)	-1.670	-6.679
	0.500	(10)	-1.670	76.031	(17)	3.027	14.503
	0.800	(10)	20.539	72.024	(17)	6.978	11.832
*	1.150	(10)	44.823	68.035	(17)	10.573	8.715
*	1.150	(17)	47.933	-70.817	(10)	41.909	-173.381
	1.500	(17)	22.602	-73.934	(10)	-19.593	-178.056
	1.550	(17)	16.894	-74.379	(10)	-28.512	-178.724
	1.550	(17)	23.034	-49.999	(10)	-27.832	-99.443
	2.000	(17)	-0.367	-54.006	(10)	-73.286	-102.574
	2.600	(17)	-34.373	-59.349	(10)	-136.690	-110.039
	2.600	(10)	-136.690	-27.330	(12)	-109.264	-36.160
	3.650	(11)	-117.246	-37.262	(12)	-151.075	-45.414
	3.650	(10)	-172.750	41.355	(17)	-62.022	-3.665
	4.700	(10)	-136.082	30.713	(17)	-70.779	-13.015
	4.700	(10)	-136.690	110.039	(17)	-66.639	27.639
	5.300	(10)	-73.286	102.574	(17)	-51.658	22.296
	5.750	(10)	-27.832	99.443	(17)	-42.527	18.289
	5.750	(10)	-28.512	178.724	(17)	-38.386	64.367
	5.800	(10)	-19.593	178.056	(17)	-35.179	63.922
*	6.150	(10)	41.909	173.381	(17)	-13.352	60.805
*	6.150	(17)	23.448	-41.262	(11)	47.876	-75.469
	6.500	(17)	8.461	-44.379	(11)	21.051	-78.938
	6.800	(17)	-5.253	-47.051	(11)	-3.153	-82.422
	6.800	(10)	-1.670	6.679	(11)	-0.756	3.025
	7.300	(10)	0.000	0.000	(11)	0.000	0.000

No. 359

DOUBLE TRACK (3*10=30) C-2

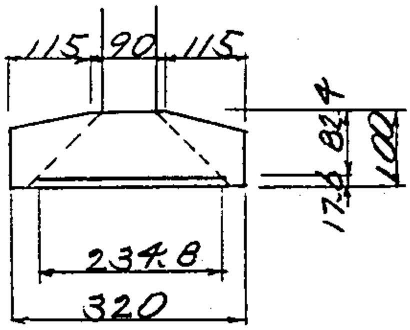
CASE	V MAX	V MIN	DELTA H
1	17.614	17.614	0.000
10	27.570	27.570	0.000
10	25.345	25.345	0.000
11	33.821	11.363	0.388
11	31.597	9.138	0.388
12	30.373	24.769	0.389
12	28.148	22.544	0.389
17	25.751	9.478	1.232

No. 360

1) Intermediate part

i) Bottom side

$M = 50.34^{tm}$



$A_s = \phi 19 - 15^{cm}$ ctc

$= 2.865 \times \frac{234.8}{15} = 44.85^{cm^2}$

$p = \frac{44.85}{234.8 \times 82.4}$

$= 0.00232$

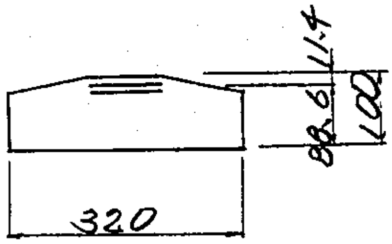
From ehe Nomogram M-1,

$1/L_c = 9.36 \qquad 1/L_s = 467$

$\sigma_c = \frac{50.34 \times 10^5}{234.8 \times 82.4^2} \times 9.36 = 29.6^{kg/cm^2} < 90^{kg/cm^2}$

$\sigma_s = \qquad " \qquad \times 467 = 1480" < 1800"$

ii) Top side



$M = -172.75^{tm}$

$A_s = D32 - \frac{8}{8} = 127.07^{cm^2}$

$p = \frac{127.07}{320 \times 88.6}$

$= 0.00448$

From the Nomogram M-1

$1/L_c = 7.29 \qquad 1/L_s = 248$

$\sigma_c = \frac{172.75 \times 10^5}{320 \times 88.6^2} \times 7.29 = 50.1^{kg/cm^2} < 90^{kg/cm^2}$

$\sigma_s = \quad " \quad \times 248 = 1710^{"} < 1800^{"}$

Check, safe against cracking

$M = -96.13^{tm}$

$\sigma_{sd} = \frac{96.13 \times 10^5}{320 \times 88.6^2} \times 248 = 950^{kg/cm^2} < 1600^{kg/cm^2}$

2). Shearing stress h/2 point from column front

$S = 102.57^t$ (case 10)

$r = \frac{2 \times 82.4}{110} = 1.498 < 4$

$P = 25.35 \times 3 = 76.02^t$

$P' = \frac{76.02}{1.498} = 50.75^t$

$S = 102.57 - (76.02 - 50.75) = 77.30^t$

$\tau = \frac{77.30 \times 10^3}{320 \times 82.4} = 2.93\ kg/cm^2 < 3.9\ kg/cm^2$

5.10 Calculation of shoes and beam supporting parts

(1) Calculation of shoes

1. Load Calculation

(1) Dead load

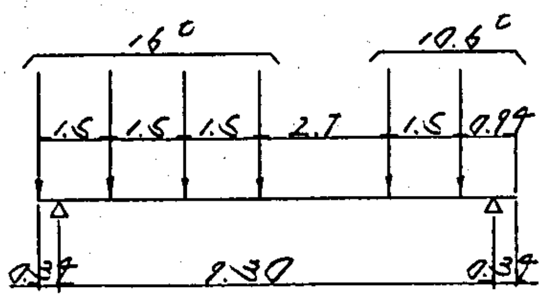
Reaction of T section simple beam

$R = 118.90^t$

Reaction per one shoe

$R_d = 118.90 \times 1/2 = 59.45^t$

(2) Train load + Impact



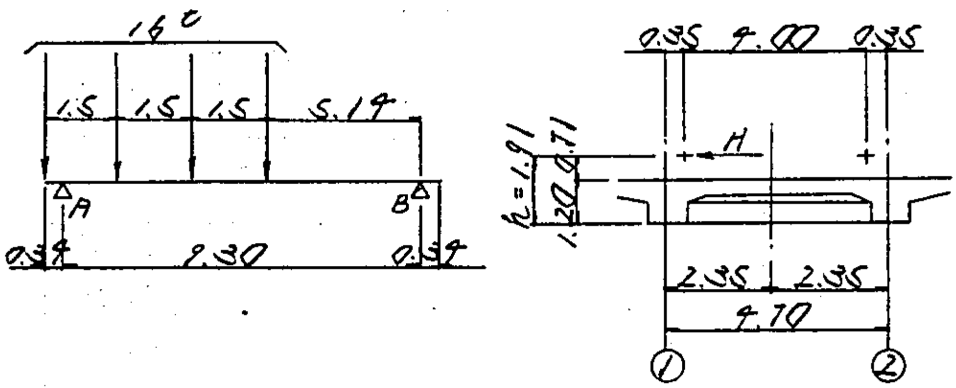
Impact coefficient $i = 0.417$

Reaction per one shoe

$R_{L+i} = \frac{1}{9.30} \times \{10.6 \times 2 \times 1.69 + 16 \times 4 \times 7.39\} \times 1.417$

$= 77.52^t$

(3) Lateral load caused by rolling stocks



$$RA = \frac{1}{9.30} \times 16 \times 4 \times 7.39 = 50.86^{t}$$

$$H = 50.86 \times 0.15 = 7.63^{t}$$

$$N = \pm \frac{H \cdot h}{l} = \pm \frac{7.63 \times 1.91}{4.70} = \pm 3.10^{t}$$

(4) Summary of reactions of beam

		①	②
Vertical load	Dead load	59.95	59.95
	Train load + Impact	77.52	77.52
	Lateral load of Rolling stocks	-3.10	-3.10
	Dead load + Train load + Impact	136.97	136.97
	Dead load + Train load + Impact + Latral load (α = 1.15)	140.07 (121.80)	133.87 (116.41)
Horizontal force	Seismic load	7.13	7.13

- Values in ( ) are the converted figures of nomal condition
- Seismic load is referred the Explanations in Page 377 Explanation

2. Calculation of rubber shoes

(1) Required area for supporting load

$$15 \leqq \frac{R}{A} \leqq 80$$

$R_{max} = 136.97^{t}$ $R_{min} = 59.45^{t}$

Hence,

$$\frac{R_{max}}{80} \leqq A \leqq \frac{R_{min}}{15}$$

$$\frac{R_{max}}{80} = \frac{136.97 \times 10^3}{80} = 1\,710^{cm^2}$$

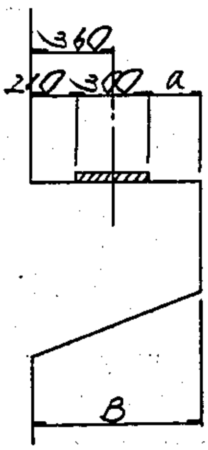
$$\frac{R_{min}}{15} = \frac{59.45 \times 10^3}{15} = 3\,960^{cm^2}$$

Assumed the size of rubber shoe as

$60^{cm} \times 30^{cm}$

$A = 60 \times 30 = 1\,800^{cm^2}$

Width of beam supporting part



$a \geqq 150$ ($l = 10^{m}$ or less)

$B = 210 + 300 + \overset{a}{150}$

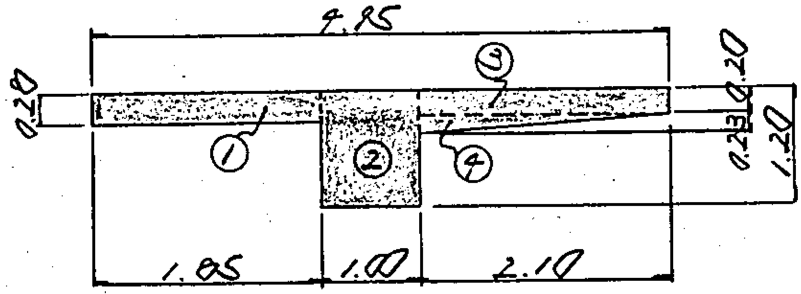
$= 650^{mm}$

$\therefore$ Say, 700^{mm}

(2) Relative displacement between beam and substructure

(a) Displacement of beam caused by the deflection of beam : Δl_a

i) Calculation of beam deflection



	b (m)	h (m)	A (m²)	y (m)	A·y (m³)
①	1.850	0.280	0.518	0.140	0.07252
②	1.000	1.200	1.200	0.600	0.72000
③	2.100	0.200	0.420	0.100	0.04200
④	2.100	0.230/2	0.242	0.277	0.06703
Σ	—	—	2.380	—	0.90155

$$y = \frac{0.90155}{2.380} = 0.379^{m}$$

	b (m)	h (m)	A (m²)	y_0 (m)	I_0 (m⁴)	$A \cdot y_0^2$ (m⁴)	$I_0 + A \cdot y_0^2$ (m⁴)
①	1.850	0.280	0.518	0.239	0.00338	0.02959	0.03297
②	1.000	1.200	1.200	0.221	0.14400	0.05861	0.20261
③	2.100	0.200	0.420	0.279	0.00140	0.03269	0.03409
④	2.100	0.230/2	0.242	0.102	0.00071	0.00252	0.00323
Σ	—	—	2.380	—	0.14949	0.12341	0.27290

$$I = 0.27290^{m^4}$$

Magnitude of vertical deflection at the beam center point

$E = 2.7 \times 10^6\ t/m^2$

$I = 0.27290\ m^4$

(a) Deflection caused by dead load

Uniformly distributed load (From reaction calculation of T section simple beam)

$Rd = 118.90 - \overset{(\text{Cross Beam})}{5.96} = 112.94\ t$

$Wd = \dfrac{112.94}{10.00} = 11.29\ t/m$

$\delta_1 = \dfrac{5 w l^4}{384 EI} = \dfrac{5 \times 11.29 \times 9.30^4}{384 \times 2.7 \times 10^6 \times 0.27290}$

$= 0.00149\ m$

(b) Deflection caused by train load

Maximum bending moment at the center point of span

(KS-16) $Ml = 116.89 \times \dfrac{16}{18} = 103.90\ tm$

$\delta_2 = \dfrac{5 Ml\, l^2}{48 EI} = \dfrac{5 \times 103.90 \times 9.30^2}{48 \times 2.7 \times 10^6 \times 0.27290}$

$= 0.00127\ m$

Deflection caused by (Train load + Impact)

$\delta_3 = 0.00127 \times 1.417 = 0.00180\ m$

ii) Displacement of beam caused by bending deflection : Δl_2

a) Dead load

$\Delta l_2 = h \cdot \alpha$ (Semi-fixed)

h: Distance from beam bottom to neutral axis

$h = 1.20 - 0.379 = 0.821^m$

α: Deflection angle of beam at the support point (Radian)

$\delta = 0.00149^m$ (from calculation of T section simple beam)

$l = 9.30^m$ (Span)

$\alpha = 3.2 \times \frac{\delta}{l}$

$= \frac{3.2 \times 0.00149}{9.30} = 0.00051$

$\Delta l_\alpha = 82.1 \times 0.00051 = 0.04^{cm}$

b) Train load

$\delta = 0.00127^m$

$\alpha = \frac{3.2 \times 0.00127 \; (0.00180)}{9.30} = 0.00056 \; (0.00079)$

Value in ( ) is the case considered impact

$$\Delta l_{al} = 82.1 \times 0.00056 = 0.05^{cm}$$

$$\Delta l_{al+i} = 82.1 \times 0.00079 = 0.06^{cm}$$

(b) Displacement of beam caused by temperature change : Δl_t

$$\Delta l_t = \Delta t \cdot \alpha \cdot l$$

Δt : Temperature change $\pm 20°C$

α : Coefficient of linear expansion of beam $1 \times 10^{-5}/°C$

l : Span $l = (30.00 + 9.30) \times 1/2 = 19.65^{m}$

Hence,

$$\Delta l_t = \pm 20 \times 10^{-5} \times 19.65 = \pm 0.0039^{m} = \pm 0.39^{cm}$$

(c) Displacement of beam caused by drying contraction : Δl_s

$$\Delta l_s = \varepsilon_{cs} \cdot l$$

ε_{cs} : Ratio of drying contraction of concrete 20×10^{-5}

Hence,

$$\Delta l_s = 20 \times 10^{-5} \times 19.65 = 0.0039^{m} = 0.39^{cm}$$

(d) Displacement in horizontal direction in case of earthquake

Displacement caused by horizontal force in case of earthquake

$$\Delta e_1 = \frac{H \cdot t}{G \cdot Ac} = \frac{7.13 \times 10^3 \times 1.2}{8.0 \times 1800} = 0.59^{cm}$$

Relative displacement between beam and substructure

$$\Delta e_2 = 0.5^{cm}$$

(e) Required thickness Σte

a) Normal case

$$\Delta n = \Delta l_d + \Delta l_t + \Delta l_s + \Delta l_e$$

$$= 0.04 - 0.39 - 0.39 = -0.74^{cm}$$

$$\Sigma te_1 = \frac{\Delta n}{0.7} = \frac{0.74}{0.7} = 1.06^{cm}$$

b) Temporary case

$$\Delta n' = \Delta n + \Delta l_{ye} = -0.74 + 0.05 = -0.69^{m}$$

$$\Sigma te_2 = \frac{\Delta n'}{0.7} = \frac{0.69}{0.7} = 0.99^{cm}$$

c) Earthquake Case

$$\Delta E = \Delta la + \Delta lt + \Delta ls + (\Delta e_1 + \Delta e_2)$$

$$= 0.07 - 0.39 - 0.39 - (0.51 + 0.50)$$

$$= -1.83^{cm}$$

$$\Sigma t_{eq} = \frac{\Delta E}{2.0} = \frac{1.83}{2.0} = 0.92^{cm}$$

Therefore, use $te = 12^{mm}$ of one layer.

(3) Restricted tortional strain corresponding to deflection ange at the support point

(a) $\Sigma \Delta te > \frac{a}{2} \tan\alpha$

$\Sigma \Delta te$: Average deformation of rubber shoe in vertical direction (cm)

a : Side length of rubber shoe in direction of bridge axis (cm)

α : Angle between beam bottom face and support face at the support point

$$\Delta te = ct \cdot \frac{f}{G} \cdot \frac{te^3}{a_o^2}$$

ct : Factor determined by the ratio of both side lengths (Refer explanation chart 179-1)

$$\frac{b_o}{a_o} = \frac{60}{30} = 2.00 \text{ then, } ct = 1.955$$

f : Bearing stress of rubber shoe in vertical direction (kg/cm^2)

(Dead load) $fd = \frac{Rd}{A} = \frac{59.45 \times 10^3}{30 \times 60} = 33.03 \ kg/cm^2$

(Train load + Impact) $f_{l+i} = \frac{R_{l+i}}{A} = \frac{77.52 \times 10^3}{30 \times 60} = 43.07$ "

G : Elastic modulus of rubber shoe in terms of shear (kg/cm^2)

Subjected dead load $G = 6.2\ kg/cm^2$

Subjected live load $G = 8.0$ "

te : Thickness of rubber shoe, one layer $te = 12^{mm}$

$$\Delta ted = 1.955 \times \frac{33.03}{6.2} \times \frac{1.2^3}{30^2} = 0.015^{cm}$$

$$\Delta teli = 1.955 \times \frac{43.07}{8.0} \times \frac{1.2^3}{30^2} = 0.015 \text{ "}$$

Hence, $\Delta te = 0.015 + 0.015 = 0.030^{cm}$

$$\alpha = 0.00051 + 0.00079 = 0.00130$$

Hence, $\frac{a \cdot \tan\alpha}{2} = \frac{30 \times 0.00130}{2} = 0.020^{cm}$

$< \Sigma\Delta te = 0.030^{cm}$

(b) Maximum deformation in vertical direction

: $\Sigma\Delta temax$

$$\Sigma\Delta temax = \Sigma\Delta te + a \cdot \tan\alpha/2$$

$$= 0.030 + 0.020 = 0.050^{cm}$$

$$0.15 \cdot \Sigma te = 0.15 \times 1.2 = 0.18^{cm} > \Sigma\Delta temax$$

(4) Safety analysis in terms of buckling when subjected vertical load

$a, b \geqq 5 \cdot \Sigma te$

$a = 30^{cm}, \; b = 60^{cm} > 5 \times 1.2 = 6.0^{cm}$

Analyzes as above, dimensions of rubber shoe are determined as fallows.

Bridge axis direction $a = 30^{cm}$

Cross sectional direction $b = 60^{cm}$

Thickness of the layer $t = 1.2^{cm}$ Use one layer

Gross thickness 1.9^{cm} (Including stainless steel cover plates)

(2) Calculation of stopper made of steel rod

1. Horizontal seismic load applied for the Stopper desigh

$Ksh = \Delta f \cdot Kh$

Δf : Extra factor

In direction of bridge axis $\Delta f = 1.2$

In direction of cross section $\Delta f = 1.4$

Kh : Horizontal seismic load for desigh $Kh = 0.10$

Horizontal seismic load applied for the stopper desigh will be,

Bridge axis $Ksh = 1.2 \times 0.10 = 0.12$

Cross sextion $Ksh = 1.4 \times 0.10 = 0.14$

2. Horizontal force acting the stopper

(1) Bridge axis

One unit stopper per one main girder is equipped, with semi-rigid construction.

(a) Seismic force due to dead weight

$Hsd = Ksh \cdot Rd$

$= 0.12 \times 59.45 = 7.13^{t}$

(2) Cross sectional direction

(a) Seismic load due to dead weight

$$Hsd = Ksh \cdot Rd$$

$$= 0.14 \times 59.45 = 8.32^{t}$$

Analysed as above, horizontal force calculation is made based on the case in cross sectional direction

3. Stress calculation of the stopper made of steel rod

(1) Shearing stress

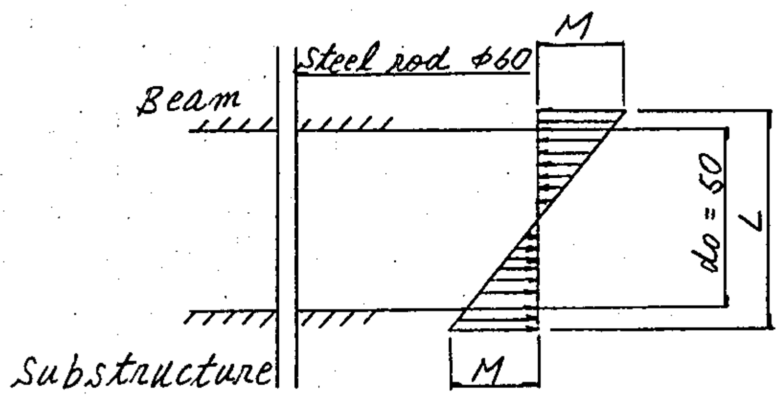
Steel rod $\phi = 60^{mm}$ (SS41) $As = 28.27\ cm^2$

$$H = 8.32^{t}$$

$$\tau = \frac{H}{As}$$

$$= \frac{8.32 \times 10^3}{28.27} = 290\ kg/cm^2 < 850 \times 1.5 = 1275\ kg/cm^2$$

(2) Bending stress



$L = d_o + 1/2 \cdot \phi = 50 + 60 \times 1/2 = 80^{mm}$

$H = 8.32^{t}$

$M = \frac{1}{2} \cdot H \cdot L$

$= \frac{1}{2} \times 8.32 \times 0.08 = 0.33^{tm}$

Section modulus $Z = \frac{\pi \cdot \phi^3}{32} = 0.098 \cdot \phi^3$

$\sigma_s = \frac{M}{Z}$

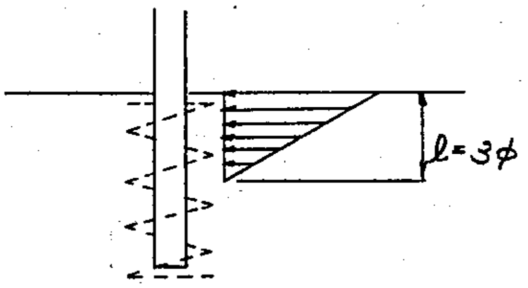
$= \frac{0.33 \times 10^5}{0.098 \times 6.0^3} = 1\,560^{kg/cm^2} < 1\,500 \times 1.5 = 2\,250^{kg/cm^2}$

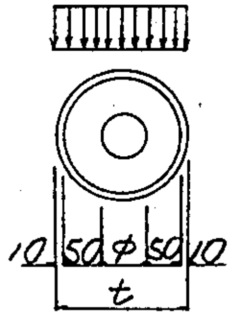
(3) Combined stress

$\sqrt{\left(\frac{\sigma_s}{\sigma_{sa}}\right)^2 + \left(\frac{\tau}{\tau_a}\right)^2} = \sqrt{\left(\frac{1\,560}{2\,250}\right)^2 + \left(\frac{290}{1\,275}\right)^2}$

$= 0.73 < 1.1$

4. Calculation of bearing stress of concrete





$$\sigma_c = \frac{2 \cdot H}{l t}$$

$$H = 8.32^{t}$$

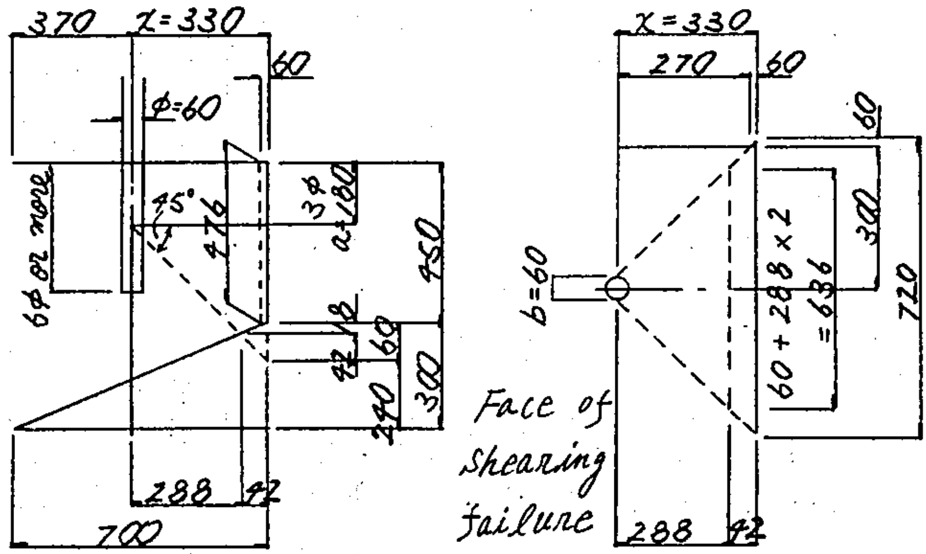
$$l = 3 \cdot \phi = 3 \times 6.0 = 18.0^{cm}$$

$$t = 6.0 + (5.0 + 1.0) \times 2 = 18.0^{cm}$$

$$\sigma_c = \frac{2 \times 8.32 \times 10^3}{18.0 \times 18.0} = 51.4 \ kg/cm^2 < \sigma_{ca} = 240 \times 0.8 = 192 \ kg/cm^2$$

(3) Calculation of related of the stopper installation

1. Shearing strees calculation



Shearing stress

$$\tau = \frac{H}{A\tau}$$

$$A\tau = \sqrt{2}\, x\,(2x + 2a + b)$$

τ : Shearing stress

$A\tau$: Area of the face of shearing failure

$$A\tau = \sqrt{2} \times 33.0 \times (2 \times 33.0 + 2 \times 18.0 + 6.0)$$

$$- (72.0 + 63.6) \times 1/2 \times 4.2 \times \sqrt{2}$$

$$- 6.0 \times 4.2 \times 1/2 \times \sqrt{2} \times 2$$

$$- (47.6 + 45.0) \times 1/2 \times 6.0 \times \sqrt{2}$$

$$= 4\ 209.0\ \text{cm}^2$$

$H = 7.13^t$ (In direction of railway profile)

$$\tau = \frac{7.13 \times 10^3}{4209.0} = 1.69^{kg/cm^2} < 3.9^{kg/cm^2}$$

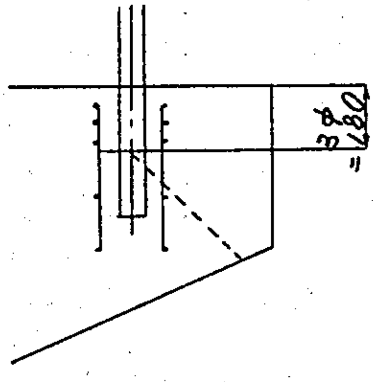
2. Reinforcing bar arrangement around the part of stopper installation

$$As' = \frac{H}{\sigma sa}$$

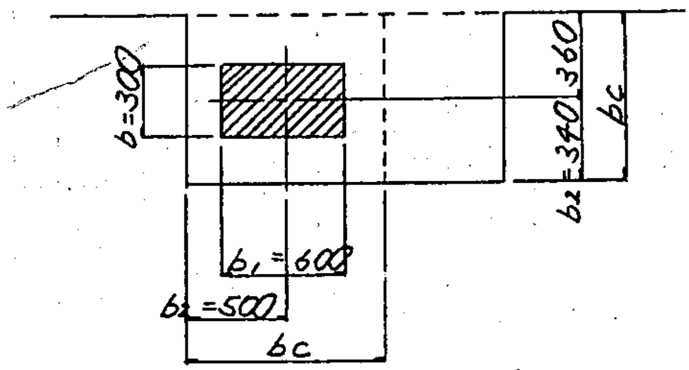
$$= \frac{7.13 \times 10^3}{2000 \times 1.5} = 2.38^{cm^2}$$

$As = D13 - 3\ bars = 3.80^{cm^2} > As' = 2.38^{cm^2}$

Therefor, D13 - 3 bars are arranged within the range of 3ϕ.



(4) Calculation of shoe bed part subjected vertical load



1. Reinforcing bar arrangement for vertical load

$$As = \frac{1}{4}\left(1 - \frac{b_1}{bc}\right)\frac{R}{\sigma sa}$$

Where, As : Sectional area of bars (cm²)

σsa : Allowable tensile stress of bar (kg/cm²)

$\sigma sa = 2\,000$ kg/cm² (SD35)

R : Vertical force acting on shoe bed (kg)

$R = 59.45 + 77.52 = 136.97$ kg/cm²

b_1 : Acting width of bearing force (cm)

bc : Distributing width of bearing power (cm)

$bc = 2 \cdot b_2$

(1) In direction of bridge axis

$b_1 = 30.0^{cm}$ $b_2 = 34.0^{cm}$

$bc = 2 \cdot b_2 = 2 \times 34.0 = 68.0^{cm}$

$$As = \frac{1}{4} \times \left(1 - \frac{30.0}{68.0}\right) \times \frac{136.97 \times 10^3}{2\,000} = 9.57^{cm^2}$$

(2) In direction of bridge cross section

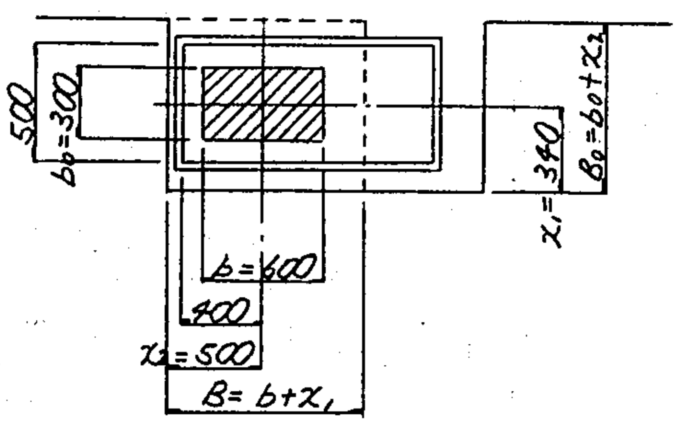
$b_1 = 6.00^{cm}$ $b_2 = 50.0^{cm}$

$bc = 2 \cdot b_2 = 2 \times 50.0 = 100.0^{cm}$

$$As = \frac{1}{4} \times \left(1 - \frac{60.0}{100}\right) \times \frac{136.97 \times 10^3}{2\,000} = 6.85^{cm^2}$$

2. Bar arrangement

Range of bar arrangement



$B.B_0$: Range of bar arrangement

(1) In direction of bridge axis

$B' = b + x_1$

$= 60.0 + 34.0 = 94.0^{cm} > 2 \times 34.0 = 68^{cm}$

Therefore, the range of bar arrangement will be,

$B = 34.0 + \frac{94.0}{2} = 81.0^{cm}$

Use D16 - 150 ctc (n = 6 bars,) then

$As = 1.986 \times 6 = 11.92\ cm^2 > 9.57\ cm^2$

(2) In direction of bridge cross section

$Bo' = bo + x_2$

$= 30.0 + 50.0 = 80.0^{cm} > 50.0^{cm}$

Therefore, the range of bar arrangement will be,

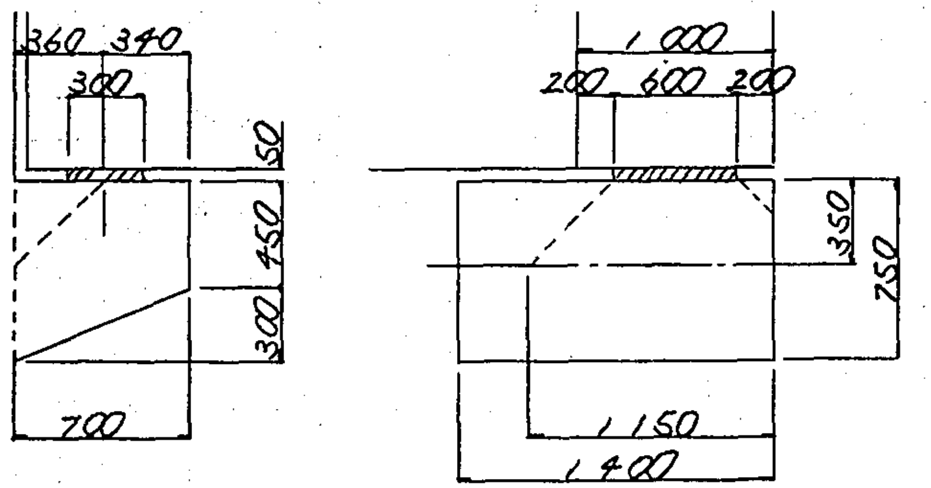
$Bo = 50^{cm}$

Use D16 - 150 ctc (4 bars) then

$As = 1.986 \times 4 = 7.94\ cm^2 > 6.85\ cm^2$

(5) Calculation of beam supporting part

1. Bending stress calculation



Effective width $B = 0.60 + 0.20 + 0.35 = 1.15^m$

(1) Load calculation

(a) Reaction of T section simple beam

Referred the summary table of shoe calculation and beam reaction,

$Rd = 59.45^t$

$Re + i = 77.52^t$

(b) Own weight of beam support part

$W_1 = 2.5^{t/m^3} \times 0.70 \times 0.45 = 0.79^{t/m}$

$W_2 = 2.5'' \times 0.70 \times 0.30 \times 1/2 = 0.26''$

$Wd = 1.05^{t/m}$

(2) Bending moment calculation

Stress per $B = 1.00^{m}$ of effective width

(a) Dead load

$M_d = 59.45 \times 0.36 + 0.79 \times 1.00 \times 0.70 \times 1/2$

$+ 0.26 \times 1.00 \times 0.70 \times 1/3$

$= 21.74^{tm}$

(b) Train load + Impact

$M_{l+i} = 77.52 \times 0.36 = 27.91^{tm}$

(c) Dead load + Train load + Impact

$\Sigma M = 21.74 + 27.91 = 49.65^{tm}$

(3) Allowable stress, safe against cracking

$$Md = 21.74^{tm}$$

$$Me+i = 27.91''$$

$$\Sigma M = 49.65^{tm}$$

$$\alpha = \frac{ML}{\Sigma M} = \frac{27.91}{49.65} = 0.56 > 0.25$$

Hence, determined $\sigma sa = 1\,000^{kg/cm^2}$

(4) Allowable stress for members that may be affected by fatigue of the material

Load sharing ratio is assumed, as 1.0

$$l = 9.30^{m} < 10^{m} \rightarrow \sigma rao = 1600^{kg/cm^2}$$

$$\sigma min = 700^{kg/cm^2} \quad (\text{dead load})$$

$$\sigma sa = \sigma min + (1 - \frac{\sigma min}{5\,000}) \times \sigma rao$$

$$= 700 + (1 - \frac{700}{5\,000}) \times 1\,600$$

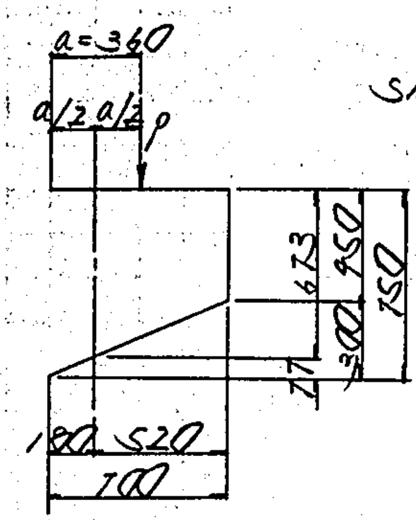
$$= 2\,070^{kg/cm^2} > 2\,000^{kg/cm^2}$$

(5) Bending stress calculation

M (tm)	21.74	49.65	
N (t)			
S (t)			
b (cm)	100	100	
h (cm)	75	75	
d (cm)	69.4	69.4	
d' (cm)	5.6	5.6	
As (cm^2)	D32-125ctc = 63.54	D32-125ctc = 63.54	
p	0.00914	0.00914	
As' (cm^2)			
p'			
e=M/N (cm)			
e=M/N+u (cm)			
e=M/N−u (cm)			
e/h			
d/e			
d'/h			
d'/d			
Ne/bd^2 (kg/cm^2)			
k			
c			
j			
1/Lc		6.12	
1/Ls	154	154	
β=σs/σc			
σc (kg/cm^2)	27.6	63.1	
σs (kg/cm^2)	700	1 590	
τ (kg/cm^2)			
σsa (kg/cm^2)	1 000	2 000	
σca (kg/cm^2)	90	90	
τa (kg/cm^2)			
Nomogram number	M − 1	〃	
combination	D	D+T+I	

2. Calculation of Shearing Stress

Referred R.C. Standard 39 (1).(a).(b),



Shearing stress is calculated at the a/2 point.

Effective width is assumed as the full width.

$b = 140^{cm}$

$d = 67.3 - 5.6 = 61.7^{cm}$

(1) Shearing force

$P = 59.45 + 77.52 = 136.97^{t}$

$a = 0.36^{m} \quad d = 0.617^{m}$

$$\gamma = \frac{2}{a/d} = \frac{2 \times 0.617}{0.36} = 3.428 < 4$$

Therefore, $\gamma = 3.428$

$$S = \frac{P}{\gamma} = \frac{136.97}{3.428} = 39.96^{t}$$

$$\Sigma S = 39.96 + 2.5 \times 0.52 \times 0.45 \times 1.40$$
$$+ 2.5 \times 0.52 \times 0.223 \times 1/2 \times 1.40 = 40.98^{t}$$

(2) Shearing stress

$$\tau = \frac{S}{b \cdot d} \quad \frac{40.98 \times 10^3}{140 \times 61.7} = 4.74 \ kg/cm^2 < \tau_a = 3.9 \ kg/cm^2$$

(3) Bar arrangement for resisting against diagonal tension

Shearing force per unit one meter

$S = \Sigma S / \text{Effective with } B = 1.40^{m}$

$= \frac{136.97}{1.40} = 97.84^{t}$

$As' = \frac{S \cdot \sqrt{2}}{\sigma sa}$ $\quad \sigma sa = 1\,800\ kg/cm^2$

$= \frac{97.84 \times 10^3 \times \sqrt{2}}{1\,800} = 76.87\ cm^2$

Use diagonal tension bars D29-125 ctc (8 bars)

$As1 = 7.942 \times 8 = 63.54\ cm^2$

$As2 = 63.54 \times \frac{1\,800 - 1\,310}{1\,800 \times \sqrt{2}} = 12.23\ cm^2$

$As = 75.77\ cm^2 < As' = 76.87\ cm^2$

3. Extra bars arranged at the side face of beam support

Extra bars are arranged at the side face, with use of bars of 40% cross section of bending stress and installed in three steps formation.

$As' = 63.54 \times 0.40 = 25.42 \, cm^2$

Use extra bars of D19-250^{ctc} (9 bars) in three steps then,

$As = 2.865 \times 9 \times 3 = 77.30 \, cm^2 > As' = 25.42 \, cm^2$

4. Bar arrangement chart