CALCULATION OF LIVE LOAD REACTION FOR PIER SUBSTRUCTURE
FOR SIMPLY SUPPORTED SPANS OF A TWO LANE BRIDGE STRUCTURE

Centre line of pier w.r.t. the bearings :-

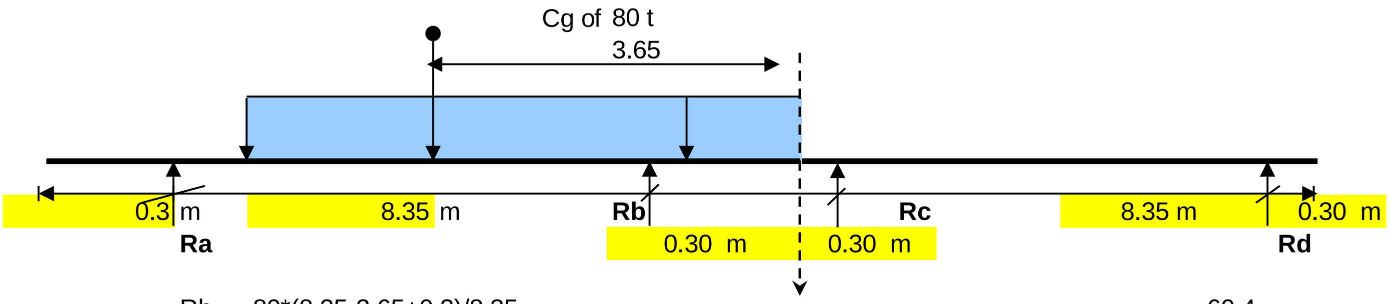
Rb	=	**0.3**	m
Rc	=	**0.3**	m

Reaction has been calculated for the following cases

1. One lane of class 70-R(W)
2. One lane of class - A
3. Two lane of class - A
4. Three lane of class - A
5. One lane of class 70-R(W) + One lane of class - A

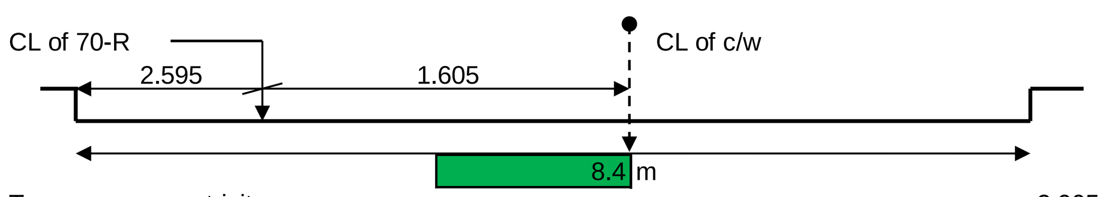
Condition A: **MAXIMUM LONGITUDINAL MOMENT CASE**

Case 1: **One lane of class 70-R(W)**



Rb = 80*(8.35-3.65+0.3)/8.35		=	60.4	t
Rc =		=	0.0	t
Ra=		=	19.6	t
Vert.Reaction=	60.4 + 0	=	60.4	t
Braking Force, B =	0.2*80	=	16.0	t
Dead load reaction on the pier , Rg		=	485.0	t
Value of " μ " =		=	0.00	
Horizontal force due to temperature, T = μ*(Rg+Ra)		=	0.0	t
Design horizontal force is higher of either (B/2+T) or (B-T)		=	16.0	t

(neglecting shear rating of elastomeric bearing in the adjacent span, which is on the conservative side)

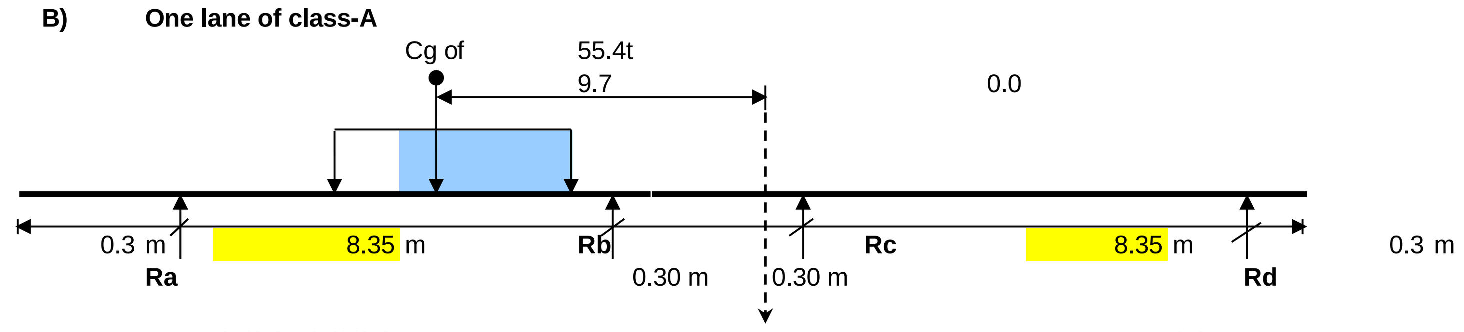


Transverse eccentricity		=	2.905	m
Transverse moment =	2.905*(60.4 + 0)	=	175.3	t.m
Long. moment =	60.4*0.3-0*0.3	=	18.1	t.m
Long. Eccentricity (for input)		=	0.300	m

span	load	cg
4.42	51	1.93
5.79	68	2.895
7.92	80	3.65
9.44	92	4.4
13.4	100	5.12

8.78

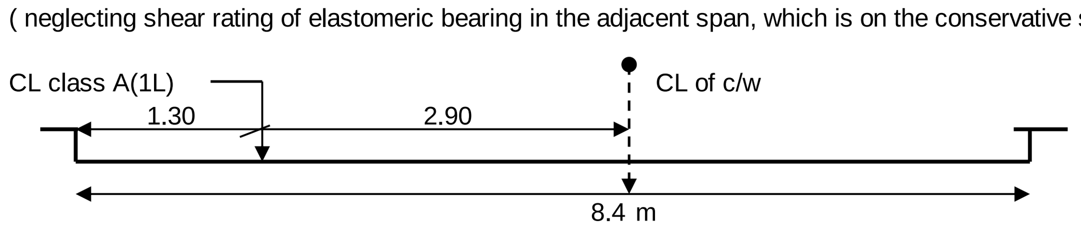
B) **One lane of class-A**



Rc = 0*(8.35-0.3)/8.35		=	0.0	t
Rb = 55.4*(8.35-9.7+0.3/2)/8.35		=	7.0	t
Ra=		=	48.4	t
Vert.Reaction =	48.4 + 7	=	55.4	t
Braking Force, B =	0.2*(0+55.4)	=	11.1	t
Dead load reaction on the pier , Rg		=	485.0	t
Value of " μ " =		=	0.00	
Horizontal force due to temperature, T = μ*(Rg+Ra)		=	0.0	t
Design horizontal force is higher of either (B/2+T) or (B-T)		=	11.1	t

(neglecting shear rating of elastomeric bearing in the adjacent span, which is on the conservative side)

SPAN	LOAD	CG
5.5	29.6	1.73
8.5	36.4	2.99
11.5	43.2	4.33
14.5	50	5.71
24	50	5.71
8.78		



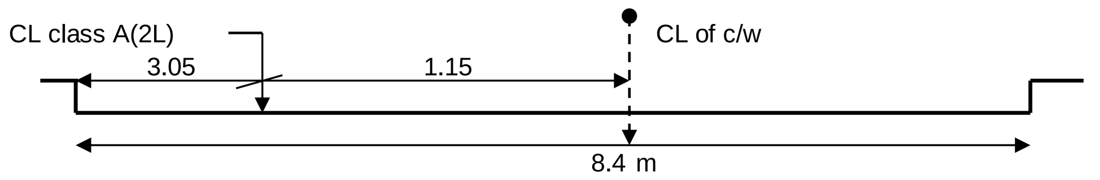
Transverse eccentricity		=	2.90	m
Transverse moment =	2.9*55.4	=	160.7	t.m
Long. moment =	7*0.3-0*0.3	=	2.1	t.m
Long. Eccentricity (for input)		=	0.038	m

Case 3 : **Two lane of class-A**

Rc = 2*0		=	0.0	t
Rb = 2*7		=	13.9	t
Ra=		=	96.9	t
Vert.Reaction =	0 + 13.9	=	13.9	t
Braking Force(For single lane only)		=	11.1	t
Dead load reaction on the pier , Rg		=	485.0	t
Value of " μ " =		=	0.00	
Horizontal force due to temperature, T = μ*(Rg+Ra)		=	0.0	t

Design horizontal force is higher of either (B/2+T) or (B-T)		=	11.1	t

(neglecting shear rating of elastomeric bearing in the adjacent span, which is on the conservative side)

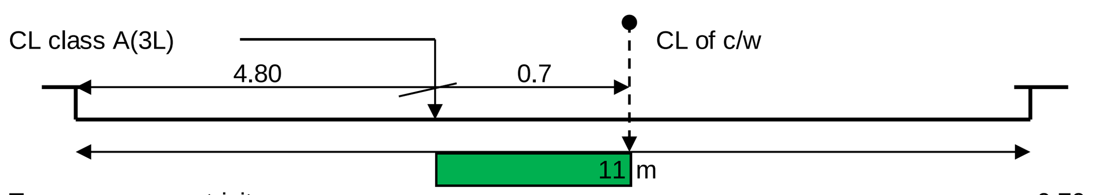


Transverse eccentricity		=	1.15	m
Transverse moment =	1.15*13.9	=	16.0	t.m
Long. moment =	13.9*0.3-0*0.3	=	4.2	t.m
Long. Eccentricity (for input)		=	0.300	m

Case 4 : **Three lane of class-A**

Rc = 90% of 3*0		=	0.0	t
Rb = 90% of 3*7		=	18.8	t
Ra=		=	61.1	t
Vert.Reaction =	0 + 18.8		18.8	
Braking Force, B =	(0.2)*55.4+0.05*55.4	=	13.9	t
(5% extra taken for third lane)				
Dead load reaction on the pier , Rg		=	485.0	t
Value of " μ " =		=	0.00	
Horizontal force due to temperature, T = μ*(Rg+Ra)		=	0.0	t
Design horizontal force is higher of either (B/2+T) or (B-T)		=	13.9	t

(neglecting shear rating of elastomeric bearing in the adjacent span, which is on the conservative side)

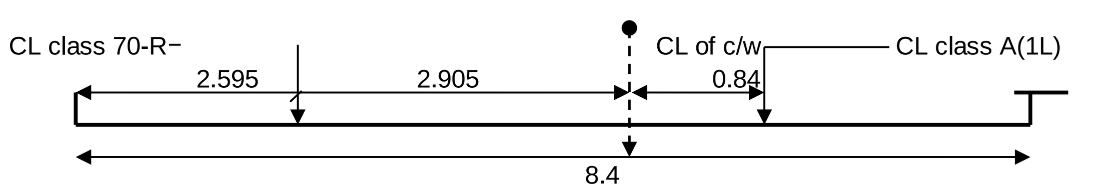


Transverse eccentricity		=	0.70	m
Transverse moment =	0.7*18.8	=	13.2	t.m
Long. moment =	18.8*0.3-0*0.3	=	5.6	t.m
Long. Eccentricity (for input)		=	0.300	m

Case 5 : **One lane of class-70R(W)+One lane of class-A**

Rc = 90% of(0+0)		=	0.0	t
Rb = 90% of(6.97+60.36)		=	60.6	t
Ra=		=	61.3	t
Braking Force =	16 + 5% of 55.4	=	18.8	t
(5% extra taken for class A)				
Dead load reaction on the pier , Rg		=	485.0	t
Value of " μ " =		=	0.00	
Horizontal force due to temperature, T = μ*(Rg+Ra)		=	0.0	t
Design horizontal force is higher of either (B/2+T) or (B-T)		=	18.8	t

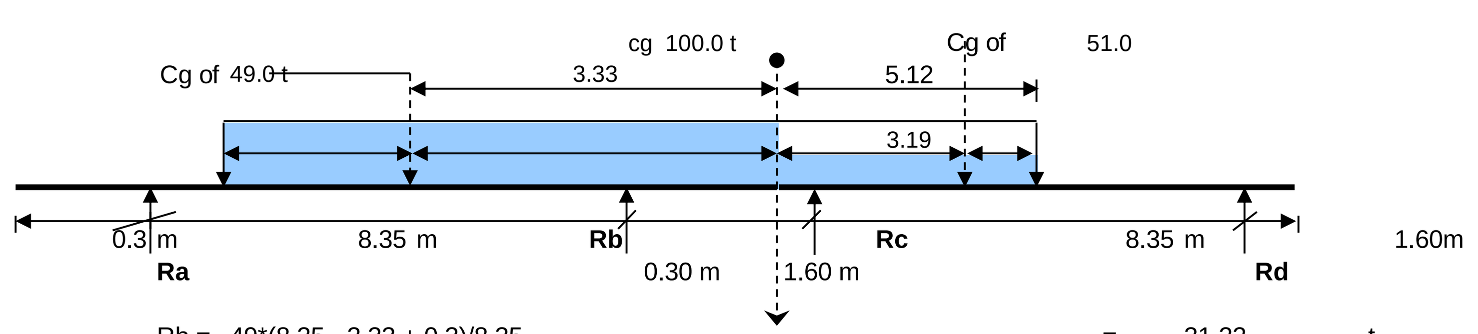
(neglecting shear rating of elastomeric bearing in the adjacent span, which is on the conservative side)



Transverse ecc.(class 70 R)		=	2.905	m
Transverse ecc.(class A)		=	-0.84	m
Trans. moment =	0.9*(60.4*2.905-55.4*-0.84)	=	115.9	
Net transverse ecc. (for input)		=	1.913	t.m
Long. moment =	60.6*0.3-0*0.3	=	18.2	t.m
Long. Eccentricity (for input)		=	0.300	m

Condition B: **MAXIMUM TRANSVERSE MOMENT / REACTION CASE**

CASE 1: **ONE LANE OF CLASS 70-R(W)**



first span		
SPAN	LOAD	CG
8.28	49	3.33
5.04	58	2.18
8.95		

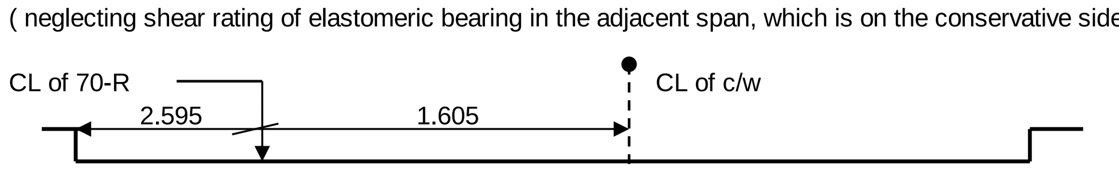
second span		
SPAN	LOAD	CG
3	80	3.65
4.52	92	4.4
8.48	100	5.12
24	100	5.12
8.95		

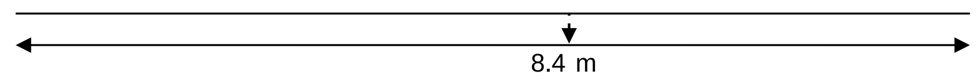
second span		
4.4	34	3.715
5.12	51	3.19
11.55		

first span		
3	17	0.87
4.52	29	1.75
8.48	41	2.56
24	49	3.53
8.95		

Rb = 49*(8.35 - 3.33 + 0.3)/8.35		=	31.22	t
Rc = 51*(8.35-3.19+1.6)/8.35		=	21.74	t
Ra=		=	27.3	t
Vert. Reaction =	31.2 + 21.7	=	53.0	t
Braking Force, B =	0.2*100	=	20.0	t
Dead load reaction on the pier , Rg		=	485.0	t
Value of " μ " =		=	0.00	
Horizontal force due to temperature, T = μ*(Rg+Ra)		=	0.0	t
Design horizontal force is higher of either (B/2+T) or (B-T)		=	20.0	t

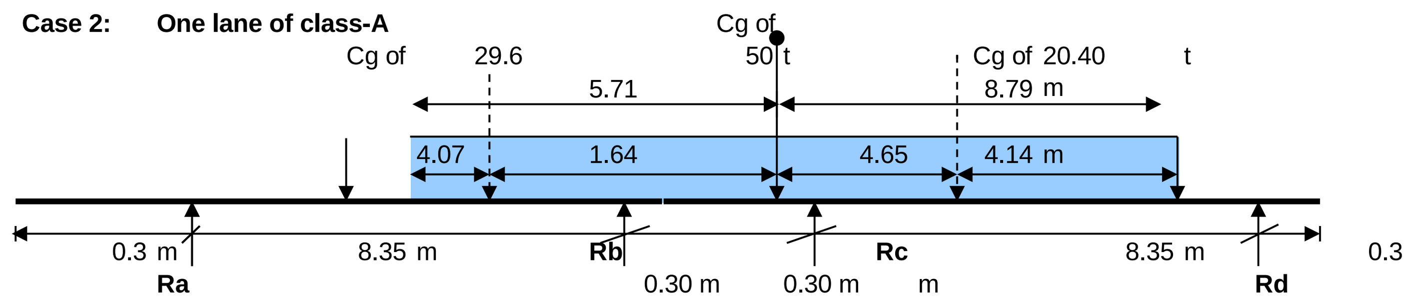
(neglecting shear rating of elastomeric bearing in the adjacent span, which is on the conservative side)





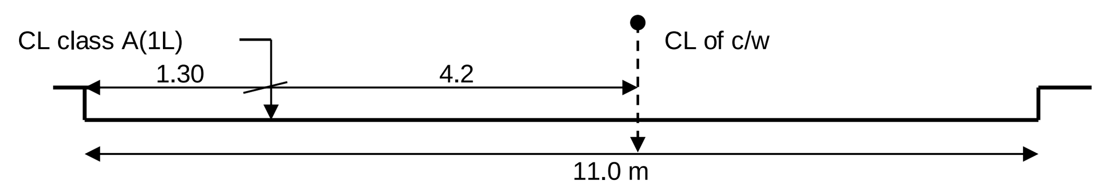
Transverse eccentricity		=	2.905	m
Transverse moment =	2.905*(31.2 + 21.7)	=	154.0	t.m
Long. moment =	31.22*0.3-21.74*0.3	=	2.8	t.m
Long. Eccentricity (for input)		=	0.054	m

Case 2: One lane of class-A



Rc =	20.4*(8.35-4.65+0.3)/8.35	=	9.77	t
Rb =	50*(8.35-1.64+0.3)/8.35	=	24.85	t
Ra=		=	4.8	t
Vert.Reaction =	9.77 + 24.85	=	34.62	t
Braking Force, B =	0.2*(50)	=	10.0	t
Dead load reaction on the pier , Rg		=	485.0	t
Value of " μ " =		=	0.00	
Horizontal force due to temperature, T = μ*(Rg+Ra)		=	0.0	t
Design horizontal force is higher of either (B/2+T) or (B-T)		=	10.0	t

(neglecting shear rating of elastomeric bearing in the adjacent span, which is on the conservative side)

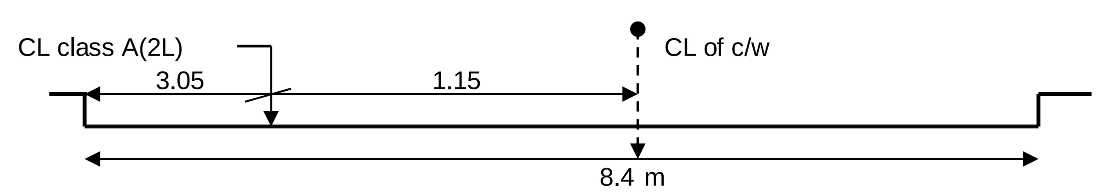


Transverse eccentricity		=	4.20	m
Transverse moment =	4.2*34.6	=	145.4	t.m
Long. moment =	24.8*0.3-9.8*0.3	=	4.5	t.m
Long. Eccentricity (for input)		=	0.131	m

Case 3 : Two lane of class-A

Rc =	2*9.8	=	19.5	t
Rb =	2*24.8	=	49.7	t
Ra=		=	9.5	t
Vert.Reaction =	19.5 + 49.7	=	69.2	t
Braking Force(For single lane only)		=	11.1	t
Dead load reaction on the pier , Rg		=	485.0	t
Value of " μ " =		=	0.00	
Horizontal force due to temperature, T = μ*(Rg+Ra)		=	0.0	t
Design horizontal force is higher of either (B/2+T) or (B-T)		=	11.1	t

(neglecting shear rating of elastomeric bearing in the adjacent span, which is on the conservative side)

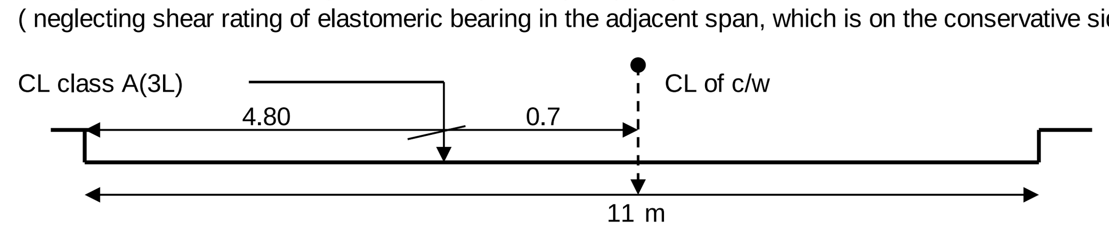


Transverse eccentricity		=	1.15	m
Transverse moment =	1.15*69.2	=	79.6	t.m
Long. moment =	49.7*0.3-19.5*0.3	=	9.0	t.m
Long. Eccentricity (for input)		=	0.131	m

Case 4 : Three lane of class-A

Rc =	90% of 3*9.8	=	26.4	t
Rb =	90% of 3*24.8	=	67.1	t
Ra=		=	12.8	t
Vert.Reaction =	26.4 + 67.1		93.5	
Braking Force, B =	(0.2)*55.4+0.05*55.4	=	13.9	t
(5% extra taken for third lane)				
Dead load reaction on the pier end , Rg		=	485.0	t
Value of " μ " =		=	0.00	
Horizontal force due to temperature, T = μ*(Rg+Ra)		=	0.0	t
Design horizontal force is higher of either (B/2+T) or (B-T)		=	13.9	t

(neglecting shear rating of elastomeric bearing in the adjacent span, which is on the conservative side)



Transverse eccentricity		=	0.70	m
Transverse moment =	0.7*93.5	=	65.4	t.m
Long. moment =	67.1*0.3-26.4*0.3	=	12.2	t.m
Long. Eccentricity (for input)		=	0.131	m

Case 5 : One lane of class-70R(W)+One lane of class-A

Rc =	90% of(9.77+21.74)	=	28.4	t
Rb =	90% of(24.85+31.22)	=	50.5	t
Ra=		=	29.5	t

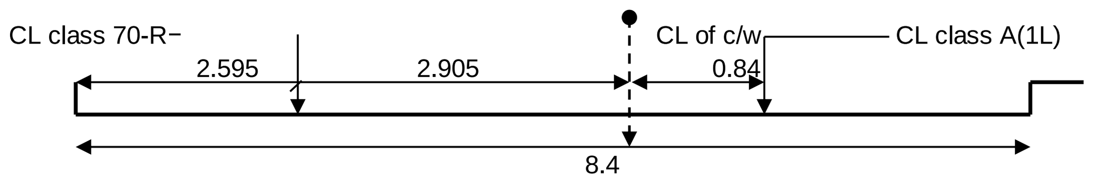
two span length	load	cg6.8 end	cg2.7 end
9	27.2	4.5	4.5
13.3	38.6	7.1	6.2
14.5	50	8.79	5.71
18.7	52.7	9.24	9.46
18.8	55.4	9.71	9.09
17.6	55.4	9.71	9.09

load	Span2load	cg 6.8	load	Span2 load	cg 6.8
27.2	13.6	1.5	55.4	27.2	4.5
38.6	20.4	4.14	52.7	27.2	4.5
50	20.4	4.14	50	20.4	4.14
52.7	27.2	4.5	38.6	20.4	4.14
55.4	27.2	4.5	27.2	13.6	1.5
			span2	8.78	

load 1	Cg 2.7 end	load 1	Cg 2.7 end
13.6	1.5	28.2	4.07
18.2	1.81	25.5	3.4
25.5	3.4	29.6	1.73
28.2	4.07	18.2	1.81

Braking Force =	16 + 5% of 55.4	=	18.8	t
(5% extra taken for class A)				
Dead load reaction on the pier , Rg		=	485.0	t
Value of " μ " =		=	0.00	
Horizontal force due to temperature, T = μ*(Rg+Ra)		=	0.0	t
Design horizontal force is higher of either (B/2+T) or (B-T)		=	18.8	t

(neglecting shear rating of elastomeric bearing in the adjacent span, which is on the conservative side)



Transverse ecc.(class 70 R)		=	2.905	m
Transverse ecc.(class A)		=	-0.84	m
Trans. moment =	0.9*(60.4*2.9-0*-0.8)	=	112.4	
Net transverse ecc. (for input)		=	1.426	t.m
Long. moment =	50.5*0.3-28.4*0.3	=	6.6	t.m
Long. Eccentricity (for input)		=	0.084	m