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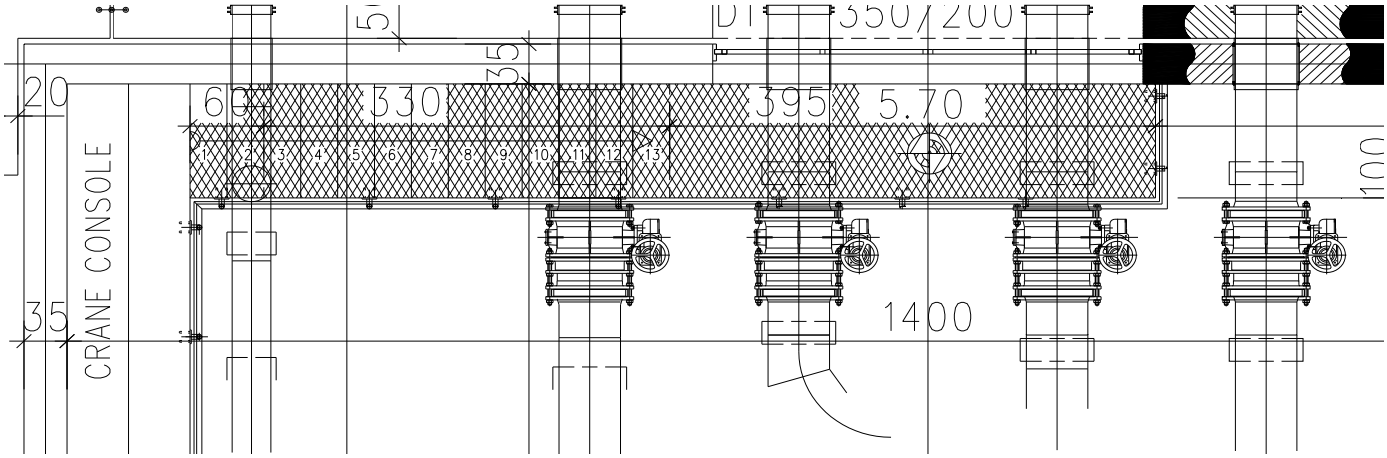
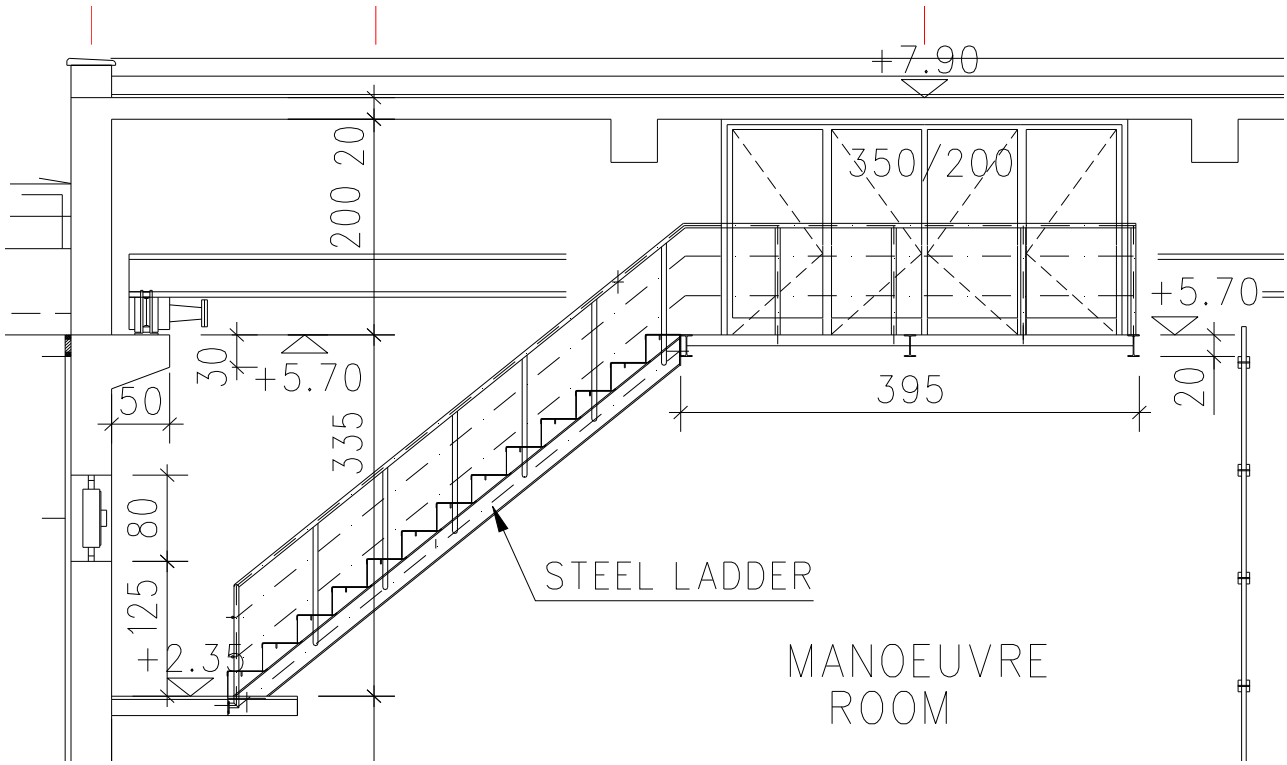
Architectural Plans and Sections



No. 1-02-0004-INF-OZA-ARC-DRW-DWST-R5/1-0004 was taken from the drawing.

Stair Plan



No. 1-02-0004-INF-OZA-ARC-DRW-DWST-R5/1-0005 was taken from the drawing.

Stair Section

Metarial Specification

Structural Steal Property Data

Material Type :	**St 37 -2**	= S235JRG2
Used Standard :	DIN17100	referans from libyan steel company (www.libyansteel.com)

Weight per Unit Volume (W) :	7.85E-05
Modulus of Elasticity (E) :	210000
Poisson's Ratio (U) :	0.3
Cofficient of Thermal Expansion (A) :	1.20E-05
Shear Modulus (G) :	80769
Minimum Yield Stress (Fy) :	240
Minimum Tensile Stress (Fu) :	370

All Units are N. , mm. , C.

Structural Bolt and Nut Property Data

Material Type :	**8.8**
Used Standard :	DIN7990
Minimum Yield Stress (Fy) :	640
Minimum Tensile Stress (Fu) :	800

All Units are N. , mm. , C.

Design Standard

AISC-ASD89 be used as the design standard. (USA Steel Standart for Allowable Stress)

Load Analysis

Platform Covering and Step

Load Table (MPa)		
	G	Q
Platform	0.0008	0.005
Step	reel section	0.005

Important Notes :
Steps and platform cover will be manufactured 6x7.5 section checkered plate.
Weight of the real section will be calculated by sap2000 programs.

G : dead load
Q : live load

Important Notes 2 :
Wind load shall not be taken because this structure is in the building.
Earthquake load shall not be taken because this structure is connected to concrete.

Used Fabrication Section Profil

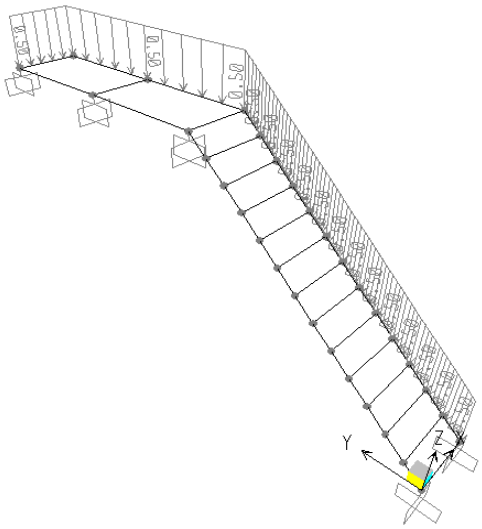
UNP and INP Profile Series used at this project.
Profile of the weights shall be calculated by Sap2000 Programs.

Handrail Design and Load

Will be assigned to a distributed load 0.5 N/mm for handrail.
Design will be made with profile of the pipe section.

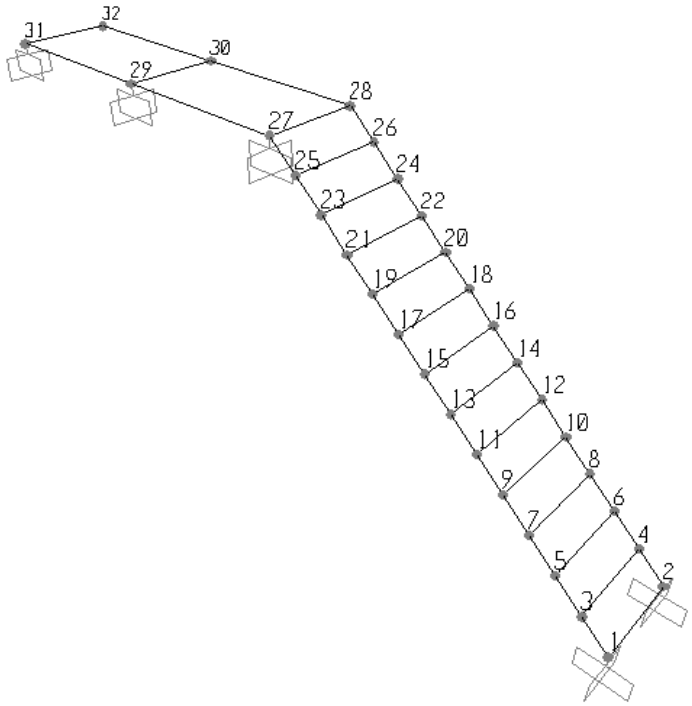
Design Combination

1.00 Dead Load + 1.00 Live Load

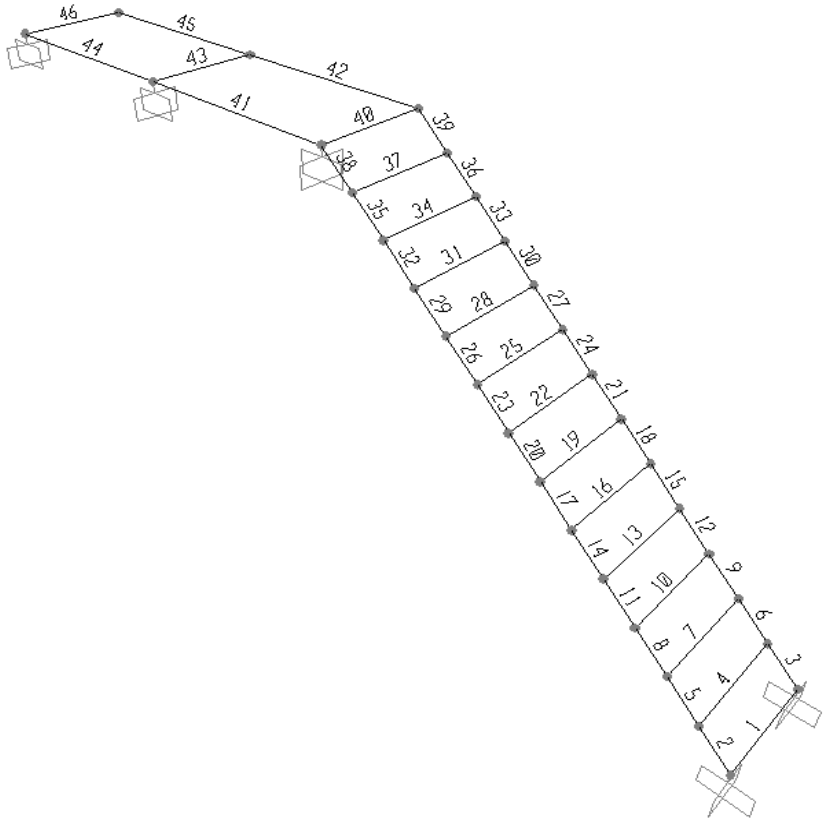


Assign to Handrail Dead Load

Structural Program Input Data

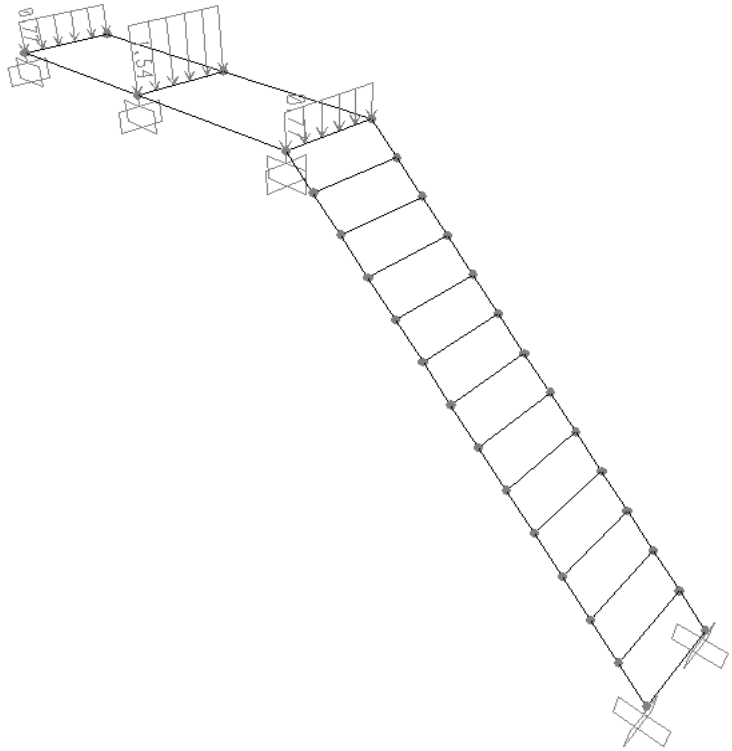


System Joint Label

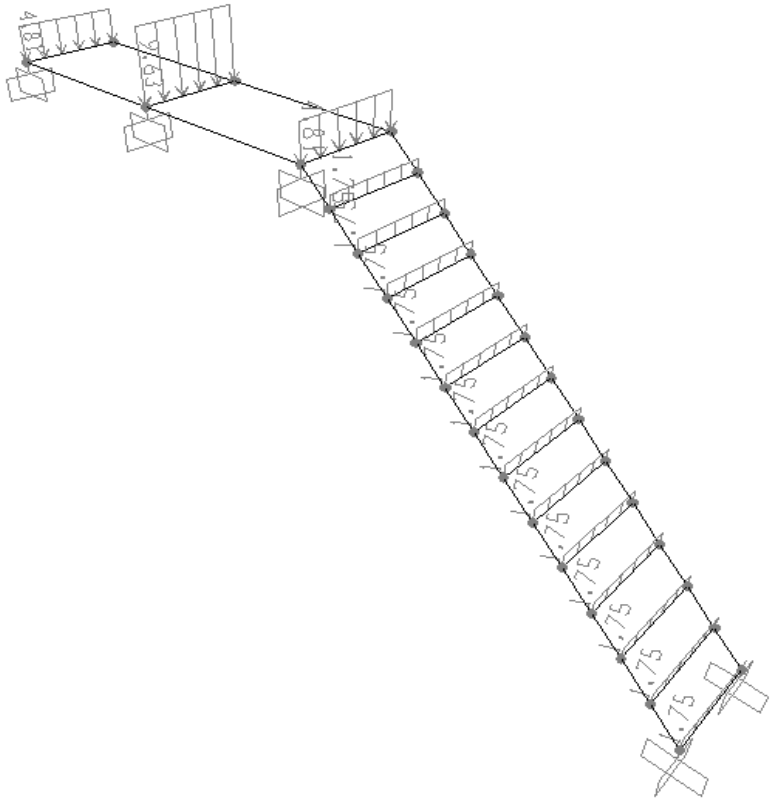


System Frame Label

Structural Program Input Data

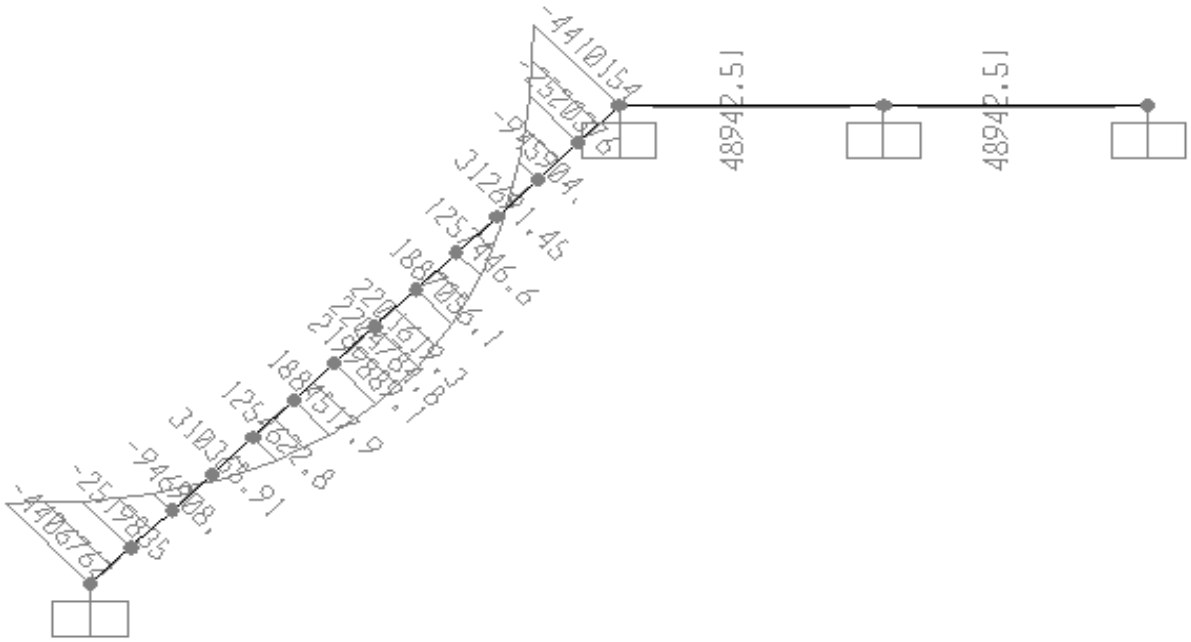


Assign to Platform Cover Dead Load

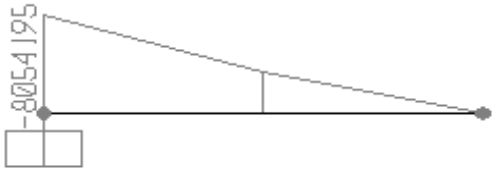


Assign to Live Load

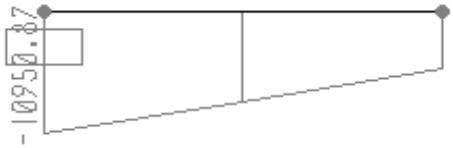
Structural Analysis Output



Stairs Main Beam Moment Diagram



Platform Beam Moment Diagram



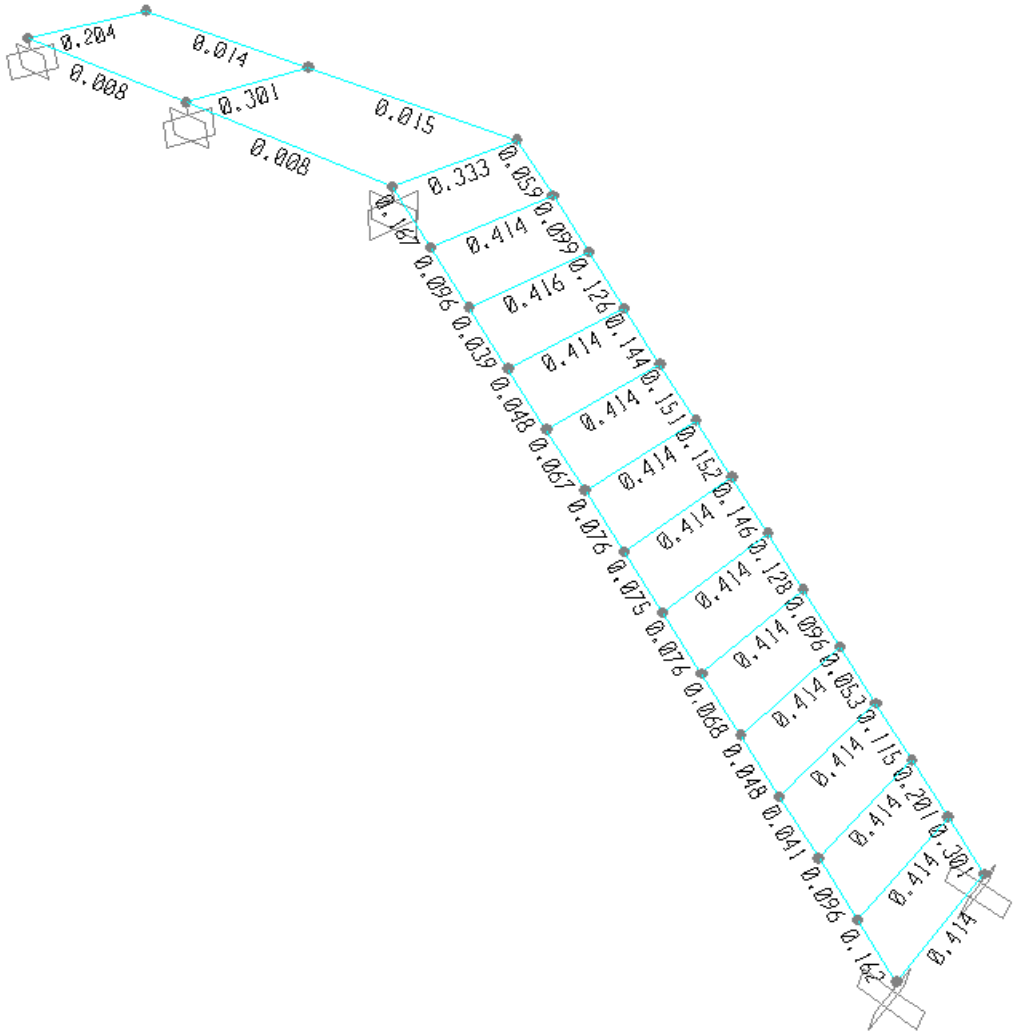
Platform Beam Shear Force Diagram

All Units are N. , mm. , C.

Steel Design Output

TABLE: Steel Design 1 - Summary Data - AISC-ASD89									
Frame	DS	ST	Status	Ratio	RT	Combo	Loc.	ErrMsg	WarnMsg
Text	Text	Text	Text	Unitless	Text	Text	mm	Text	Text
42	UPN200	Beam	No Mes.	0.0153	PMM	COMB1	962.5	No Mes.	No Mes.
45	UPN200	Beam	No Mes.	0.014	PMM	COMB1	962.5	No Mes.	No Mes.
41	UPN100	Beam	No Mes.	0.0083	PMM	COMB1	962.5	No Mes.	No Mes.
44	UPN100	Beam	No Mes.	0.0083	PMM	COMB1	962.5	No Mes.	No Mes.
40	INP200	Beam	No Mes.	0.333	PMM	COMB1	0	No Mes.	No Mes.
43	INP200	Beam	No Mes.	0.3006	PMM	COMB1	0	No Mes.	No Mes.
46	INP200	Beam	No Mes.	0.2041	PMM	COMB1	0	No Mes.	No Mes.
2	UPN200	Brace	No Mes.	0.1617	PMM	COMB1	0	No Mes.	No Mes.
5	UPN200	Brace	No Mes.	0.0959	PMM	COMB1	0	No Mes.	No Mes.
8	UPN200	Brace	No Mes.	0.0407	PMM	COMB1	0	No Mes.	No Mes.
11	UPN200	Brace	No Mes.	0.0485	PMM	COMB1	413.4	No Mes.	No Mes.
14	UPN200	Brace	No Mes.	0.0677	PMM	COMB1	413.4	No Mes.	No Mes.
17	UPN200	Brace	No Mes.	0.0763	PMM	COMB1	413.4	No Mes.	No Mes.
20	UPN200	Brace	No Mes.	0.0746	PMM	COMB1	206.7	No Mes.	No Mes.
23	UPN200	Brace	No Mes.	0.0761	PMM	COMB1	0	No Mes.	No Mes.
26	UPN200	Brace	No Mes.	0.0672	PMM	COMB1	0	No Mes.	No Mes.
29	UPN200	Brace	No Mes.	0.0477	PMM	COMB1	0	No Mes.	No Mes.
32	UPN200	Brace	No Mes.	0.0389	PMM	COMB1	413.4	No Mes.	No Mes.
35	UPN200	Brace	No Mes.	0.0959	PMM	COMB1	413.4	No Mes.	No Mes.
38	UPN200	Brace	No Mes.	0.167	PMM	COMB1	413.4	No Mes.	No Mes.
3	UPN200	Brace	No Mes.	0.3008	PMM	COMB1	0	No Mes.	No Mes.
6	UPN200	Brace	No Mes.	0.2013	PMM	COMB1	0	No Mes.	No Mes.
9	UPN200	Brace	No Mes.	0.1145	PMM	COMB1	0	No Mes.	No Mes.
12	UPN200	Brace	No Mes.	0.0526	PMM	COMB1	413.4	No Mes.	No Mes.
15	UPN200	Brace	No Mes.	0.0964	PMM	COMB1	413.4	No Mes.	No Mes.
18	UPN200	Brace	No Mes.	0.1277	PMM	COMB1	413.4	No Mes.	No Mes.
21	UPN200	Brace	No Mes.	0.1464	PMM	COMB1	413.4	No Mes.	No Mes.
24	UPN200	Brace	No Mes.	0.1525	PMM	COMB1	413.4	No Mes.	No Mes.
27	UPN200	Brace	No Mes.	0.1505	PMM	COMB1	0	No Mes.	No Mes.
30	UPN200	Brace	No Mes.	0.1441	PMM	COMB1	0	No Mes.	No Mes.
33	UPN200	Brace	No Mes.	0.1259	PMM	COMB1	0	No Mes.	No Mes.
36	UPN200	Brace	No Mes.	0.0991	PMM	COMB1	0	No Mes.	No Mes.
39	UPN200	Brace	No Mes.	0.0593	PMM	COMB1	0	No Mes.	No Mes.

Steel Design Output



Steel P-M Interaction Ratios

Joint Design and Calculation

Stair Main Beam and Concrete Slab Connection Joint

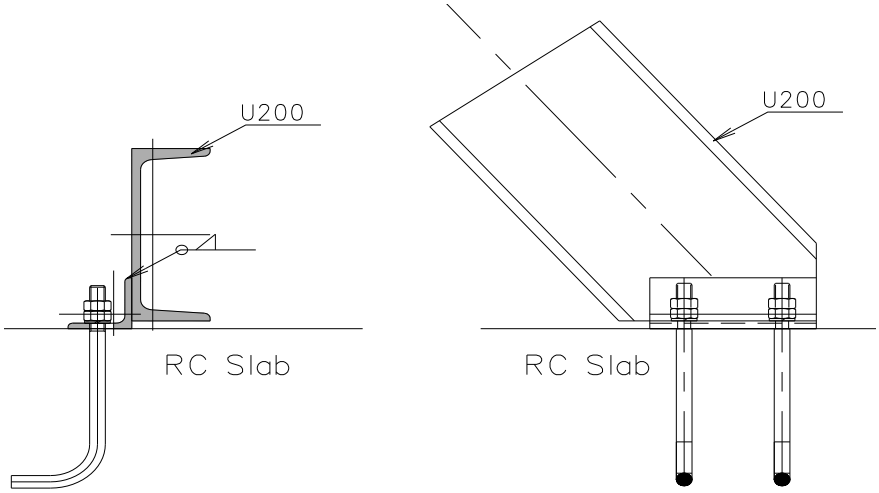


TABLE: Joint Reactions								
Joint	OC	CT	F1	F2	F3	M1	M2	M3
Text	Text	Text	N	N	N	N-mm	N-mm	N-mm
1	COMB1	Combo	-1.03	2.2	7523	4E+06	-1289	1323.7
2	COMB1	Combo	-1.03	1300.4	12301	8E+06	-2676	-26.73

$$Rx = \frac{M}{f} + \frac{N}{n}$$ (horizontal force) $$Ry = \frac{V}{n}$$ (vertical force)

Rx = 650.20 N Ry = 6150.72 N

Principal stress = $$R = \sqrt{Rx^2 + Ry^2}$$

R = 6184.99 N

Bolt Capacity Check

$$\tau_s = \frac{V_1}{A \times \phi} \le \tau = 23.54 kN / cm^2$$

Used Bolt = 1 M 16
ϕ = 0.75
V_1 = 6.18 kN
τ = 4.10 kN/cm² **capacity =** 17.4

Crush Check at Bolt

$$\delta h = \frac{N}{d \times t \times \phi \times 2.4} \le \delta = 35.30 kN/cm^2$$

d = 3 cm plate thickness
ϕ = 0.75
δh = 0.72 kN/cm² **capacity =** 2.0

Joint Design and Calculation

Stair Main Beam and Concrete Slab Connection Joint

Concrete Copression Check

f_c =	3	kN/cm²	concrete copression strength (C30 specification)
A =	7	cm²	
Pu =	12.4	kN	
Pd =	18	kN/cm²	**capacity** 69.3

Verify the Stress

$$\delta = \frac{N}{A*\phi} + \frac{M}{Ikaynak*\phi} \times y \le 23.54 kN/cm^2$$

N =	6.15	kN			
M =	0.1324	kNxcm			
V =	0.6502	kN			
ϕ =	0.9				
δ =	0.58	kN/cm²	**capacity**	**2.45**	**%**

Shear Stress Check

$$\tau = \frac{T}{A} \times \phi \le 23.54 kN/cm^2$$

V =	0.6502	kN			
A =	12	cm²			
ϕ =	0.9				
τ =	0.06	kN/cm²	**capacity**	**0.26**	**%**

Principal Stress Check

$$\delta v = \sqrt{\tau^2 + \delta^2}$$

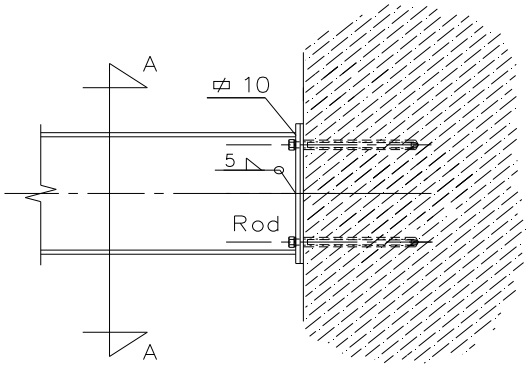
δ =	0.58	kN/cm²	**capacity**	**2.46**	**%**

Important Notes :

Main beam of te stair with main beam of the platform will be use same connection .

Joint Design and Calculation

Platform Main Beam and Concrete Slab Connection Joint



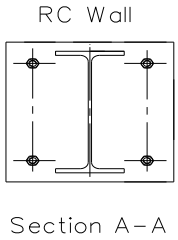
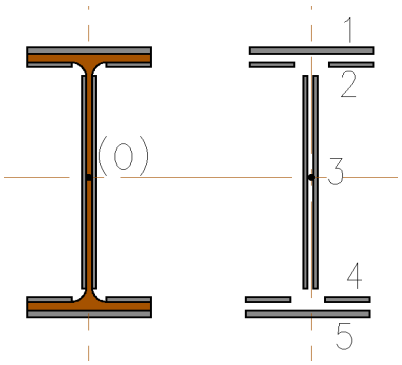
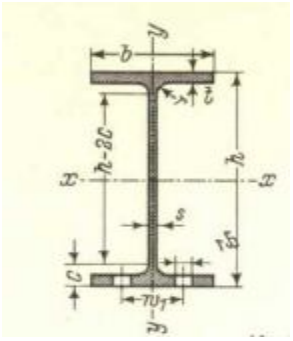


TABLE: Joint Reactions								
Joint	OC	CT	F1	F2	F3	M1	M2	M3
Text	Text	Text	N	N	N	N-mm	N-mm	N-mm
27	COMB1	Com.	2.07	-467.3	17679	-5E+06	-8E+06	-458448
29	COMB1	Com.	0	-418.08	13080	0	-7E+06	-418083
31	COMB1	Com.	0	-417.21	7170.9	0	-4E+06	-417211





Select to weld thickness

Flange Zone Weld Thickness

INP200	t =	1.13	cm	(Flange Thickness)
plate	t =	2.00	cm	(End Plate Thickness)
tmin =	1.13	cm		
tmin =	11.3	mm		
amin =	3	mm		
amax =	7.91	mm		
a =	5	mm	selected.	

Joint Design and Calculation

Platform Main Beam and Concrete Slab Connection Joint

Select to weld thickness

Web Zone Weld Thickness

INP200	t =	0.75	cm	(Web Thickness)
plate	t =	2.00	cm	(End Plate Thickness)
tmin =	0.75	cm		
tmin =	7.5	mm		
amin =	3	mm		
amax =	5.25	mm		
a =	5	mm	selected..	

Calculation to Weld Lenght

INP200	h =	200	mm	(Profile height)
INP200	c =	20.05	mm	(lenght of the weld can not be)
INP200	h - 2 c =	159.9	mm	(Web weld thickness)
INP200	b =	90.00	mm	(Flange width)
INP200	z =	24.6	cm	(Flange Botton Weld Lenght)

Note : Weld lenght of the top flange is equal to flange width

Section	a	b	Area	Y	AxY	AxY²	I
1	9.00	0.50	4.50	20.75	93.38	1937.53	0.09
2	4.92	0.50	2.46	19.12	46.99	898.40	0.05
3	15.99	1.00	15.99	10.50	167.90	1762.9	1.33
4	4.92	0.50	2.46	1.88	4.62	8.69	0.05
5	9.00	0.50	4.50	0.25	1.13	0.28	0.09
Total			29.91		314.00	4607.8	1.62

Iz = 4609.4 Iz = Total(I) + Total(Ay²)

yl = 10.50 cm $y^{l} = \frac{\sum Ay}{\sum A}$

Isection= 1312.39 cm4 I = Iz – (Total(A) x (yl)²)

Joint Design and Calculation

Platform Main Beam and Concrete Slab Connection Joint

Iz = 4609 yl = 10.50 cm Isec = 1312 cm4

0 Points Compared to Verify the Stress

$$\delta = \frac{N}{A*\phi} + \frac{M}{Ikaynak*\phi} \times y \le 23.54 kN/cm^2$$

N = 17.679 kN
M = 45.845 kNxcm
V = 0.4673 kN
ϕ = 0.9
δ = 1.00 kN/cm² **capacity** **4.24** **%**

Shear Stress Check

$$\tau = \frac{T}{A} \times \phi \le 23.54 kN/cm^2$$

V = 0.4673 kN
A = 15.99 cm²
ϕ = 0.9
τ = 0.03 kN/cm² **capacity** **0.11** **%**

Principal Stress Check

$$\delta v = \sqrt{\tau^2 + \delta^2}$$

δ = 1.00 kN/cm² **capacity** **4.24** **%**

Joint Design and Calculation

Cursh Check at Concrete

L =	30	cm	(End Plate Distance at Calculation Way)
f =	5.0	cm	(Outside Distance of the anchor bolt)
h =	20.00	cm	(Column Distance at Calculation Way)
$c_{1,2}$ = L / 4	8	cm	(The Distance From Outside Anchor The Resultant of Concreate Crush Zone)
a= L-(f+c/2)	21	cm	(Between Distance)
e=L/2-f	10	cm	(The Distance From The Center of The Tension Stress Resultant at Anchor)

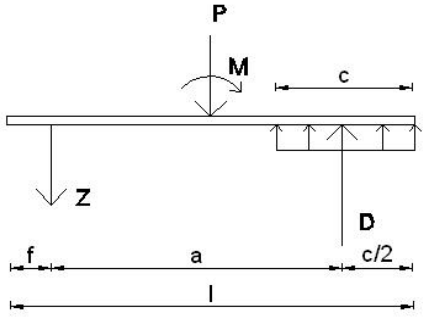
Z point, if we accept Orjin

$$D = \frac{M}{a} + \frac{P * e}{a}$$

Dx = 10.4768 kN

$$\omega\ bas = \frac{D}{c_1 * c_2} = 0.04656\ \text{kN/cm}^2$$

capacity 0.2 %



Tensile Stress Compared to Verify the Rod

D point, if we accept Orjin

$$Z = \frac{M}{a} - \frac{P(a-e)}{a}$$

Z = 11.52 kN
A = 2.01 cm²
ϕ = 0.75

$$\delta = \frac{N}{A * \phi} \le 23.54\ kN/cm^2$$

ϕ = 7.64 kN/cm² **capacity 32.46 %**

Shear Stress Compared to Verify the Rod

$$\tau = \frac{T}{A \times \phi} \le 23.54 kN/cm^2$$

V = 0.47 kN
A = 2.01 cm²
f = 0.75
t = 0.31 kN/cm² **capacity 1.32 %**

Crush Check at Rod

$$\delta h = \frac{N}{d \times t \times \phi \times 2.4} \le \delta = 35.30 kN/cm^2$$

d = 1 cm plate thickness
ϕ = 0.75
δh = 0.61 0 **capacity = 1.74 %**