

BAB V

KESIMPULAN DAN SARAN

5.1 Kesimpulan

Berdasarkan hasil perhitungan yang telah dilakukan dalam perencanaan Jembatan Samota dapat diambil kesimpulan sebagai berikut:

1. Dimensi yang digunakan dalam perencanaan Jembatan samota adalah sebagai berikut:
 - a. Dimensi PC U Girder yang digunakan adalah produk PC U berdasarkan produk WASKITA *Precast* yaitu PC U H-185 dengan mutu beton K-800 untuk bentang jembatan 40 m.
 - b. Tendon yang diperlukan untuk bentang jembatan 40 m adalah sebanyak 20 buah tendon yang dibagi menjadi 5 untuk bagian sebelah kiri dan 5 untuk bagian sebelah kanan. Tendon terdiri dari 15 strands dengan diameter 15,24 mm, menggunakan *jenis strands Seven wire stress relieved standart for restress concrete*. Jenis angkur yang digunakan berdasarkan spesifikasi BBR PT CONA SMI SP 1506.
2. Hasil dari perancangan bangunan atas adalah sebagai berikut:
 - a. Deck slab precast menggunakan mutu beton ($f'c$) 24,90 MPa dan mutu baja (f_y) 320 MPa dengan tulangan lentur $\varnothing 12 - 140$ mm dan tulangan bagi $\varnothing 10 - 140$ mm.
 - b. Diafragma dengan dimensi $b = 20$ cm) dan ($h = 80$ cm) menggunakan 2D19 dan tulangan bagi 2 D 13 serta sengkang $\varnothing 8 - 150$ mm.
 - c. Beban yang diterima oleh PC U girder adalah 894026,6614 kg.m beban mati sendiri (MS); 65553,044 kg.m beban mati tambahan (MA); 452200 kg.m lajur "D" (TD) ;7138,125 kg.m untuk beban akibat gaya

rem (TB); 30034,286 kg.m untuk beban angin (EW); 252037,662 kg.m untuk beban gempa (EQ).

- d. Total kehilangan prategang gesekan ankur, gesekan pada kabel, rangkai, susut, relaksasi dan perpendekan elastis beton adalah 8682,290 kN dengan presentase 27,721%.

5.2 Saran

Berdasarkan pengerjaan tugas akhir ini, saran yang dapat penulis berikan antara lain.

1. Sebelum melakukan analisis perhitungan struktur jembatan sebaiknya seorang perencana meremati beban-beban yang bekerja pada setiap bagian struktur berdasarkan peraturan yang digunakan.
2. Perlu dilakukan perencanaan dengan dimensi PC U yang berbeda sebagai pembandingan sehingga dapat diketahui tipe PC U yang efektif untuk digunakan.

DAFTAR PUSTAKA

- BBR.2010.*BBR VT CONA CMI SP, Europhen Technical Apporval Switzerland.*
- Manu, Agus Iqbal. 1995. *Dasar-Dasar Perencanaan Jembatan Beton Bertulang.* Jawa Timur: PT. MEDIATAMA SAPTAKARYA.
- Nawy, E. G. (2001). *Beton Prategang Suatu Pendekatan Mendasar. Jilid I Edisi III.* Jakarta: Erlangga.
- Purwaningrum, (2020) *Perencanaan Ulang Jembatan Meninting Dengan Bangunan Atas Menggunakan Precast U Girder,* Universitas Mataram.
- Putra, (2018) *Analisa dan Perancangan Gelagar Jembatan Beton Prategang Precast Concrate U (PCU Girder),* Universitas Gadjah Mada.
- Putri, (2018) *Perencanaan Ulang Jembatan Kesejahtraan Dengan Menggunakan Precast Concrate U-Girder,* Universitas Mataram.
- SNI 1725:2016. *Pembebanan Untuk Jembatan.* Jakarta: Badan Standarisi Nasional Indonesia.
- SNI 2833:2016. *Pembebanan Jembatan Terhadap Beban Gempa:* Badan Standarisasi Nasional Indonesia.
- SNI 1154:2001. *Tujuh kawat baja tanpa lapisan dipilin untuk konstruksi beton pratekan (PC strans/KBJP-P7:* Badan Standarisasi Nasional Indonesia.
- Struyk, H.J. 1984. *Jembatan.* Jakarta: P.T Pradya Paramita.



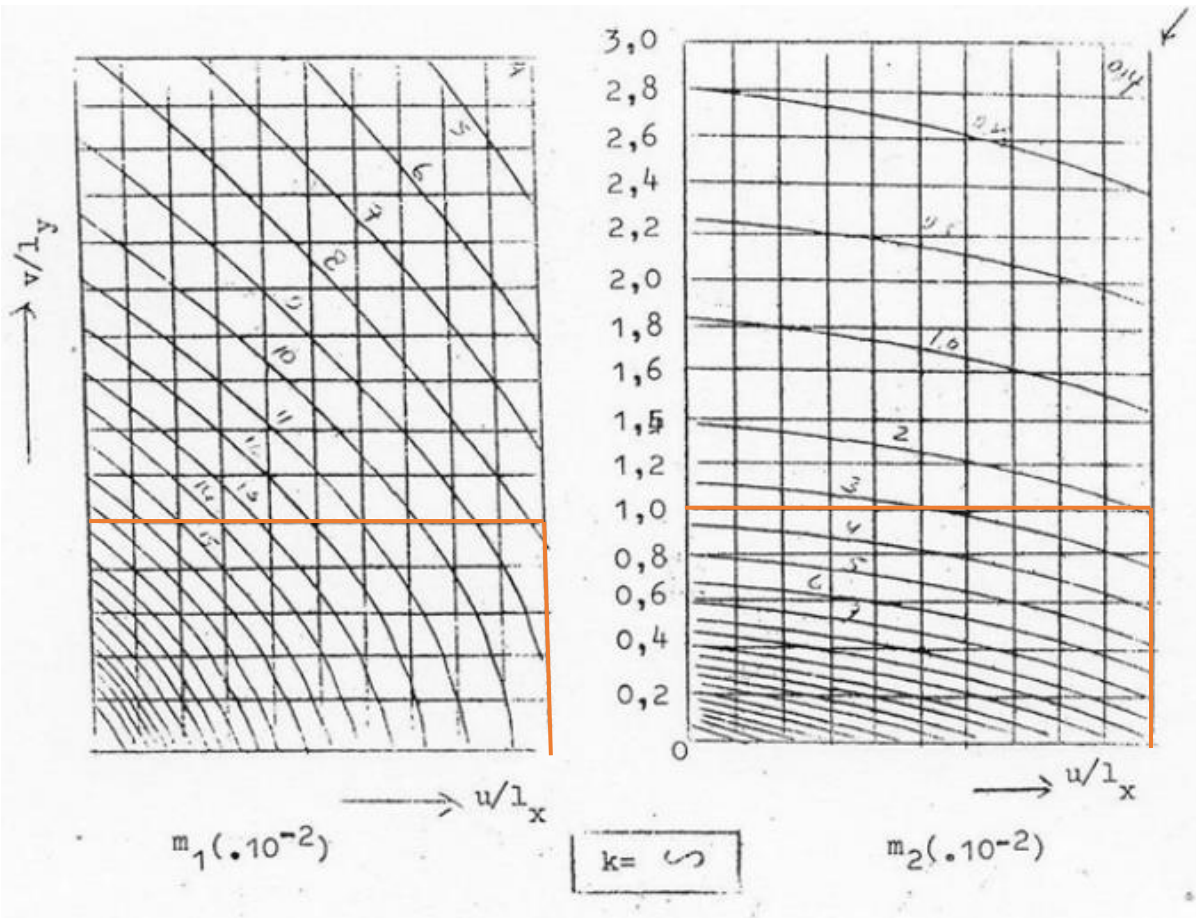
Tabel Kombinasi gaya geser akibat beban

x (m)	Mbs (kgm)	KOMB 1 MS+MA+TD +TB	KOMB 2 MS+MA+TD +TB	KOMB 3 MS+MA	KOMB 4 MS+MA	KOMB 5 MS+MA+Ewl	KOMB 6 MS+MA+TD+ TB+EQ	KOMB 7 MS+MA+TD +TB	KOMB 8 MS+MA+TD+ TB+EW	KOMB 9 MS+MA+TD+TB	KOMB 10 MS+MA+TD +TB	KOMB 11 MS+MA
0	63100.8	132891.411	132891.411	94174.50	94174.50	97177.933	158095.177	132891.411	135894.839	132891.411	132891.411	94174.50
1	59638.56	126607.685	126607.685	89465.78	89465.78	92319.036	150551.263	126607.685	129460.943	126607.685	126607.685	89465.78
2	56176.32	120323.960	120323.960	84757.05	84757.05	87460.140	143007.350	120323.960	123027.046	120323.960	120323.960	84757.05
3	52714.08	114040.235	114040.235	80048.33	80048.33	82601.243	135463.436	114040.235	116593.149	114040.235	114040.235	80048.33
4	49251.84	107756.510	107756.510	75339.60	75339.60	77742.346	127919.523	107756.510	110159.253	107756.510	107756.510	75339.60
5	45789.6	101472.785	101472.785	70630.88	70630.88	72883.450	120375.609	101472.785	103725.356	101472.785	101472.785	70630.88
6	42327.36	95189.059	95189.059	65922.15	65922.15	68024.553	112831.696	95189.059	97291.459	95189.059	95189.059	65922.15
7	38865.12	88905.334	88905.334	61213.43	61213.43	63165.656	105287.782	88905.334	90857.563	88905.334	88905.334	61213.43
8	35402.88	82621.609	82621.609	56504.70	56504.70	58306.760	97743.869	82621.609	84423.666	82621.609	82621.609	56504.70
9	31940.64	76337.884	76337.884	51795.98	51795.98	53447.863	90199.955	76337.884	77989.769	76337.884	76337.884	51795.98
10	28478.4	70054.158	70054.158	47087.25	47087.25	48588.966	82656.042	70054.158	71555.873	70054.158	70054.158	47087.25
11	25208.16	63770.433	63770.433	42378.53	42378.53	43730.070	75112.128	63770.433	65121.976	63770.433	63770.433	42378.53
12	21617.92	57486.708	57486.708	37669.80	37669.80	38871.173	67568.214	57486.708	58688.079	57486.708	57486.708	37669.80
13	18163.06462	51202.983	51202.983	32961.08	32961.08	34012.277	60024.301	51202.983	52254.183	51202.983	51202.983	32961.08
14	14708.20923	44919.258	44919.258	28252.35	28252.35	29153.380	52480.387	44919.258	45820.286	44919.258	44919.258	28252.35
15	11253.35385	38635.532	38635.532	23543.63	23543.63	24294.483	44936.474	38635.532	39386.389	38635.532	38635.532	23543.63
16	7798.498462	32351.807	32351.807	18834.90	18834.90	19435.587	37392.560	32351.807	32952.493	32351.807	32351.807	18834.90
17	4343.643077	26068.082	26068.082	14126.18	14126.18	14576.690	29848.647	26068.082	26518.596	26068.082	26068.082	14126.18
18	888.7876923	19784.357	19784.357	9417.45	9417.45	9717.793	22304.733	19784.357	20084.700	19784.357	19784.357	9417.45
19	-2566.067692	13500.631	13500.631	4708.73	4708.73	4858.897	14760.820	13500.631	13650.803	13500.631	13500.631	4708.73
20	-6020.923077	7216.906	7216.906	0.00	0.00	0.000	7216.906	7216.906	7216.906	7216.906	7216.906	0.00

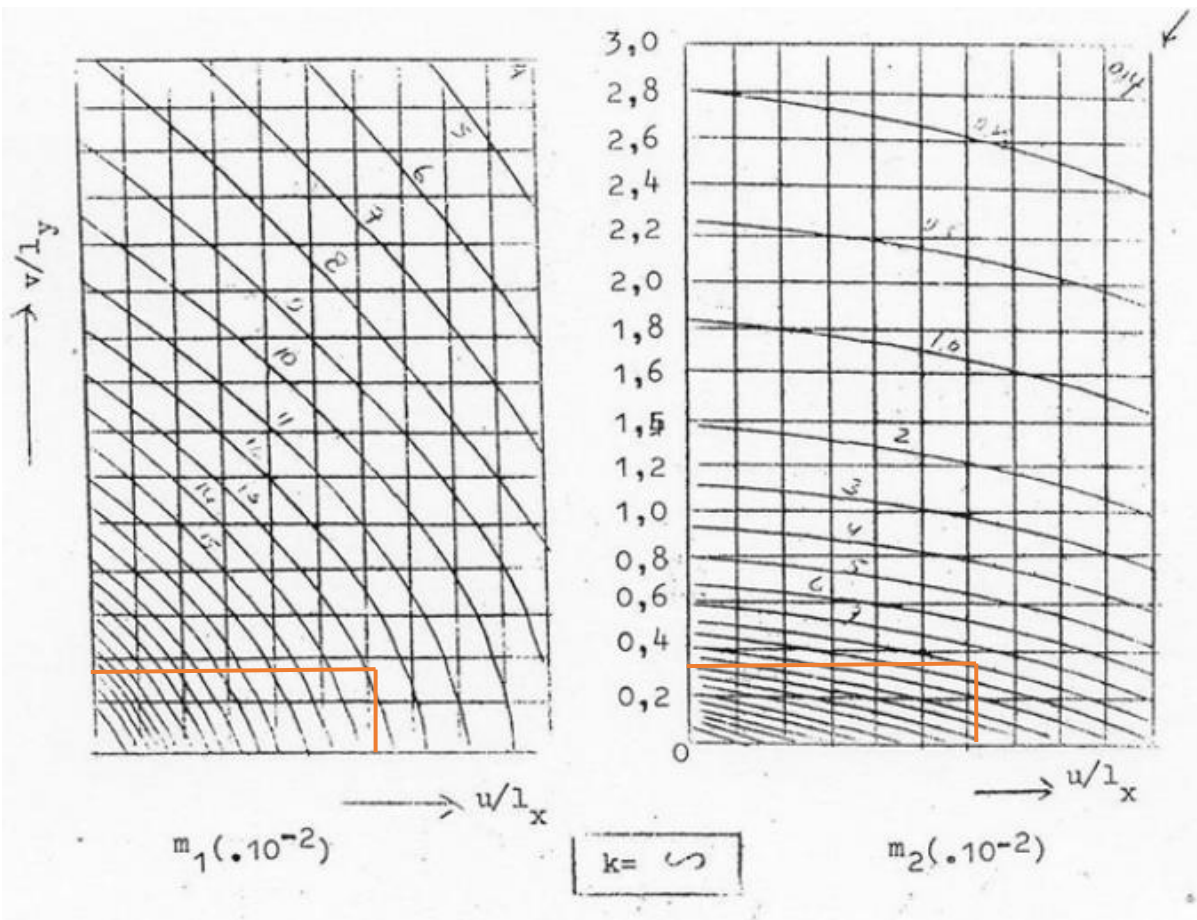
Tabel Kombinasi momen akibat beban

x (m)	Mbs (kgm)	KOMB 1 MS+MA+TD+TB	KOMB 2 MS+MA+TD +TB	KOMB 3 MS+MA	KOMB 4 MS+MA	KOMB 5 MS+MA+Ewl	KOMB 6 MS+MA+TD+ TB+EQ	KOMB 7 MS+MA+TD +TB	KOMB 8 MS+MA+TD+ TB+EW	KOMB 9 MS+MA+TD +TB	KOMB 10 MS+MA+TD+TB	KOMB 11 MS+MA
0	0	0.000	0.000	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.00
1	61529.68	129749.548	129749.548	91820.14	91820.14	94748.485	154323.220	129749.548	132677.891	129749.548	129749.548	91820.14
2	119917.12	253215.371	253215.371	178931.56	178931.56	184638.073	301102.527	253215.371	258921.885	253215.371	253215.371	178931.56
3	175162.32	370397.468	370397.468	261334.25	261334.25	269668.764	440337.920	370397.468	378731.983	370397.468	370397.468	261334.25
4	227265.28	481295.841	481295.841	339028.22	339028.22	349840.559	572029.399	481295.841	492108.184	481295.841	481295.841	339028.22
5	276226	585910.488	585910.488	412013.46	412013.46	425153.457	696176.965	585910.488	599050.488	585910.488	585910.488	412013.46
6	322044.48	684241.410	684241.410	480289.97	480289.97	495607.458	812780.617	684241.410	699558.896	684241.410	684241.410	480289.97
7	364720.72	776288.607	776288.607	543857.76	543857.76	561202.563	921840.356	776288.607	793633.407	776288.607	776288.607	543857.76
8	404254.72	862052.078	862052.078	602716.83	602716.83	621938.771	1023356.182	862052.078	881274.021	862052.078	862052.078	602716.83
9	440646.48	941531.824	941531.824	656867.17	656867.17	677816.082	1117328.093	941531.824	962480.739	941531.824	941531.824	656867.17
10	473896	1014727.846	1014727.846	706308.78	706308.78	728834.497	1203756.092	1014727.846	1037253.560	1014727.846	1014727.846	706308.78
11	503579.28	1081640.141	1081640.141	751041.67	751041.67	774994.015	1282640.176	1081640.141	1105592.484	1081640.141	1081640.141	751041.67
12	530839.4311	1142268.712	1142268.712	791065.84	791065.84	816294.637	1353980.348	1142268.712	1167497.512	1142268.712	1142268.712	791065.84
13	554659.1424	1196613.557	1196613.557	826381.28	826381.28	852736.362	1417776.605	1196613.557	1222968.643	1196613.557	1196613.557	826381.28
14	575339.0515	1244674.678	1244674.678	856987.99	856987.99	884319.190	1474028.950	1244674.678	1272005.878	1244674.678	1244674.678	856987.99
15	592879.1584	1286452.073	1286452.073	882885.98	882885.98	911043.122	1522737.380	1286452.073	1314609.215	1286452.073	1286452.073	882885.98
16	607279.4633	1321945.742	1321945.742	904075.24	904075.24	932908.157	1563901.897	1321945.742	1350778.657	1321945.742	1321945.742	904075.24
17	618539.966	1351155.687	1351155.687	920555.78	920555.78	949914.295	1597522.501	1351155.687	1380514.201	1351155.687	1351155.687	920555.78
18	626660.6666	1374081.906	1374081.906	932327.59	932327.59	962061.536	1623599.191	1374081.906	1403815.849	1374081.906	1374081.906	932327.59
19	631641.5651	1390724.400	1390724.400	939390.68	939390.68	969349.881	1642131.968	1390724.400	1420683.600	1390724.400	1390724.400	939390.68
20	633482.6614	1401083.169	1401083.169	941745.04	941745.04	971779.330	1653120.831	1401083.169	1431117.455	1401083.169	1401083.169	941745.04

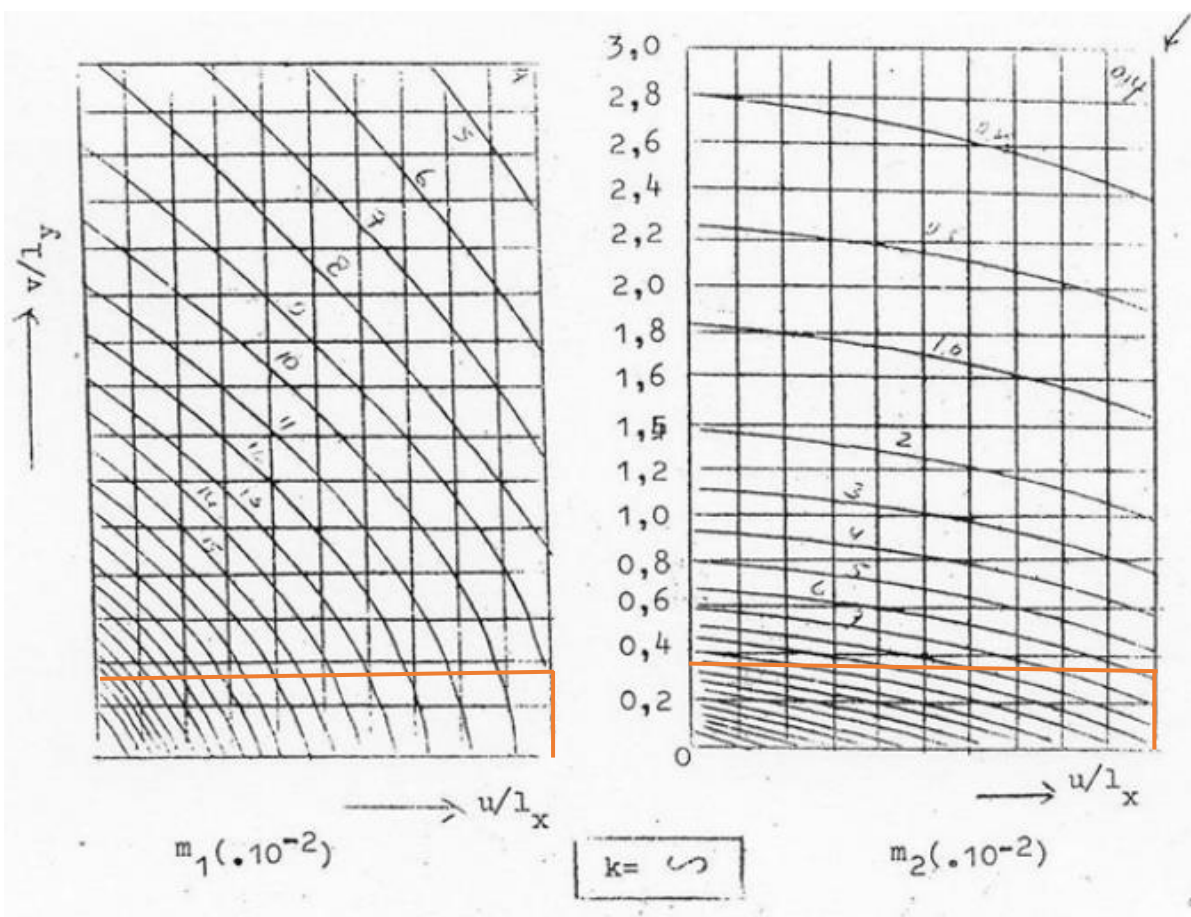
AKIBAT BEBAN MATI



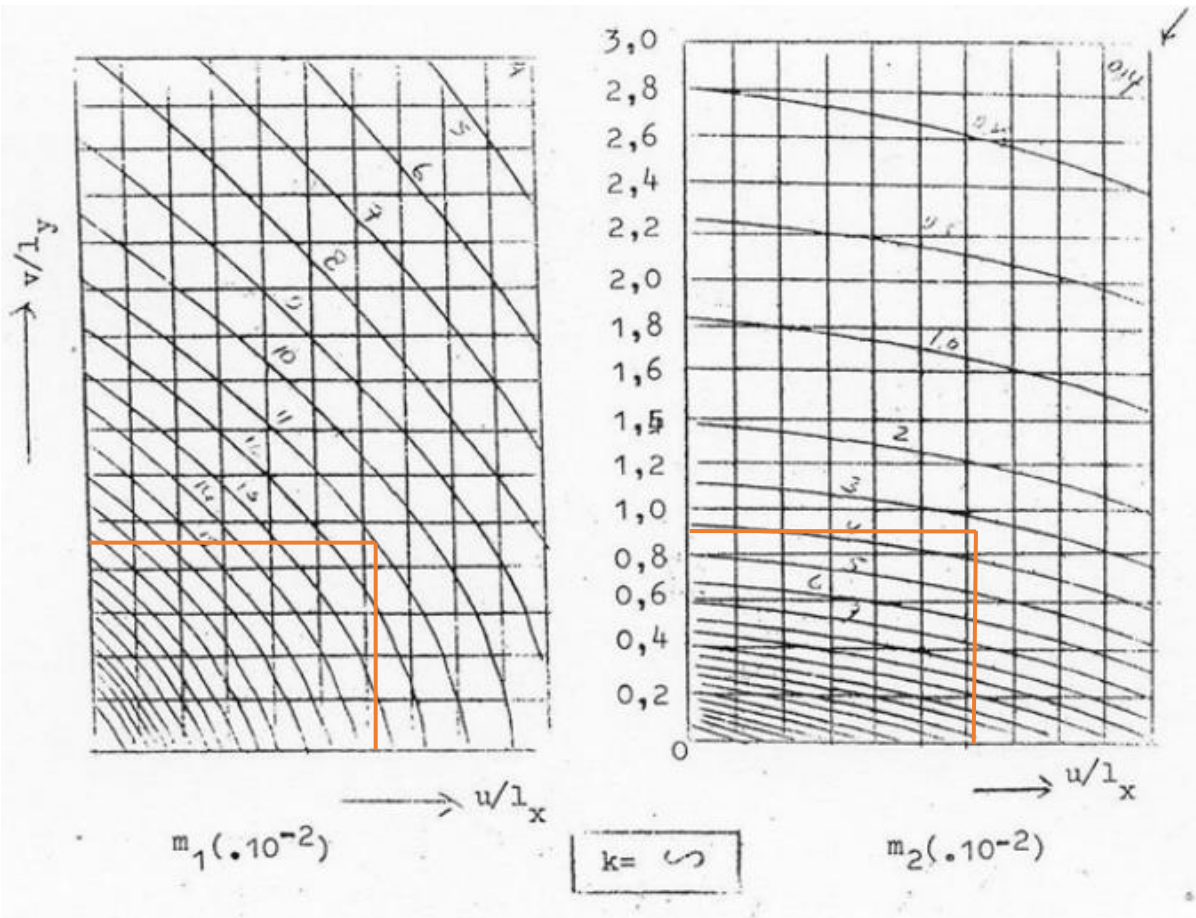
BEBAN HIDUP I



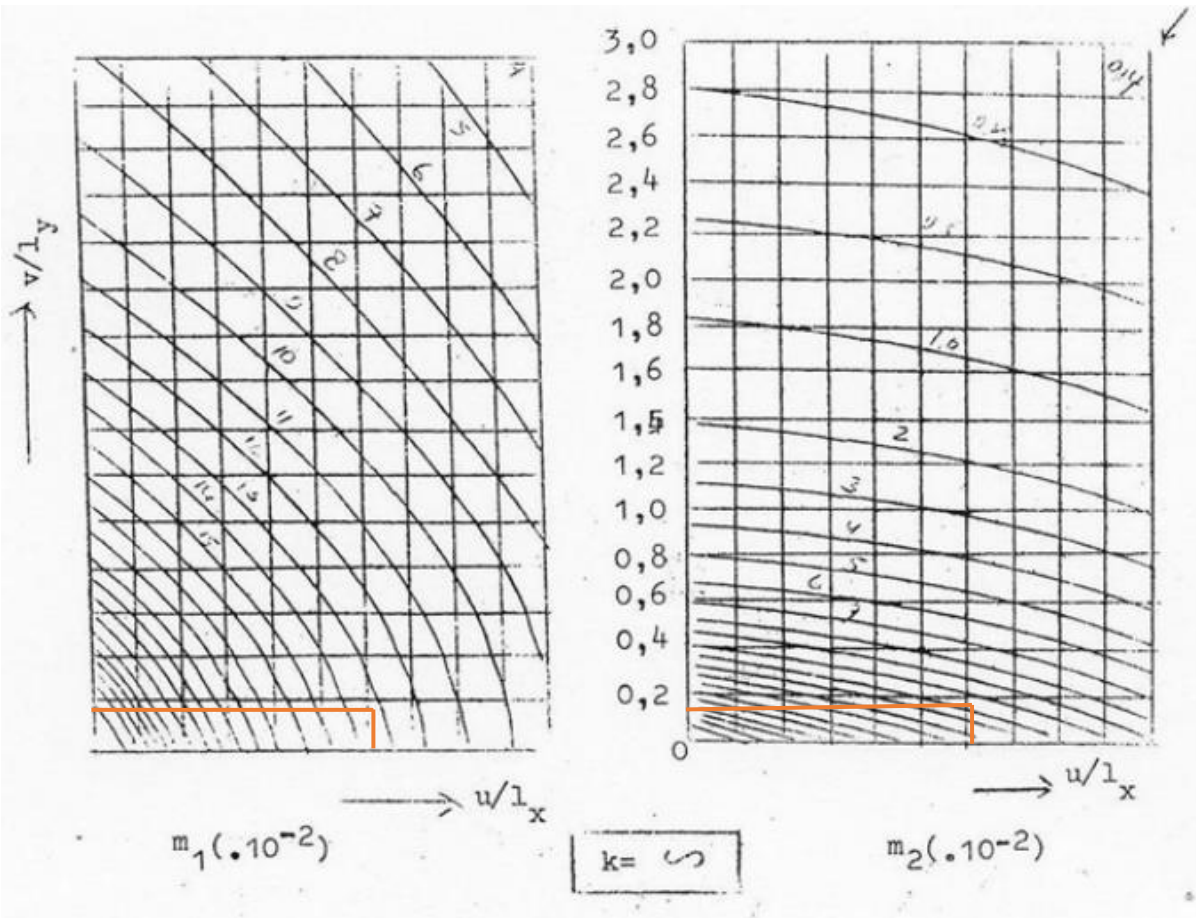
BEBAN HIDUP II



FORMASI I



Formasi II





PROGRAM STUDI TEKNIK SIPIL
FAKULTAS TEKNIK
UNIVERSITAS MUHAMMADIYAH MATARAM
2023

TUGAS AKHIR / SKRIPSI

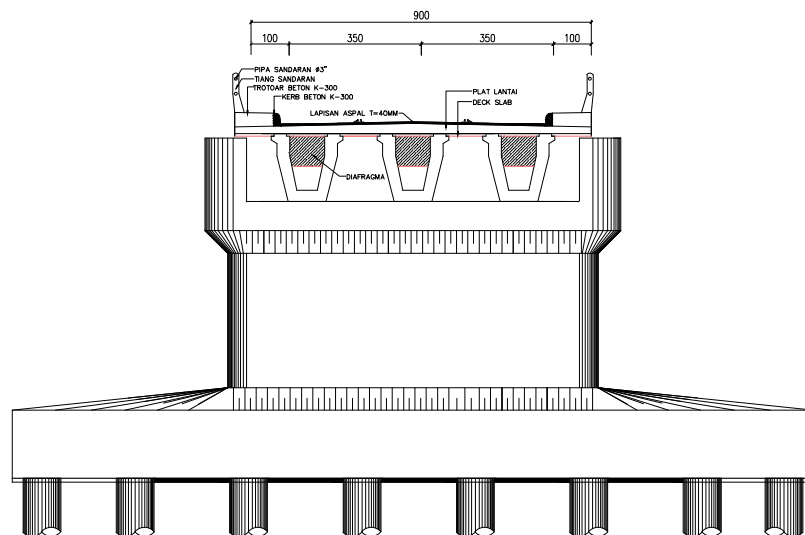
DIGAMBAR :

YAYI ANGGRAINI SAFITRI
2019D1B118

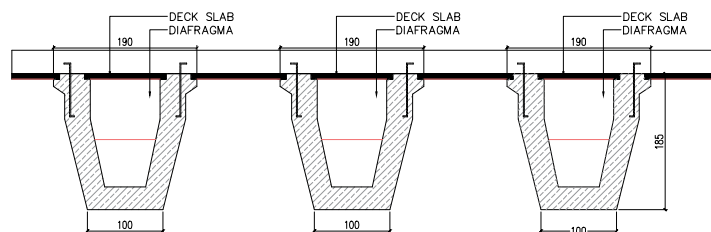
CATATAN/REVISI :

NAMA GAMBAR : SKALA :

POTONGAN
MELINTANG U GIRDER



POTONGAN A-A
SKALA 1:100



POTONGAN MELINTANG U GIRDER
SKALA 1:50



PROGRAM STUDI TEKNIK SIPIL
FAKULTAS TEKNIK
UNIVERSITAS MUHAMMADIYAH MATARAM
2023

TUGAS AKHIR / SKRIPSI

DIGAMBAR :

YAYI ANGGRAINI SAFITRI
2019D1B118

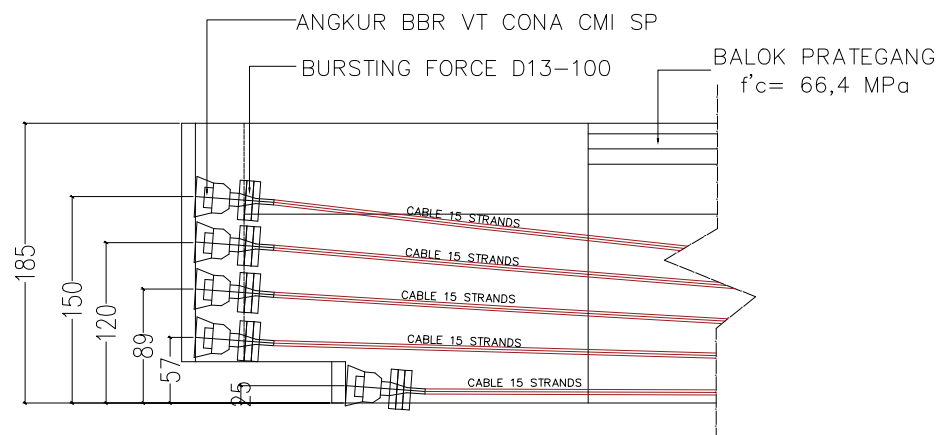
CATATAN/REVISI :

NAMA GAMBAR :

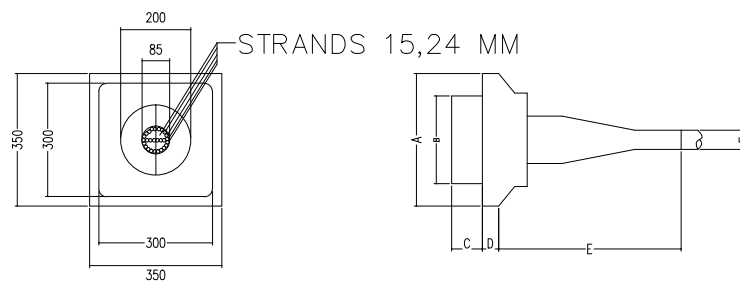
SKALA :

DETAIL END BLOCK &
ANGKUR

1 : 25



DETAIL END BLOK BENTANG 40 M
SKALA 1: 25



BBR VT CONA CMI SP 1506		ANCHORAGE SIZE	
KEPALA ANKUR	∅ B	200 mm	
	Ha C	75 mm	
PELAT ANKUR	Ssp A	300 mm	
	Tsp D	45 mm	
TRUMPET+CASTING	E	694 mm	
DIA.DUCT	F	85 mm	

DETAIL ANKUR UNTUK BENTANG 40 M
SKALA 1: 25



PROGRAM STUDI TEKNIK SIPIL
FAKULTAS TEKNIK
UNIVERSITAS MUHAMMADIYAH MATARAM
2023

TUGAS AKHIR / SKRIPSI

DIGAMBAR :

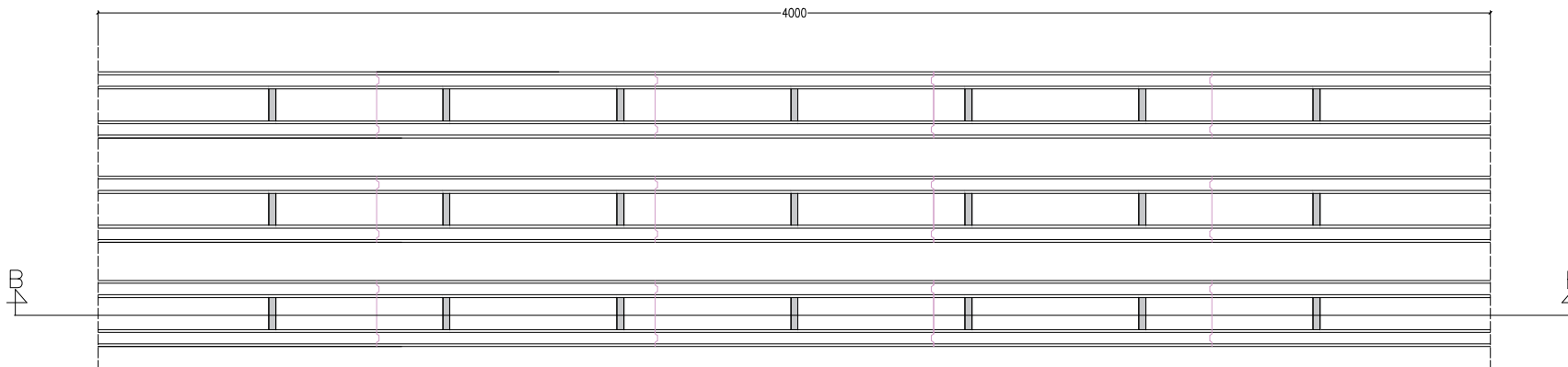
YAYI ANGGRAINI SAFITRI
2019D1B118

CATATAN/REVISI :

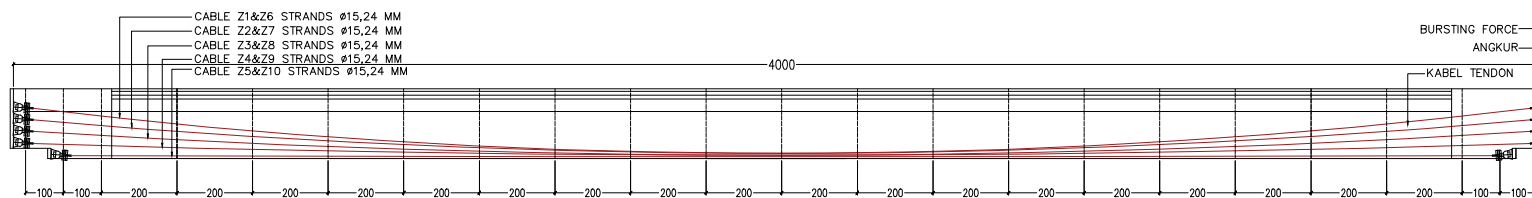
NAMA GAMBAR : SKALA :

TAMPAK ATAS PELAT U GIRDER
DAN CABLE SECTON

1 : 100



TAMPAK ATAS PELAT U GIRDER
SKALA 1:100



SECTION (TRACE KABEL TENDON) BENTANG 40 M
SKALA 1:100



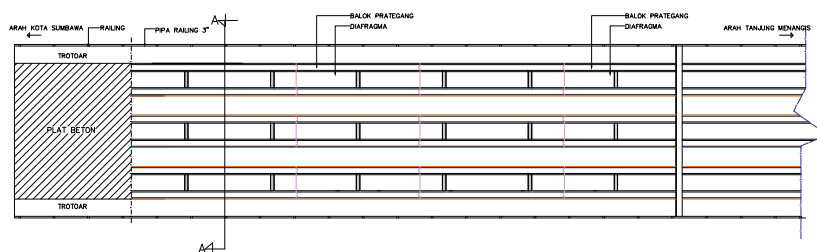
PROGRAM STUDI TEKNIK SIPIL
 FAKULTAS TEKNIK
 UNIVERSITAS MUHAMMADIYAH MATARAM
 2023

TUGAS AKHIR / SKRIPSI

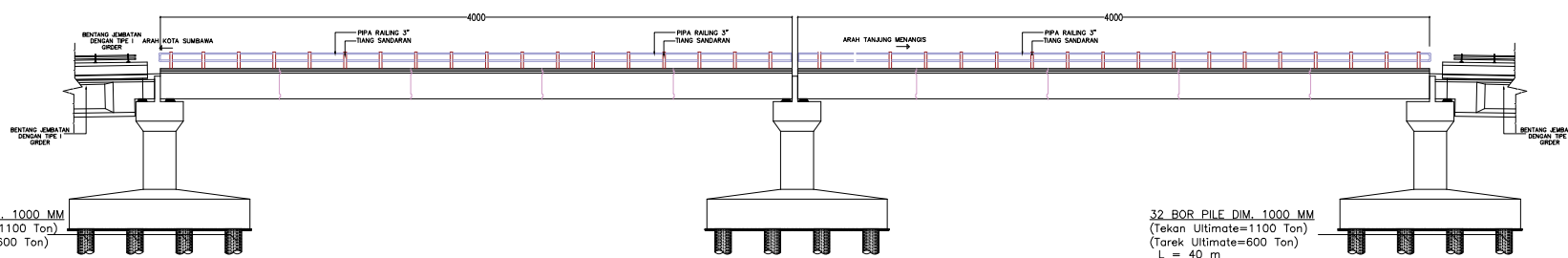
DIGAMBAR :

YAYI ANGGRAINI SAFITRI
 2019D1B118

CATATAN/REVISI :



TAMPAK ATAS JEMBATAN
 SKALA 1:200



TAMPAK SAMPING JEMBATAN
 SKALA 1:200

NAMA GAMBAR :

SKALA :

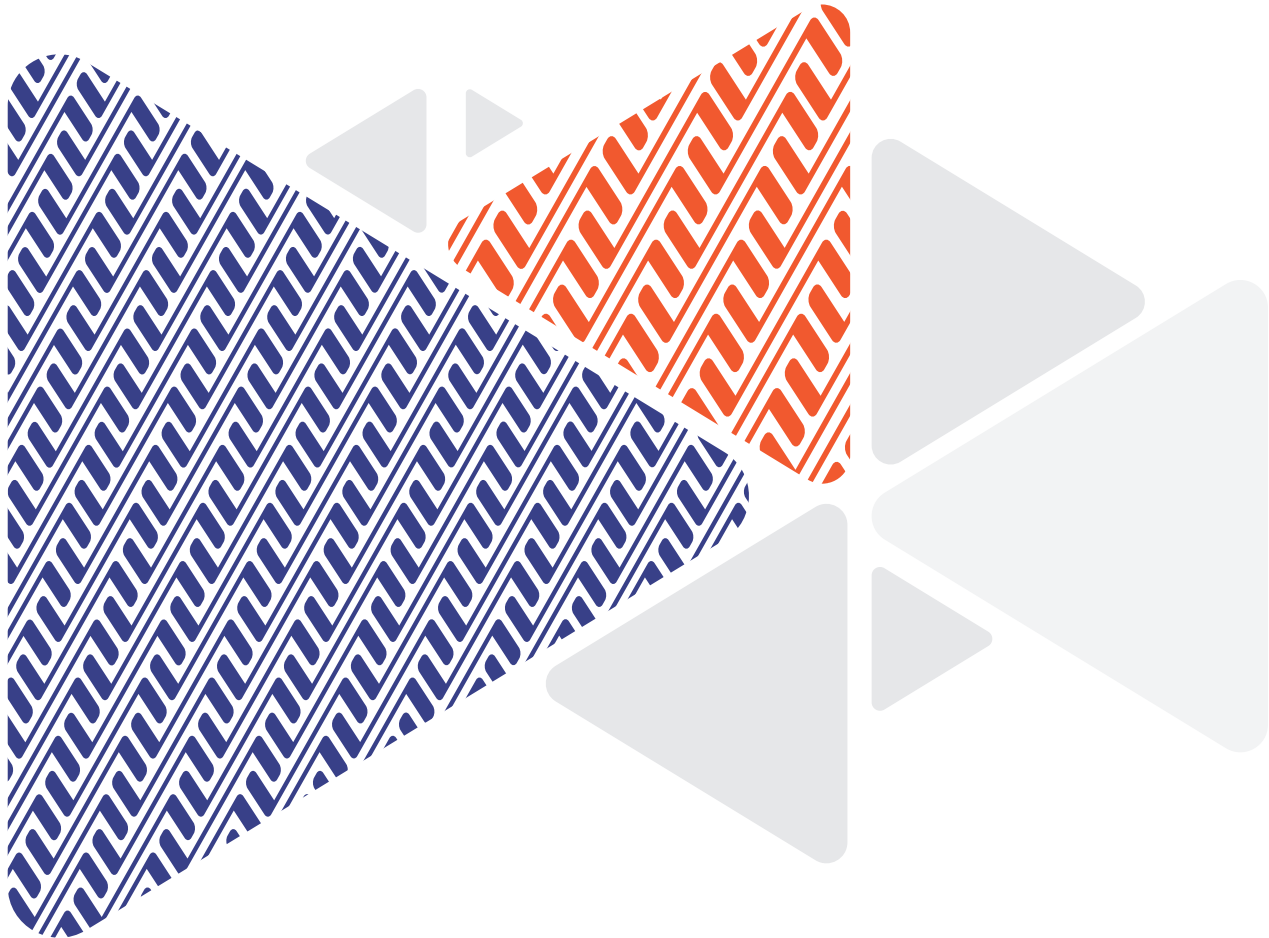
TAMPAK ATAS &
 SAMPING JEMBATAN

1:100



Dedication for Movement

Gedung Teraskita
Jl. MT. Haryono Kav. No. 10A
Jakarta Timur 13340
T. (021) 22892999 / 29838020
F. (021) 29838025
waskitaprecast.co.id



Kantor Area Pemasaran

AREA 1

**Di Aceh, Sumatera Utara, Riau,
Kepulauan Riau, dan Sumatera Barat**

Jalan Patriot No.10 Kp. Lalang
Medan, Sumatera Utara
Email : info@waskitaprecast.co.id

AREA 4

Jawa Tengah, DIY, Kalimantan

Jl Ring Road Utara, Ruko Panda Kav. O
(depan polda DIY) Condong Catur
Depok, Sleman
Email : info@waskitaprecast.co.id

AREA 2

**Sumatera Selatan, Bangka Belitung, Jambi,
Bengkulu dan Lampung**

Jl Gubernur H. Ahmad Bastari,
Kec. Seberang Ulu I, Kota Palembang
Sumatera Selatan 30967
Email : info@waskitaprecast.co.id

AREA 5

**Jawa Timur, Bali, Nusa Tenggara Barat, dan
Nusa Tenggara Timur**

Jl. Raya Prambon Km 36
Ds. Kedungwonokerto,
Prambon, Sidoarjo, Jawa Timur
Email : info@waskitaprecast.co.id

AREA 3

DKI Jakarta, Banten dan Jawa Barat

Tamansari Hive Office Tower
Jl D.I Panjaitan, Kav.2, Cawang
Jakarta Timur 13350
Email : info@waskitaprecast.co.id

AREA 6

Sulawesi, Kepulauan Maluku dan Papua

Jalan Mapala 22-3, Tidung
Kec. Rappocini
Kota Makassar
Sulawesi Selatan 90222
Email: info@waskitaprecast.co.id



DESCRIPTION

Precast beam girder that use “U” shape section, “U” shape section causes beam to have greater ly (Inertia of y Axis) on same cross sectional area, so lateral stability is increased, make erection team more confidence while lifting this product. This PC U Girder can be used on bridge for road or railway.

TECHNICAL

Type Of Girder	:	PC-U Girder
Prestressing System	:	Post-Tension, Pre-Tension
Production System	:	Segmental, Monolith
Erection System	:	Launching Gantry Launching Truss Double Crane Single Crane (Max. 15 M)

DESIGN & MANUFACTURING REFERENCE

Design	RSNI T-02-2005	Standar Pembebanan untuk Jembatan
	BMS 7	Bridge Design Code
	AASHTO - 2002	Standard Specification for Highway Bridge
	ACI 318-2011	Building Code Requirement for Structural Concrete
	SNI 03-2847-2013	Indonesian Concrete Code
	PCI Mnl-133	Bridge Design Manual

SPECIFICATION OF SOURCE MATERIAL

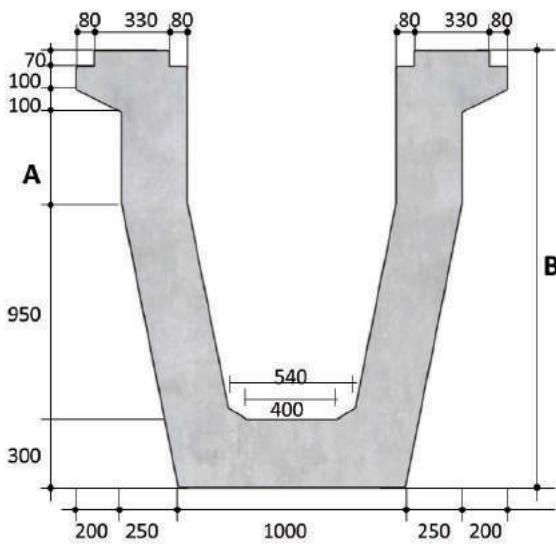
Item	Specification	Reference	
Aggregate		ASTM C33 - 2016	(Standard Specification Concrete Aggregates)
		SNI 8321-2016	(Concrete Aggregate Specification)
Cement		SNI 15-2049-2004	(Portland's Cement)
Admixture		ASTM C494 - 2016	(Standard Specification for Chemical Admixture for Concrete)
Concrete	Compressive strength at 28 day : 500 - 800 kg/cm ² (Cube), 42 – 65 MPa (Cylinder) depends on beam span	SNI 2847-2013	(Structural Concrete Requirement)
Reinforced Rebar	BJTS 40 For D >10mm BjTP 24 For D ≤ 10mm	SNI 2052-2014	(Concrete Reinforcement Steel Bar)
PC Strand	KBjP-P7 RB	SNI 1154-2011	(Uncoated Seven Wire Stress Relieved Strand for Prestress Concrete (Pc Strand/KBjP-P7))
	Grade 270	ASTM A-416	(Standard Specification for Uncoated Seven_Wire Stress Relieved Strand for Prestressed Concrete)
	SWPR7BL	JIS G 3536 : 2014	(Uncoated Stress-Relieved Steel Wires and Strands for Prestressed Concrete)
Post Tension System	VLM System DSI System		

PC-U GIRDER

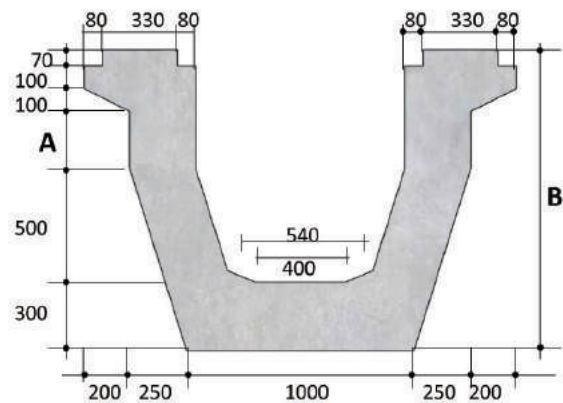


Item	Specification	Reference	
Post Tension Grout	Compressive Strength : at 7 Day : 27 MPa at 28 Day : 30 MPa	BS EN 447 : 2007	(Grout for Prestressing Tendon. Basic Requirement)
Pin Connector	S45C C45	JIS G 4051:2009 DIN EN 10083-2:2006-10	(Carbon Steel for Machine Structural) (Steel for Quenching and Tempering)

PRODUCT DIMENSION



H > 1400 MM



H > 1400 MM

All units in mm

Type	A (mm)	B (mm)
H-120	130	1200
H-130	230	1300
H-140	330	1400
H-165	130	1650
H-175	230	1750
H-185	330	1850
H-220	680	2200
H-240	880	2400

Another Available length

Type	Span (m)	
	K-500	K-800
H-120	21-25	26-29
H-130	23-27	28-30
H-140	25-29	30-33
H-165	28-34	35
H-175	31-36	37-41
H-185	34-38	39-42
H-220		Up to 50
H-240		Up to 53

Typical of girder according to length

- Span 20 m, H-120
- Span 25 m, H-130
- Span 30 m, H-140
- Span 32 m, H-165
- Span 35 m, H-185
- Span 40 m, H-185
- Span 50 m, H-220 (**Special Order**)

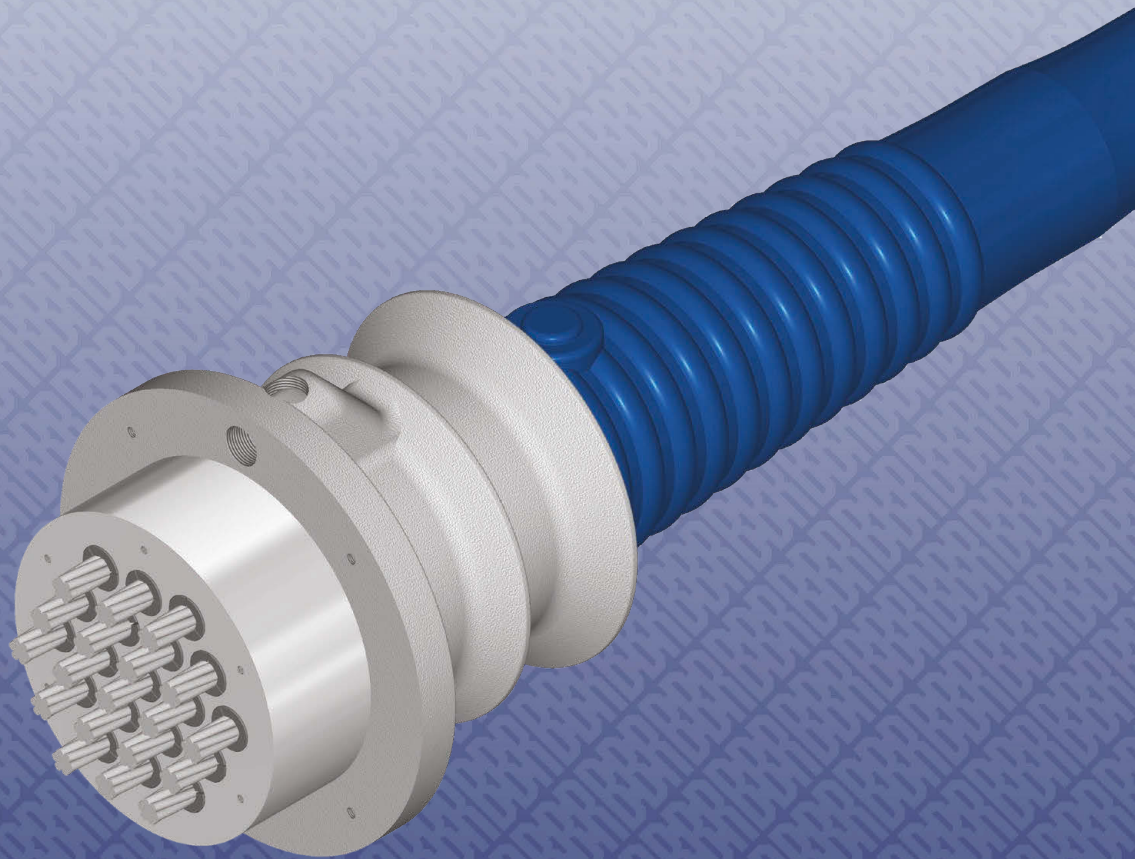
Recommended CTC Spacing (Center to Center) : 3,1 m
But another CTC Spacing can be accommodated

European Technical Assessment
ETA – 06/0147

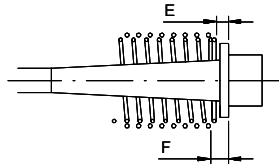
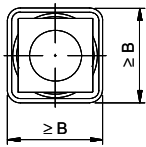
CE

BBR VT CONA CMI

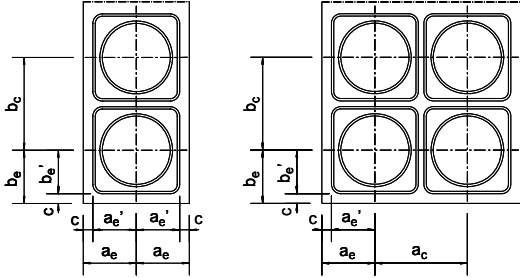
Bonded Post-tensioning System with 04 to 31 Strands



Stressing and fixed anchorage / coupler



Centre spacing and edge distance



$$a_e = a_e' + c$$

$$b_e = b_e' + c$$

BBR VT CONA CMI SP	0806	0906	1206
Strand arrangement			

7-wire prestressing steel strand
 Nominal diameter 15.7 mm ... Nominal cross-sectional area 150 mm² ... Maximum characteristic tensile strength 1860 MPa¹⁾

Tendon			
Cross-sectional area	A _p mm ²	1200	1350
Char. value of maximum force	F _{pk} kN	2232	2511
Char. value of 0.1 % proof force	F _{p0.1} kN	1968	2214
Maximum prestressing force	0.90 · F _{p0.1} kN	1771	1993
Maximum overstressing force	0.95 · F _{p0.1} kN	1870	2103

Minimum concrete strength / Helix / Additional reinforcement / Centre spacing and edge distance / Square plate dimensions																			
Minimum concrete strength																			
Cube	f _{cm, 0, cube, 150} MPa	26	28	34	38	43	46	26	28	34	38	43	46	26	28	34	38	43	46
Cylinder	f _{cm, 0, cylinder, Ø 150} MPa	21	23	28	31	35	38	21	23	28	31	35	38	21	23	28	31	35	38
Helix, ribbed reinforcing steel, R_s ≥ 500 MPa																			
Outer diameter	mm	280	270	230	215	205	200	295	280	240	225	215	215	325	320	290	280	270	260
Bar diameter ³⁾	mm	10	10	12	12	12	12	10	10	10	10	12	12	12	12	12	14	14	14
Length approximately	mm	280	258	237	237	237	212	280	280	260	260	262	327	327	312	289	289	239	239
Pitch	mm	45	45	50	50	50	50	45	45	50	50	50	50	45	45	50	50	50	50
Number of pitches	—	7	6.5	5.5	5.5	5.5	5	7	7	6	6	6	5	8	8	7	6.5	6.5	5.5
Distance	E mm	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Additional reinforcement, ribbed reinforcing steel, R_s ≥ 500 MPa																			
Number of stirrups	mm	5	4	3	3	3	3	5	4	4	4	3	4	7	6	7	6	6	6
Bar diameter ³⁾	mm	12	12	16	16	16	16	12	12	16	16	16	16	14	14	16	16	16	16
Spacing	mm	70	90	120	110	105	100	75	75	90	85	110	75	55	55	55	60	60	55
Distance from anchor plate	F mm	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
Minimum outer dimensions	B × B mm	315	300	280	265	250	240	330	320	295	280	265	255	385	375	345	325	310	300
Centre spacing and edge distance																			
Minimum centre spacing	a _c , b _c mm	335	320	300	285	270	260	355	340	315	300	285	275	410	395	365	345	330	320
Minimum edge distance	a _e ', b _e ' mm	160	150	140	135	125	120	170	160	150	140	135	130	195	190	175	165	155	150
Square plate dimensions²⁾																			
Side length	S _{SP} mm	225	225	225	220	215	215	255	255	250	245	240	240	265	265	265	260	255	250
Thickness	T _{SP} mm	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35

c..... Concrete cover
 1)..... Prestressing steel strand with nominal diameter of 15.3 mm, cross-sectional area of 140 mm² or with characteristic tensile strength below 1860 MPa may also be used.
 2)..... The square plate dimensions are minimum values, therefore larger or thicker plates may be used.
 3)..... Bar diameter of 14 mm can be replaced by 16 mm.



Internal Post-tensioning System
 Minimum concrete strength
 Helix – Additional reinforcement
 Centre and edge distance – Square plate dimensions

Annex 24
 of European technical approval
 ETA-09/0287