STRUCTURE AND WINDLOAD STUDY OUTDOOR TRANSIT DID (LRT STATIONS, OSLO)

Fully sealed vibration tested transit outdoor display

Model: NIOD700P-700, 70" Portrait, double-sided 700cd, IP65 Cross Track monitor

> Excerpt April 21, 2017



The 1st Chapter. SUMMARY OF STRUCTURE REVIEW

1.1 SITE SUMMARY

We analyze the structural safety of an 70inch advertising board installed in Oslo subway station.

1.2 STRUCTURAL REVIEW CRITERIA

Design Method	. Ultimate Strength Design Method (RC) / Allowable Stress Design (S, SRC) . Limit State Design (S, SRC)
Applied Statute	. Building Act / Building Act Enforcement Decree
Applied Rule	. Building Regulation / Regulation for Structure in Building
Applied Criteria	. Korean Building Code (KBC2016) . Korean Steel Structure Design Code (KSSC-ASD03)
Reference Criteria	. ACI 318 . AISC-ASD / AISC-LRFD / ANSI/AISC 360-05

1.3 Structure Materials Standards and Specified Strength

STEEL: KS D 3503 Rolled Steel Materials for Structure

- SS400, Fy = 235 MPa

1.4 Analysis Program

- MIDAS/GEN (Frame Analysis, Design)
- MIDAS/SET (Member Design)

The 2nd Chapter. Review of Load

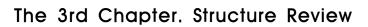
Dead Load(D.L) is considered automatically on analysis program, Live Load(L.L) is applied with 50 N/m, monitor load 1402N/m (1500N/1.07m=1402N/m) and Wind Load(W.L) is applied with 70 Pa offered by manufacturer. Also Horizontal Load is applied with 100 Pa to consider the load which man lean on the board.

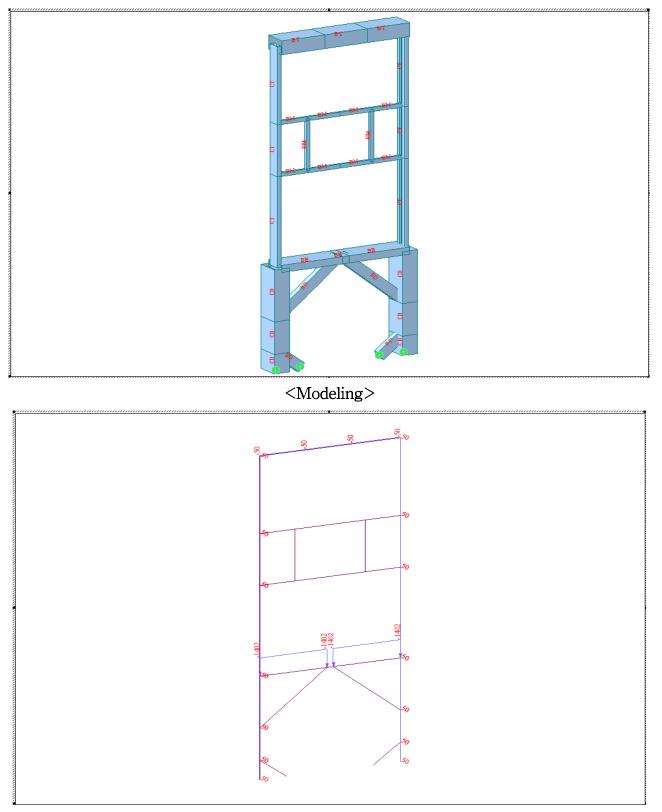
Horizontal Load $(100N/m^2x1.07m/2 = 46.7N/m) \rightarrow Applied 50N/m$ in this review

It was focused on trains passing the station without stopping. During the test most of these trains passed the station at a very low speed.

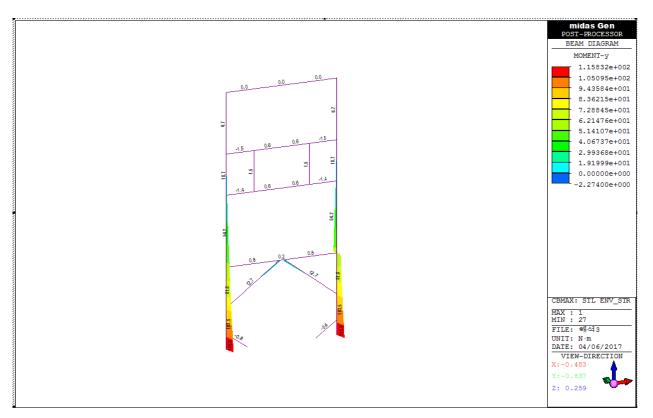
Maximum pressure from the trains was measured to approx. 70 Pa. Nearly all pressure pulses measured were negative (under pressure).

	LOAD CO	MBINATION
1	sLCB1	D+L
2	sLCB2	0.75(D+L+WY)
3	sLCB3	0.75(D+L-WY)
4	sLCB4	0.75(D+WY)
5	sLCB5	0.75(D-WY)

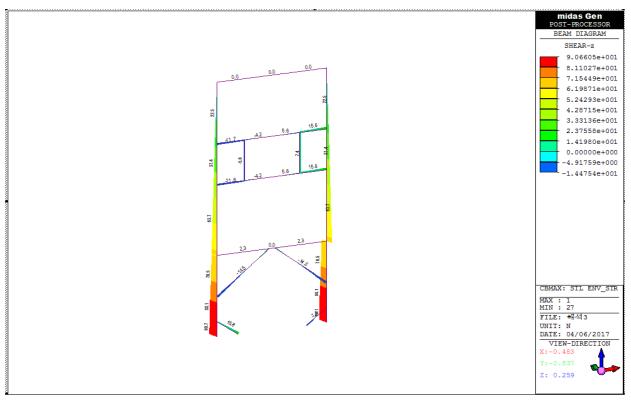




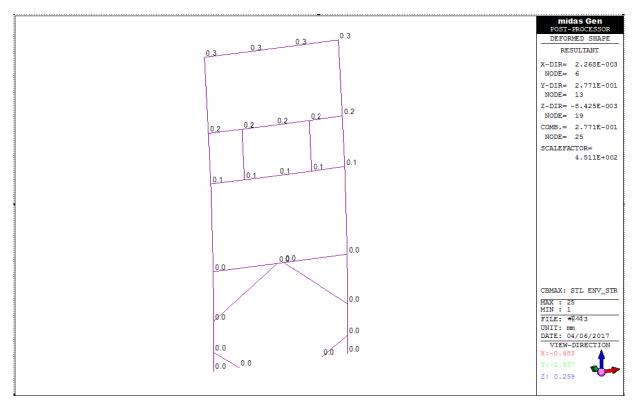
<Applied Load>



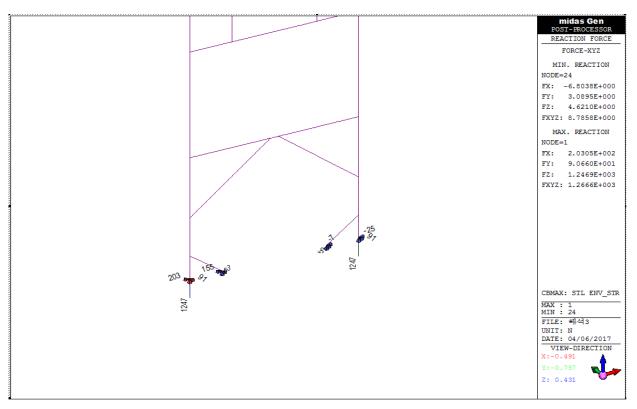
<Bending Moment Diagram>



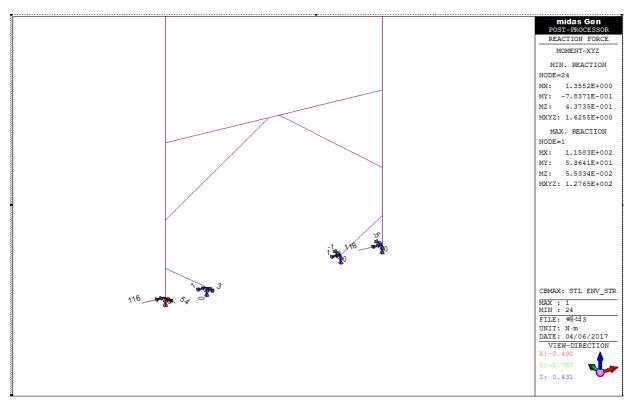
<Shear Force Diagram>



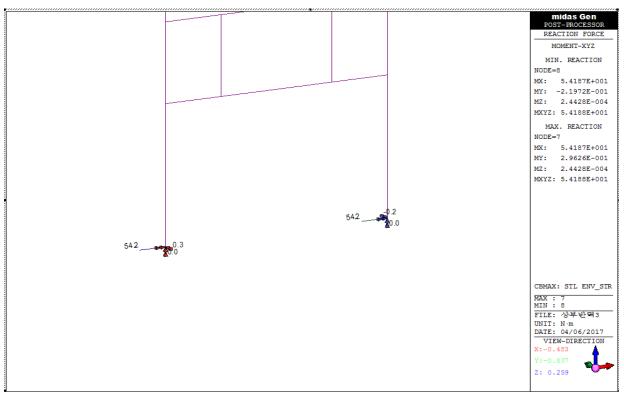
<Deformed Shape Diagram>



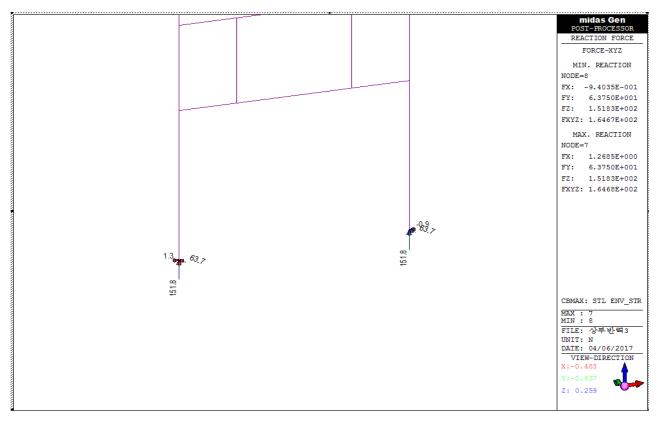
<Reaction Force Diagram - Vertical Force and Horizontal Force>

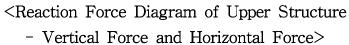


<Reaction Force Diagram - Bending Moment Diagram>



<Reaction Force Diagram of Upper Structure - Bending Moment Diagram>





1) Member Review

Certified by :	-							
-	Company			Project Title				
MIDAS	Author	SSY		File Name		E:\\해석3.mg	gb	
1. Design	nformatio	n				Z		
Design Cod Unit System Member No Material Section Nar	n : kN, m : 1 : SS40 (Fy = ne : CB (N	0 (No:1) : 235000, Es = 20	500000)		0, 19	0.125	y	
Member Le	ngth : 0.800	00				+	•	
2. Member	Forces				Depth	0.19000	Web Thick	0,00500
Axial Force	1	xx = -0.9352	(LCB: 3, F	POS: 1)	Fig.Wi Web Ce		Top F Thick Bot.F Thick	0,00500
Bending Mo		My = -0.1158.	deres .	2.2.12	Area	0,00305	Asz	0.00190
End Momer		Myi = -0.1158.	Myj = -0.10	027 (for Lb)	Qyb Iyy	0.00983	0zb	0.00735
	, i i i i i i i i i i i i i i i i i i i	Myi = -0.1158.	Myj = -0.05	542 (for Ly)	Ybar	0.06250	Zbar	0.09500
		Mzi = -0.0402.	Mzj = -0.0	174 (for Lz)	Syy	0.00016 0.07142	SZZ	0.00013 0.05157
Shear Force	es l	-yy = -0.3583	(LCB: 1.	POS: 1/4)				
	1	zz = -0,0907	(LCB: 3,	POS:1)				
Desimu	Deserved							
3. Design								
Unbraced L			y = 0,80000			. Lb = 0.	15000	
	ngth Factors		xy = 1.00	kz = 1.0	0			
Moment Fa	ctor / Bending		0.05			1 00		
		C	my = 0.85.	Cmz = 0.8	5. Cb	= 1.00		
4. Checkin	g Results							
Slenderne								
K	/r =	11.2 < 200.0	(Memb:1, LC	B: 3)				.к
Axial Stres	s							
fi	a/Fa =	307/ 137845 =	0.002 < 1.0	00			0	.к
Bending S	tresses							
fl	by/Fby =	707/ 155100 =	0.005 < 1.0	00			0	.к
fi	oz/Fbz =	310/ 141000 =	0.002 < 1.0	00			0	.К
Combined	Stress (Co	mpression+Ber	nding)					
R	max = fa/Fa	+ fbcy/Fbcy +	fbcz/Fbcz =	0.009 < 1.0	00		0	.К
Shear Stre	esses							
f	vy/Fvy	= 0.003 < 1.00	0				0	.К

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BAIDA	Company			Project Title	6- C			
MIDAS	Author	SSY		File Name	E:\	\해석3.mg	b	
1. Design	Informatio	n				Z		
Design Cod	e :KSSC	-ASD03			+ 6	-		
Unit System	n : kN, m					0.003		
Member No	:7				11.0	v		
Material	: SS40	0 (No:1)			0.066			
	(Fy =	235000, Es = 20	05000000)					
Section Na	me : CT (N	lo:2)				0,007		
	and the second se	-up Section).				10.032		
Member Le	ngth 1.700	00						
	5 Sec. 1				-	-		
2. Member	20.2195C - J		a		Depth Top F Width		Web Thick Top F Thick	0,00300
Axial Force		xx = -0.1139	A	POS ()	Bot.F Width	0.03200	Bot.F Thick	0.00300
Bending Mo		Ay = -0.0542.			Area Qyb	0.00050	Asz Ozb	0.00033
End Momen		Ayi = -0.0542.		187 (for Lb)	lyy Ybar	0.00000	1zz Zbar	0,00000
		Ayi = -0.0542,		the state of the second	Syy	0.00002	Szz	0.00000
Shear Forc		Azi = -0.0006. Evv = -0.0057	Contract Strength		тy	0.04060	٢Z	0.00909
Shear Ford		zz = -0.0637		POS: 1/2/				
		22 - 0.0007	100. 0.	100-17				
3. Design	Parameter	rs						
			v = 1.70000). Lz = 0	,70000.	Lb = 0.7	70000	
Unbraced I	enoths				2 A 10 COLO M		2330	
Unbraced L Effective Le			(y = 1.00)	KZ = 1.0	0			
Effective Le	engths ength Factors ctor / Bending (ł	(y = 1,00,	Kz = 1,0	0			
Effective Le	ength Factors	Coefficient			0 15, Cb =	1.00		
Effective Le Moment Fa	ength Factors ctor / Bending (P Coefficient				1.00		
Effective Le	ength Factors ctor / Bending (P Coefficient				1.00		
Effective Le Moment Fa 4. Checkin Slenderne	ength Factors ctor / Bending (ng Results ess Ratio	P Coefficient				1.00		
Effective Le Moment Fa 4. Checkin Slenderne K	ng Results ess Ratio	P Coefficient	Cmy = 0.85.	Cmz = 0.8			0	.К
Effective Le Moment Fa 4. Checkin Slenderne K Axial Stree	ength Factors ctor / Bending (ag Results ass Ratio L/r = ss	Coefficient (77.0 < 200.0	Cmy = 0.85. (Memb:7, LC	Cmz = 0.8 B: 3)	15, Cb =			
Effective Le Moment Fa 4. Checkin Slenderne K Axial Stre f	ngth Factors ctor / Bending (ng Results ess Ratio L/r = ss a/Fa =	k Coefficient (Cmy = 0.85. (Memb:7, LC	Cmz = 0.8 B: 3)	15, Cb =			
Effective Le Moment Fa 4. Checkin Slenderne K Axial Stree f Bending S	ngth Factors ctor / Bending (ng Results ess Ratio L/r = ss a/Fa = Stresses	Coefficient (77.0 < 200.0 226/ 104483 =	Cmy = 0.85. (Memb:7, LC = 0.002 < 1.0	Cmz = 0.8 B: 3)	15. Cb =		0	.К
Effective Le Moment Fa 4. Checkin Slenderne K Axial Stree f Bending S f	ength Factors ctor / Bending (ag Results ass Ratio L/r = ss a/Fa = Stresses by/Fby =	Coefficient (77.0 < 200.0 226/ 104483 = 3587/ 103481 =	Cmy = 0.85. (Memb:7, LC = 0.002 < 1.0 = 0.035 < 1.0	Cmz = 0.8 B: 3) 00	15. Cb =		0	.к .к
Effective Le Moment Fa Slenderne K Axial Stre f Bending S f f	angth Factors ctor / Bending (ang Results ass Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz =	Coefficient 77.0 < 200.0 226/ 104483 = 3587/ 103481 = 336/ 141000 =	Cmy = 0.85. (Memb:7, LC = 0.002 < 1.0 = 0.035 < 1.0 = 0.002 < 1.0	Cmz = 0.8 B: 3) 00	15. Cb =		0	.к .к
Effective Le Moment Fa Slenderne K Axial Stree f Bending S f f Combinec	ength Factors ctor / Bending (ag Results ass Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz = t Stress (Con	Coefficient (77.0 < 200.0 226/ 104483 = 3587/ 103481 = 336/ 141000 = mpression+Ber	Cmy = 0.85. (Memb:7, LC = 0.002 < 1.0 = 0.035 < 1.0 = 0.002 < 1.0 nding)	Cmz = 0.8 B: 3) 00 00	15. Cb =		0 0 0	.К .К .К
Effective Le Moment Fa 4. Checkin Slenderne K Axial Stree f Bending S f Combinec R	angth Factors ctor / Bending (ang Results ass Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz = d Stress (Coi max = fa/Fa	Coefficient 77.0 < 200.0 226/ 104483 = 3587/ 103481 = 336/ 141000 =	Cmy = 0.85. (Memb:7, LC = 0.002 < 1.0 = 0.035 < 1.0 = 0.002 < 1.0 nding)	Cmz = 0.8 B: 3) 00 00	15. Cb =		0 0 0	.К .К .К
Effective Le Moment Fa 4. Checkin Slenderne K Axial Stree f Bending S f Combinec R Shear Stree	angth Factors ctor / Bending (ang Results ass Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz = d Stress (Coi max = fa/Fa esses	Coefficient (77.0 < 200.0 226/ 104483 = 3587/ 103481 = 336/ 141000 = mpression+Ber	Cmy = 0.85. (Memb:7, LC = 0.002 < 1.0 = 0.035 < 1.0 = 0.002 < 1.0 nding) + fbcz/Fbcz =	Cmz = 0.8 B: 3) 00 00 00 00 0.037 < 1.0	15, Cb =		0 0 0	.к .к .к

Certified by :						_			
BARAD	Company			Project Title					
MIDAS	Author	SSY		File Name		E:\\	해석3.mg	jb	
1. Design	Informatio	n			-		Z		
Design Cod	e :KSSC	-ASD03			1	- 001			
Unit System	n : kN, m							1.0	
Member No	: 15				0.03			- y	
Material	: SS400	0 (No:1)			0				
	(Fy =	235000, Es = 20	05000000)						
Section Nat	me BM (N	lo:3)							
		-up Section).					1 0.02	1	
Member Le	ngth : 1.050	00					•	•	
i instant					-			-	_
2. Member	Forces				Depth Fla W		0.03000	Web Thick Top F Thick	0.00320
Axial Force		xx = -0.0024		POS J)	Web C		0.01680	Bol, F Thick	0.00320
Bending Mo		My = -0.0020.			Area Ovb		0.00028	Asz Ozb	0.00019
End Momen	0.11	Myi = -0.0020.			lyy Ybar		0.00000	Izz Zbar	0.00000
		Myi = 0.00136,			SVY		0.00000	Szz	0.00000
01- F		Azi = 0.00000.	1.		ry		0.01039	rz	0.00734
Shear Force		yy = 0.00007		POS:1)					
	C	77 - 0.01556	() (9 1	DOC* 1)					
	F	zz = 0,01556	(LCB; 1,	POS:J)					
3. Design			(LCB; 1,	POS:J)					
3. Design	Parameter	rs			.05000).	Lb = 1.0	05000	
Unbraced L	Parameter engths	rs L	(LCB: 1, _y = 0.26250 (y = 1.00,), Lz = ').	Lb = 1.0	05000	
Unbraced L Effective Le	Parameter	rs L	_y = 0.26250), Lz = ').	Lb = 1,0	05000	
Unbraced L Effective Le	Parameter engths ength Factors	r s L K	_y = 0.26250), Lz = 1.(Kz = 1.(00		Lb = 1,0	05000	
Unbraced L Effective Le Moment Fa	Parameter engths ength Factors ctor / Bending (r s L K	Ly = 0.26250 (y = 1.00,), Lz = 1.(Kz = 1.(00			05000	
Unbraced L Effective Le	Parameter engths ength Factors ctor / Bending (r s L K	Ly = 0.26250 (y = 1.00,), Lz = 1.(Kz = 1.(00			05000	
Unbraced L Effective Le Moment Fa	Parameter engths ength Factors ctor / Bending (ng Results	r s L K	Ly = 0.26250 (y = 1.00,), Lz = 1.(Kz = 1.(00			05000	
Unbraced L Effective Le Moment Fa 4. Checkin Slenderne K	Parameter engths ength Factors ctor / Bending (og Results ess Ratio L/r =	r s L K	_y = 0.26250 (y = 1.00, Cmy = 1.00,), Lz = ' Kz = 1.(Cmz = 1.(00, Cb	=	1.00	D5000	.К
Unbraced L Effective Le Moment Fa 4. Checkin Slenderne K Axial Stre	Parameter engths ength Factors ctor / Bending (og Results ess Ratio L/r = ss	r S L K Coefficient C 143.0 < 200.0	_y = 0.26250 (y = 1.00, Cmy = 1.00, (Memb:15, L), Lz = ' Kz = 1.(Cmz = 1.(CB: 1)	00, Cb) =	1.00		
Unbraced L Effective Le Moment Fa 4. Checkin Slenderne K Axial Stree f	Parameter engths ength Factors ctor / Bending (ag Results bas Ratio L/r = ss a/Fa =	r S L K Coefficient	_y = 0.26250 (y = 1.00, Cmy = 1.00, (Memb:15, L), Lz = ' Kz = 1.(Cmz = 1.(CB: 1)	00, Cb) =	1.00		
Unbraced L Effective Le Moment Fa 4. Checkin Slenderne K Axial Stree f Bending S	Parameter engths ength Factors ctor / Bending (ag Results bass Ratio L/r = ss a/Fa = Stresses	rs Coefficient 143.0 < 200.0 8.7/51651.5 =	y = 0.26250 (y = 1.00, Cmy = 1.00, (Memb:15, L = 0.000 < 1.0), Lz = 1.0 Kz = 1.0 Cmz = 1.0 CB: 1)	00, Cb		1.00		.К
Unbraced L Effective Le Moment Fa 4. Checkin Slenderne K Axial Stree f Bending S	Parameter engths ength Factors ctor / Bending (ag Results ess Ratio L/r = ss a/Fa = Stresses by/Fby =	rs Coefficient 143.0 < 200.0 8.7/51651.5 = 987/ 141000 =	y = 0.26250 (y = 1.00, Cmy = 1.00, (Memb:15, L = 0.000 < 1.0), Lz = 1.0 Kz = 1.0 Cmz = 1.0 CB: 1) 00	ю ю. Сы		1.00		.к
Unbraced L Effective Le Moment Fa 4. Checkin Slenderne K Axial Stree f Bending S f f	Parameter engths ength Factors ctor / Bending (ag Results bas Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz =	rs Coefficient 143.0 < 200.0 8.7/51651.5 = 987/ 141000 = 0/ 141000 =	Ly = 0.26250 (y = 1.00, Cmy = 1.00, (Memb:15, L = 0.000 < 1.0 = 0.007 < 1.0 = 0.000 < 1.0), Lz = 1.0 Kz = 1.0 Cmz = 1.0 CB: 1)	ю ю. Сы		1.00		.к
Unbraced L Effective Le Moment Fa 4. Checkin Slenderne K Axial Stree f Bending S f f Combinec	Parameter engths ength Factors ctor / Bending (ag Results ess Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz = 1 Stress (Con	rs Coefficient 143.0 < 200.0 8.7/51651.5 = 987/ 141000 = 0/ 141000 = mpression+Ber	Ly = 0.26250 (y = 1.00, Cmy = 1.00, (Memb:15, L = 0.000 < 1.0 = 0.007 < 1.0 = 0.000 < 1.0 mding)), Lz = 1. 1(z = 1.0 Cmz = 1.0 CB: 1) 00	ю ю. сы		1.00		.К .К .К
Unbraced L Effective Le Moment Fa 4. Checkin Slenderne K Axial Stree f Bending S f f Combinec	Parameter engths ength Factors ctor / Bending (ag Results ess Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz = 1 Stress (Commax = fa/Fa	rs Coefficient 143.0 < 200.0 8.7/51651.5 = 987/ 141000 = 0/ 141000 =	Ly = 0.26250 (y = 1.00, Cmy = 1.00, (Memb:15, L = 0.000 < 1.0 = 0.007 < 1.0 = 0.000 < 1.0 mding)), Lz = 1. 1(z = 1.0 Cmz = 1.0 CB: 1) 00	ю ю. сы		1.00		.К .К .К
Unbraced L Effective Le Moment Fa Slenderne K Axial Stree f Bending S f Combinec R Shear Stree	Parameter engths ength Factors ctor / Bending (ag Results ess Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz = d Stress (Commax = fa/Fa esses	rs Coefficient 143.0 < 200.0 8.7/51651.5 = 987/ 141000 = 0/ 141000 = mpression+Ber	Ly = 0.26250 (y = 1.00, Cmy = 1.00, (Memb:15, L = 0.000 < 1.0 = 0.007 < 1.0 = 0.007 < 1.0 = 0.000 < 1.0 = 0.000 < 1.0 = 0.000 < 1.0), Lz = 1. 1(z = 1.0 Cmz = 1.0 CB: 1) 00	00, Cb		1.00		.К .К .К

Certified by :	í	-						
MIDAS	Company			Project Title				
IMIDV2	Author	SSY		File Name	EA.A	해석3.mg	b	
1. Design	Informatio	n				Z		
Design Coo	le : KSSC	C-ASD03			+ 8	Ē-		
Unit System	n : kN, m	1				0.005		
Member No	: 13				4	y		
Material	: SS40	0 (No:1)			0,0			
	(Fy =	= 235000, Es = 20	5000000)		0.0			
Section Na	me : BB (N	No:4)			+ +	0,012		
	(Built	t-up Section).				0.055		
Member Le	ngth : 1.050	000						
1.1.1.1.							and the second	
2. Member	r Forces				Depth Top F Width	0.19000	Web Thick Top F Thick	0.00500
Axial Force		Fxx = 0.04013		(L:20	Bot.F Width		Bot.F Thick	0.00500
Bending Mo		My = 0.00000,			Area Qyb	0.00145	Asz Ozb	0.00095
End Momen		Myi = 0.00000.			Tyy	0.00001	IZZ	0.00000
		Myi = 0.00000,			Ybar Syy	0.01198	Zbar Szz	0.09500
		Mzi = 0.02252.			ry	0.07016	ŕZ	0.01562
Shear Forc		Fyy = -0.4066		POS:J)				
	,	Fzz = 0.00228	(LCB: 3,	POS:1/4)				
3. Design	Paramete	rs						
Unbraced L			v = 1.05000	. Lz = 0	50000	Lb = 0.5	50000	
	ength Factors			Kz = 1.0	Contraction of the second	20 0,1		
LIECUVE LE				112				
Moment Fa	ctor / Rendind	ooomolom	Cmy = 1.00.	Cmz = 1.0	0. Cb =	1.00		
Moment Fa	ctor / Bending	C						
Moment Fa	ctor / Bending	C						
Moment Fa 4. Checkir								
	ng Results							
4. Checkir Slenderne	ng Results			CB: 1)			0	.к
4. Checkir Slenderne	ng Results ess Ratio /r =			CB: 1)			0	.К
4. Checkir Slenderne L Axial Stre	ng Results ess Ratio /r =	32.0 < 300.0	(Memb:13, LC	CB: 1)				
4. Checkir Slenderne L Axial Stre	ng Results ess Ratio /r = ss t/Ft =	32.0 < 300.0	(Memb:13, LC					
4. Checkir Slenderne L Axial Stre f Bending S	ng Results ess Ratio /r = ss t/Ft =	32.0 < 300.0	(Memb:13, L0	00			0	.К
4. Checkir Slenderne L Axial Stre f Bending S	ng Results ess Ratio /r = ss t/Ft = Stresses by/Fby =	32.0 < 300.0 28/ 141000 =	(Memb:13, L0 0.000 < 1.00 0.000 < 1.00	00 00			0	.к .к
4. Checkir Slenderne L Axial Stre f Bending S f f	ng Results ess Ratio /r = ss t/Ft = Stresses by/Fby = bz/Fbz =	32.0 < 300.0 28/ 141000 = 0/ 155100 =	(Memb:13, L0 0.000 < 1.00 0.000 < 1.00 0.032 < 1.00	00 00			0	.к .к
4. Checkin Slenderne L Axial Stre f Bending S f f Combined	ng Results ess Ratio /r = ss t/Ft = Stresses by/Fby = bz/Fbz = d Stress (Te	32.0 < 300.0 28/ 141000 = 0/ 155100 = 4452/ 141000 =	(Memb:13, L0 0.000 < 1.00 0.000 < 1.00 0.032 < 1.00	00 00 00			0 0 0	.К .К .К
4. Checkin Slenderne L Axial Stre f Bending S f f Combined	ng Results ess Ratio /r = ss t/Ft = Stresses by/Fby = bz/Fbz = d Stress (Te max = fbcy/	32.0 < 300.0 28/ 141000 = 0/ 155100 = 4452/ 141000 = nsion+Bending)	(Memb:13, L0 0.000 < 1.00 0.000 < 1.00 0.032 < 1.00	00 00 00			0 0 0	.К .К .К
4. Checkin Slenderne L Axial Stre f Bending S f Combinec R Shear Stre	ng Results ess Ratio /r = ss t/Ft = Stresses by/Fby = bz/Fbz = d Stress (Te max = fbcy/ esses	32.0 < 300.0 28/ 141000 = 0/ 155100 = 4452/ 141000 = nsion+Bending)	(Memb:13, L0 0.000 < 1.00 0.000 < 1.00 0.032 < 1.00 cz = 0.032 ·	00 00 00 < 1.000			0 0 0	.к .к .к

Print Date/Time : 04/06/2017 00:24

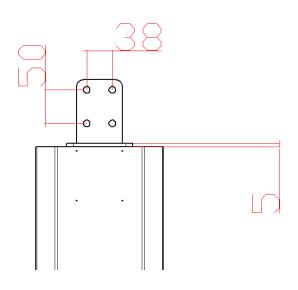
Certified by :						-			
-	Company			Project Title					
MIDAS	Author	SSY		File Name		E:\\	해석3.mg	jb	
1. Design	Informatio	n					Z		
Design Cod	le :KSSC	-ASD03			-	- 8.		Í	
Unit System	n : kN, m							- C.	
Member No	: 14				0.19			- y	
Material	: SS400	0 (No:1)			0				
	(Fy =	235000, Es = 2	205000000)						
Section Nar	me : BT (N	o:5)				0.0	012		
		-up Section).					0,106		
Member Le	ngth : 1.050	00						1	
	-				-	_			
2. Member					Depth Flg W		0.19000	Web Thick Top F Thick	0.00120
Axial Force			(LCB: 1, P		Web C	enter	0.10480	Bot,F Thick	0.00120
Bending Mo			Mz = 0.013		Area Oyb		0.00070	Asz Qzb	0.00046
End Momer		이야지는 말에서 아직 것	Myj = 0,000		Lyy		0.00000	Izz	0.00000
			Myj = 0.000		Ybar Syy		0.05300	Zbar Szz	0.09500
	A COLORADO								
			$Mz_j = -0.00$		ry.		0.07135	٢Z	0.04574
Shear Force	es F	yy = 0.05473	3 (LCB: 1.	POS:J)	ry.	_	0.07135	ſŹ	0,04574
Shear Force	es F	yy = 0.05473		POS:J)	ry	_	0,07135	ΓZ	0.04574
	es F F	yy = 0.05473 zz = 0.00000	3 (LCB: 1.	POS:J)	ry		0.07135	ΓZ	0.04574
3. Design	es F F Parameter	yy = 0.05473 zz = 0.00000	3 (LCB: 1.) (LCB: 3.	POS:J) POS:1/2)).			0.04574
3. Design	es F F Parameter .engths	yy = 0.05473 zz = 0.00000	3 (LCB: 1.) (LCB: 3. Ly = 1.05000	POS:J) POS:1/2) . Lz = 1	.05000	р.	0.07135 Lb = 1.0		0.04574
3. Design Unbraced L Effective Le	es F F Parameter engths ength Factors	yy = 0.05476 zz = 0.00000	3 (LCB: 1.) (LCB: 3. Ly = 1.05000	POS:J) POS:1/2) . Lz = 1	.05000	D.			0.04574
3. Design Unbraced L Effective Le	es F F Parameter .engths	yy = 0.05476 zz = 0.00000	3 (LCB: 1, 0 (LCB: 3, Ly = 1.05000 Ky = 1.00,	POS:J) POS:1/2) . Lz = 1 Kz = 1.C	.05000				0.04574
3. Design Unbraced L Effective Le Moment Fa	es F F Parameter engths ength Factors ctor / Bending (yy = 0.05476 zz = 0.00000	3 (LCB: 1, 0 (LCB: 3, Ly = 1.05000 Ky = 1.00,	POS:J) POS:1/2) . Lz = 1 Kz = 1.C	05000		Lb = 1.(0,04574
 Design Unbraced L Effective Le Moment Fa Checkin 	es F F Parameter engths ength Factors ctor / Bending (ng Results	yy = 0.05476 zz = 0.00000	3 (LCB: 1, 0 (LCB: 3, Ly = 1.05000 Ky = 1.00,	POS:J) POS:1/2) . Lz = 1 Kz = 1.C	05000		Lb = 1.(0,04574
 Design Unbraced L Effective Le Moment Fa Checkin Slenderne 	es F F Parameter engths ength Factors ctor / Bending (ng Results ess Ratio	yy = 0.05473 zz = 0.00000 s	3 (LCB: 1, 0 (LCB: 3, Ly = 1.05000 Ky = 1.00, Cmy = 1.00,	POS:J) POS:1/2) . Lz = 1 Kz = 1.C Cmz = 1.C	0,05000 00 00. Ct) =	Lb = 1.0	05000	
 Design I Unbraced L Effective Le Moment Fa Moment Fa Slenderme K 	es F F Parameter engths ength Factors ctor / Bending C ng Results ess Ratio L/r =	yy = 0.05473 zz = 0.00000 s	3 (LCB: 1, 0 (LCB: 3, Ly = 1.05000 Ky = 1.00,	POS:J) POS:1/2) . Lz = 1 Kz = 1.C Cmz = 1.C	0,05000 00 00. Ct) =	Lb = 1.0		
 Design I Unbraced L Effective Le Moment Fa Moment Fa Slenderne K Axial Street 	es F F Parameter engths ength Factors ctor / Bending (ng Results ass Ratio L/r = ss	yy = 0.05473 zz = 0.00000 s Coefficient 23.0 < 200.0	3 (LCB: 1, 0 (LCB: 3, Ly = 1.05000 Ky = 1.00, Cmy = 1.00, (Memb:14, Lt	POS:J) POS:1/2) . Lz = 1 Kz = 1.C Cmz = 1.C CB: 1)	0.05000 00 00. Ct) =	Lb = 1.0		.к
 Design I Unbraced L Effective Le Moment Fa Moment Fa Stenderme Ki Axial Stree f. 	es F F Parameter engths ength Factors ctor / Bending (og Results ess Ratio L/r = ss a/Fa =	yy = 0.05473 zz = 0.00000 s Coefficient 23.0 < 200.0	3 (LCB: 1, 0 (LCB: 3, Ly = 1.05000 Ky = 1.00, Cmy = 1.00,	POS:J) POS:1/2) . Lz = 1 Kz = 1.C Cmz = 1.C CB: 1)	0.05000 00 00. Ct) =	Lb = 1.0		.к
 Design I Unbraced L Effective Le Moment Fa Checkin Slenderne Ki Axial Stres f. Bending S 	es F F Parameter engths ength Factors ctor / Bending (og Results ess Ratio L/r = ss a/Fa = Stresses	yy = 0.05473 zz = 0.00000 rs Coefficient 23.0 < 200.0 4.6/48231.0	3 (LCB: 1, 0 (LCB: 3, Ly = 1.05000 Ky = 1.00, Cmy = 1.00, (Memb:14, Li = 0.000 < 1.00	POS:J) POS:1/2) . Lz = 1 Kz = 1.C Cmz = 1.C CB: 1)	0.05000 00. Ct) =	Lb = 1.0		.к
 Design I Unbraced L Effective Le Moment Fa Checkin Slenderne Ki Axial Stres f. Bending S fi 	es F F Parameter engths ength Factors ctor / Bending (ag Results ess Ratio L/r = ss a/Fa = Stresses by/Fby =	yy = 0.05473 zz = 0.00000 rs Coefficient 23.0 < 200.0 4.6/48231.0 0/ 155100	3 (LCB: 1. 0 (LCB: 3. Ly = 1.05000 Ky = 1.00. Cmy = 1.00. (Memb:14. Li = 0.000 < 1.0i = 0.000 < 1.0i	POS:J) POS:1/2) J. Lz = 1 Kz = 1.C Cmz = 1.C CB: 1) 00	0.05000 00 00. Ct) =	Lb = 1.0		.к .к
 Design I Unbraced L Effective Le Moment Fa Checkin Slenderne K Axial Stree f. Bending S fl 	es F F Parameter engths ength Factors ctor / Bending (ag Results ess Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz =	yy = 0.05473 zz = 0.00000 rs Coefficient 23.0 < 200.0 4.6/48231.0 0/ 155100 1257/ 141000	3 (LCB: 1. 0 (LCB: 3. Ly = 1.05000 Ky = 1.00. Cmy = 1.00. (Memb:14. Li = 0.000 < 1.0i = 0.000 < 1.0i = 0.009 < 1.0i	POS:J) POS:1/2) J. Lz = 1 Kz = 1.C Cmz = 1.C CB: 1) 00	0.05000 00 00. Ct) =	Lb = 1.0		.к .к
 Design I Unbraced L Effective Le Moment Fa Checkin Slenderne Ki Axial Stres f. Bending S fl fl Combined 	es F F Parameter engths ength Factors ctor / Bending (ag Results ess Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz = d Stress (Con	yy = 0.05473 zz = 0.00000 rs Coefficient 23.0 < 200.0 4.6/48231.0 0/ 155100 1257/ 141000 mpression+Be	3 (LCB: 1, 0 (LCB: 3, Ly = 1.05000 Ky = 1.00, Cmy = 1.00, Cmy = 1.00, (Memb:14, Lt = 0.000 < 1.00 = 0.000 < 1.00 = 0.009 < 1.00 pnding)	POS:J) POS:1/2) J. Lz = 1 Kz = 1.C Cmz = 1.C CB: 1) 00 00	1,05000 00. Ct) =	Lb = 1.0	D5000 0 0 0	.к .к .к
 Design I Unbraced L Effective Le Moment Fa Checkin Slenderne Ki Axial Stres fi Bending S fi Combined R 	es F F Parameter engths ength Factors ctor / Bending (C ng Results ess Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz = d Stress (Con max = fa/Fa	yy = 0.05473 zz = 0.00000 rs Coefficient 23.0 < 200.0 4.6/48231.0 0/ 155100 1257/ 141000 mpression+Be	3 (LCB: 1, 0 (LCB: 3, Ly = 1.05000 Ky = 1.00, Cmy = 1.00, (Memb:14, Li = 0.000 < 1.0i = 0.000 < 1.0i = 0.009 < 1.0i	POS:J) POS:1/2) J. Lz = 1 Kz = 1.C Cmz = 1.C CB: 1) 00 00	1,05000 00. Ct) =	Lb = 1.0	D5000 0 0 0	.к .к .к
 Design I Unbraced L Effective Le Moment Fa Checkin Slenderne Ki Axial Stres fi Bending S fi Combinect R Shear Stres 	es F F Parameter engths ength Factors ctor / Bending (C ng Results ess Ratio L/r = ss a/Fa = 5tresses by/Fby = bz/Fbz = d Stress (Con max = fa/Fa esses	yy = 0.05473 zz = 0.00000 s Coefficient 23.0 < 200.0 4.6/48231.0 0/ 155100 1257/ 141000 mpression+Be + fbcy/Fbcy	3 (LCB: 1, 0 (LCB: 3, Ly = 1.05000 Ky = 1.00, Cmy = 1.00, Cmy = 1.00, (Memb:14, Lt = 0.000 < 1.00 = 0.000 < 1.00 = 0.009 < 1.00 pnding)	POS: J) POS: 1/2) J. Lz = 1 Kz = 1.0 Cmz = 1.0 CB: 1) 00 00 00 00 00 00	1.05000 20 20. Ct	o =	Lb = 1.0	D5000 0 0 0	.к .к .к .к

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Certified by :								
MIDAS	Company			Project Title	6			
MIDV2	Author	SSY		File Name	E:\	\해석3.mg	jb	
1. Design	Informatio	n				Z		
Design Coo	de :KSSC	-ASD03			+ 8		1	
Unit System	n kN, m							
Member No	: 28				80		- v	
Material	: SS40	0 (No:1)			0.			
	(Fy =	235000, Es = 20	5000000)					
Section Na	me : BD (N	lo:6)			-	0.008		
	(Built	-up Section).				0.05	1	
Member Le	ength : 0.640	31				1	-	
2. Membe	r Forces				Depth	0.08000	Web Thick	0.00300
Axial Force		xx = -0.5528	(ICB- 1 0	005-11	Flg Width	0.05000	Top F Thick Bot F Thick	0.00300
Bending Mo		IV = -0.0145.		(A) (A)	Web Center Area	0.04700	Asz	0.00300
End Momen		lyī = −0.0145.			Qyb	0.00165	Qzb	0.00118
End monio		Myi = -0.0145.			lyy Ybar	0.00000	lzz Zbar	0.00000
		zi = 0.00000.			Syy	0.00002	Szz	0.00001
Shear Forc	es F	yy = 0.00228	(LCB: 3,	POS: 1/2)			04	
	F	zz = -0.0568	(LCB: 1,	POS: ()				
3. Design	Parameter	'S						
Unbraced L	engths	L	y = 0.64031	l, Lz = 0	.64031,	Lb = 0.0	54031	
	ength Factors		y = 1.00,	kz = 1.0	00			
Moment Fa	ctor / Bending (S 6	1				
		C	my = 1.00,	Cmz = 1.0	00, Cb =	1.00		
4. Checkir	ng Results							
4. Checkir Slenderne								K
Slenderne	ess Ratio	31.5 < 200.0	(Memb:28, L	CB: 1)				. 11
Slenderne	ess Ratio L/r =	31.5 < 200.0	(Memb:28, L	CB: 1)			0	.1
Slenderne K Axial Stre	ess Ratio L/r =	31.5 < 200.0 743/ 130062 =						
Slenderne K Axial Stre	ess Ratio L/r = ss a/Fa =							
Slenderne K Axial Stre f Bending S	ess Ratio L/r = ss a/Fa =		0.006 < 1.0	00			0	.К
Slenderne K Axial Stre f Bending S	ess Ratio L/r = ss a/Fa = Stresses	743/ 130062 = 895/ 155100 =	0.006 < 1.0	00			0	.к .к
Slenderne K Axial Stre f Bending S f f Combine	a/Fa = Stresses by/Fby = bz/Fbz = d Stress (Co	743/ 130062 = 895/ 155100 = 0/ 141000 = mpression+Ben	0.006 < 1.0 0.006 < 1.0 0.000 < 1.0 ding)	00 00 00			0 0 0	.к .к .к
Slenderne K Axial Stre f Bending S f f Combinec R	ass Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz = d Stress (Co Imax = fa/Fa	743/ 130062 = 895/ 155100 = 0/ 141000 =	0.006 < 1.0 0.006 < 1.0 0.000 < 1.0 ding)	00 00 00			0 0 0	.к .к .к
Slenderne K Axial Stre f Bending S f f Combine R Shear Stre	ess Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz = d Stress (Col Imax = fa/Fa esses	743/ 130062 = 895/ 155100 = 0/ 141000 = mpression+Ben + fbcy/Fbcy +	0.006 < 1.0 0.006 < 1.0 0.000 < 1.0 ding) fbcz/Fbcz =	00 00 00 0.011 < 1.0	00		0 0 0	.к .к .к
Slenderne k Axial Stre- f Bending S f f Combinec R Shear Str f	ess Ratio L/r = ss a/Fa = Stresses by/Fby = bz/Fbz = d Stress (Co Imax = fa/Fa esses vy/Fvy	743/ 130062 = 895/ 155100 = 0/ 141000 = mpression+Ben	0.006 < 1.0 0.006 < 1.0 0.000 < 1.0 ding) fbcz/Fbcz =	00 00 00 0.011 < 1.0			0 0 0 0 0	.к .к .к .к

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2) Connecting Bolt of Upper-Lower Member (Base+Monitor)



- Internal Force of Wrench Bolt M10
 Fy = 325MPa, Fa = 117MPa, A = 78.5mm2
 Vr = 9.18kN/ea
- ② Design Load
 - M = 54.2 N.m

$$Vx = 64N$$
, $Rx = Vx/4 = 16.0N/ea$

$$Vy = 152N$$
, $Ry = Vy/4 = 38.0N/ea$

3 Bolt Review

$$\begin{split} \sum(x_i^2 + y_i^2) &= 4(19^2 + 25^2) = 3944 \\ R_{m,x} &= \frac{M \times y_m}{\sum(x^2 + y^2)} = \frac{54.2 \times 1000 \times 25}{3944} = 344 \text{N/ea} \\ R_{m,y} &= \frac{M \times x_m}{\sum(x^2 + y^2)} = \frac{54.2 \times 1000 \times 19}{3944} = 261 \text{N/ea} \\ R &= \sqrt{(R_{m,x} + V_x)^2 + (R_{m,y} + V_y)^2} = \sqrt{(344 + 16.0)^2 + (261 + 38.0)^2} = 468 \text{N/ea} \\ &< \text{Vr} = 9.18 \text{kN/ea} \quad ----> \text{O.K} \end{split}$$

3) Connectiong Bolt of Foundation Member



① Internal Force of Hilti HVU-HAS M16 (Refer to Hilti Manual)

Fz,r = 24.8kNFx,r = 24.7kN

2 Design Load

M = 116 N.m

Fz = 1247N

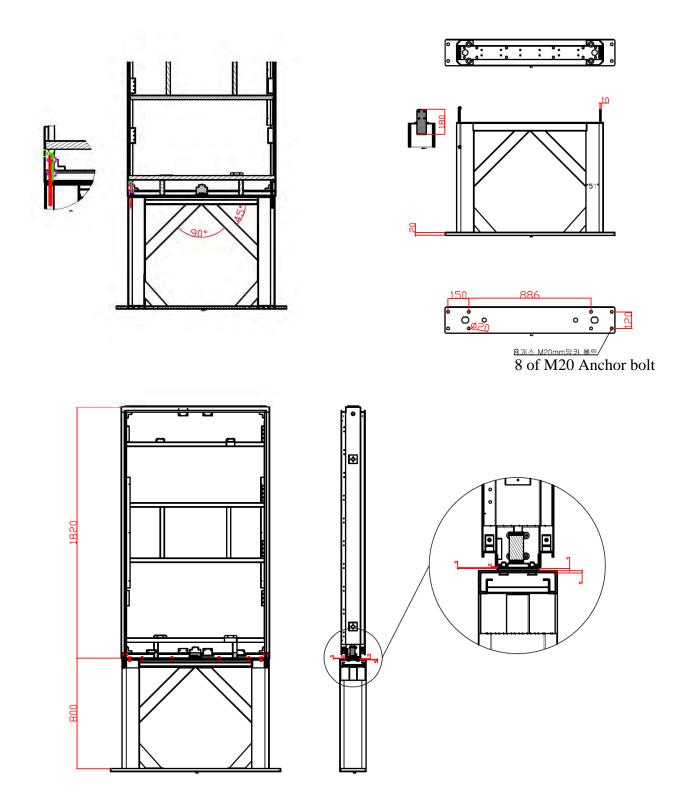
Vx = 203N

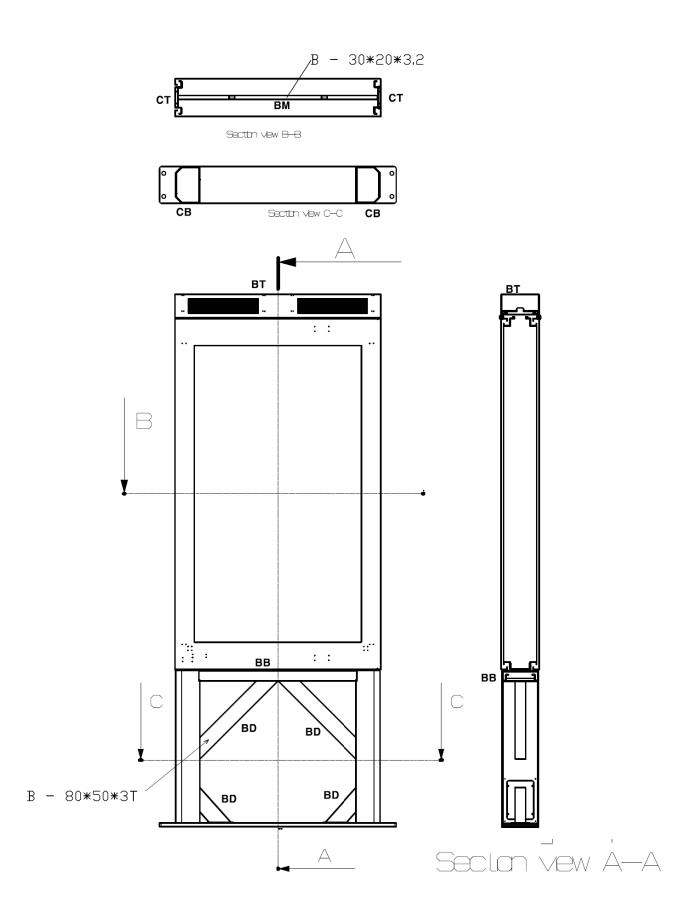
- Vy = 92N
- ③ Axial Force Review

M/d+Fz = 116/0.12+1247 = 967+1247 = 2214N < Fz,r = 24.8kN ----> O.K

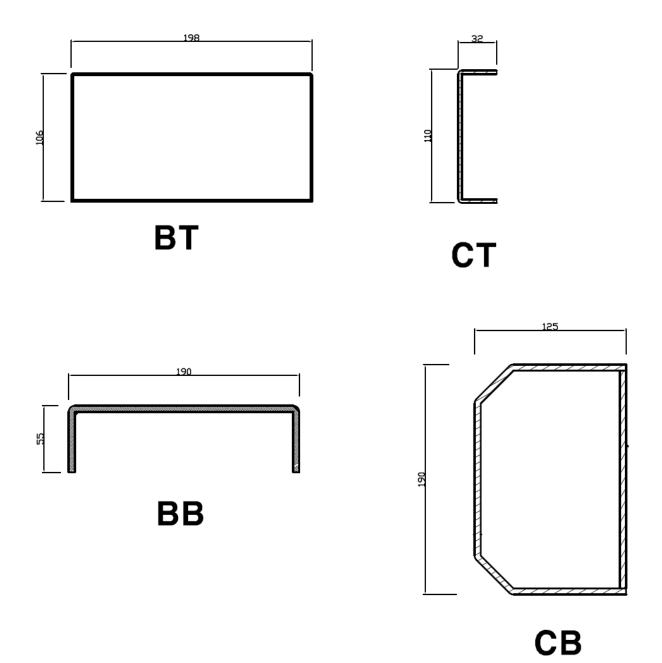
④ Shear Force Review

 $V = (Vx^2+Vy^2)^{0.5} = 223N < Fx,r = 24.7kN$ ----> O.K





Approximative Member Section



The 5th Chapter. Review Result

1) The 70inch advertising board installed in Oslo subway station secured structural safety on dead load and 100 Pa of wind load in subway station and leaning load, if it is installed as reviewed drawing.

This is to confirm that model #NIOD-700P, 70" Double-sided transit KIOSK, is structurally safe on dead load and 100 Pa of wind load in subway station at Oslo subway station as reviewed drawing.