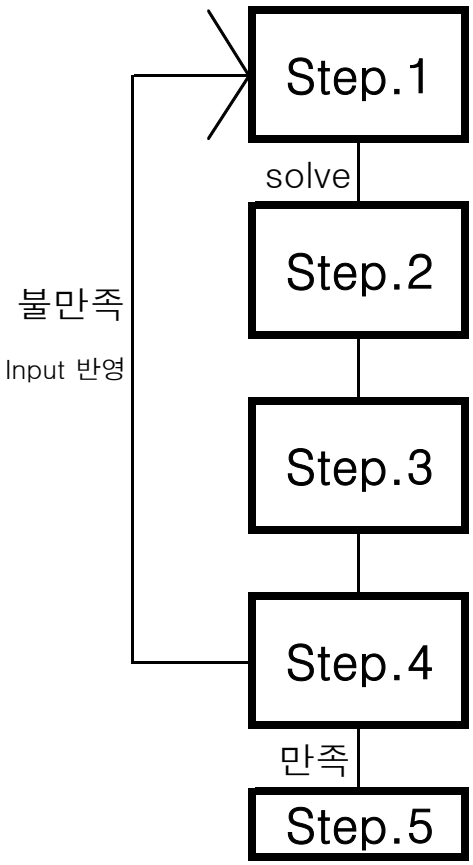
※ 반복시산법을 통한 축강성 결정 순서도



Strut 및 Tie의 축강성을 가정한다.

부정정 스트럿-타이 모델에 대한 구조해석

각 Strut 및 Tie의 단면력을 결정

단면력을 각 Strut 및 Tie의 유효강도로 나누어 Strut 및 Tie의 단면적 결정

Strut 및 Tie의 단면적에 탄성계수를 곱하여 Strut 및 Tie의 축강성을 결정

Step.1의 가정된 축강성과 Step.3의 축강성 차이가 허용한계를 만족

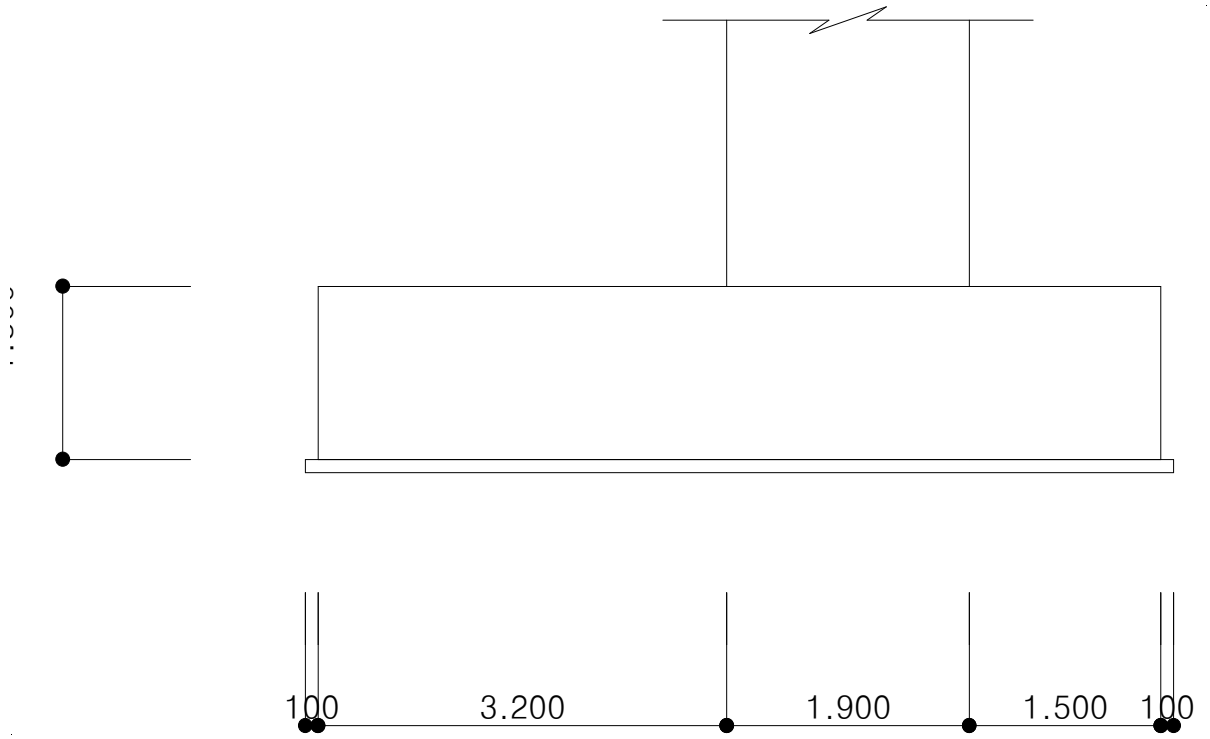
결정된 단면력과 필요 단면적으로 검토

2. STM 해석 : 기초

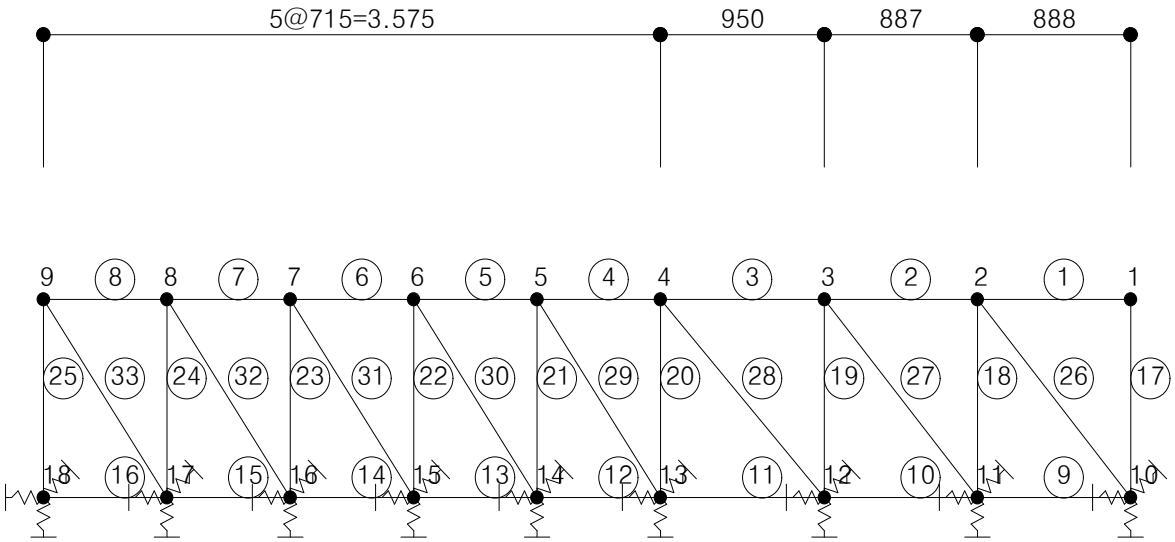
2.1 설계조건

1) 본체강도 : fck = 24 MPa
2) 철근강도 : fy = 300 MPa
3) 기초폭 : 6600 mm

2.2 단면형상



2.3 해석 모델링



1) 절점 좌표

구분	X	Z	절점	구분	X	Z	절점
1	-0.200	1.200	1	10	-0.200	0.100	10
2	-1.088	1.200	2	11	-1.088	0.100	11
3	-1.975	1.200	3	12	-1.975	0.100	12
4	-2.925	1.200	4	13	-2.925	0.100	13
5	-3.640	1.200	5	14	-3.640	0.100	14
6	-4.355	1.200	6	15	-4.355	0.100	15
7	-5.070	1.200	7	16	-5.070	0.100	16
8	-5.785	1.200	8	17	-5.785	0.100	17
9	-6.500	1.200	9	18	-6.500	0.100	18

2) 지반 Spring 산정

< 연직방향 지반반력계수 >

- 사질토층이 우세한 경우 $$K_V = K_{V0}\left(\frac{B_v}{0.3}\right)^{-1/2}$$

- 사질토와 점성토의 혼합층인 경우 $$K_V = K_{V0}\left(\frac{B_v}{0.3}\right)^{-3/4}$$

- 점성토층이 우세한 경우 $$K_V = K_{V0}\left(\frac{B_v}{0.3}\right)^{-1}$$

α = Eo 의 산정방법에 대한 보정계수

Eo = 지반의 탄성계수

$$K_V = K_{V0}\left(\frac{B_v}{0.3}\right)^{-3/4}$$

여기서, $$K_{vo} = \frac{1}{0.3} \times \alpha \times E_0$$

Eo : 지반탄성계수 (kN/m²)

① 평상시

α = 1

Eo = 2800 x N = 2800 x 40 = 112000.000 kN/m²

Bv = √(B × B) = √(6.600 × 6.600) = 6.600 m (L > B)

Kvo = 1 / 0.3 x 1.000 x 112000.000 = 373333.333 kN/m²

Kv = 373333.333 x (6.600 / 0.3) ^ (-3 / 4) = 36751.897 kN/m²

- 전단 지반반력계수

Ksb = λ × Kv = 1 / 3 × 36751.897 = 12250.632 kN/m²

② 지진시

α = 2

Eo = 2800 x N = 2800 x 40 = 112000.000 kN/m²

Bv = √(B × B) = √(6.600 × 6.600) = 6.600 m (L > B)

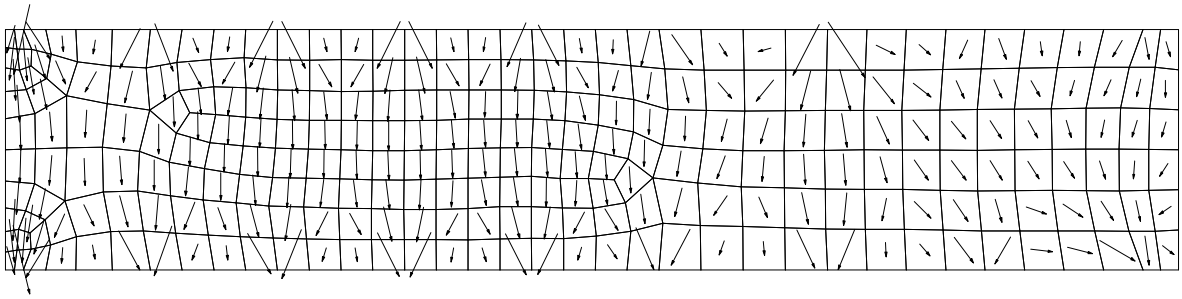
Kvo = 1 / 0.3 x 2.000 x 112000.000 = 746666.667 kN/m²

Kv = 746666.667 x (6.600 / 0.3) ^ (-3 / 4) = 73503.793 kN/m²

- 전단 지반반력계수

Ksb = λ × Kv = 1 / 3 × 73503.793 = 24501.264 kN/m²

3) 주응력 흐름도



2.4 하중산정

1) 작용하중 집계표

구 분	수직력	수평력	작용거리		모멘트	
			X(m)	Y(m)	Mr(kN.m)	Mo(kN.m)
1. 교대구체(평상시)	210.390	-	2.606	2.480	548.346	-
2. 교대구체(지진시)	210.390	16.200	2.606	2.480	548.346	40.176
3. 뒷채움재(평상시)	433.780	-	5.009	4.696	2172.860	-
4. 뒷채움재(지진시)	433.780	33.401	5.009	4.696	2172.860	156.841
5. 배면토압(평상시)	-	178.682	-	2.707	-	483.633
6. 배면토압(지진시)	-	207.034	-	4.060	-	840.558
7. 토압의 연직분력	25.489	-	5.533	-	141.039	-
8. 뒷채움 상재하중	32.000	22.005	5.000	4.060	160.000	89.340
9. 상부 고정하중반력	250.000	-	2.300	-	575.000	-
10. 상부 활하중반력	133.333	-	2.300	-	306.666	-
11. 교량받침마찰력	-	37.500	-	5.179	-	194.212
12. 상부관성력	-	37.500	-	5.179	-	194.212

2) 기초자중 (SW-F)

: 기초 자중은 구간별 평균두께로 산정하여 기초상단절점에 분할하여 재하한다.

절점	분담폭	평균두께	단위폭	단위중량	수직하중(kN)
1	0.644	1.300	6.600	25.000	-20.930
2	0.888	1.300	6.600	25.000	-28.844
3	0.918	1.300	6.600	25.000	-29.851
4	0.833	1.300	6.600	25.000	-27.056
5	0.715	1.300	6.600	25.000	-23.238
6	0.715	1.300	6.600	25.000	-23.237
7	0.715	1.300	6.600	25.000	-23.237
8	0.715	1.300	6.600	25.000	-23.237
9	0.457	1.300	6.600	25.000	-14.869

3) 교대구체(평상시) (SW-N)

: 교대구체는 기초를 제외한 벽체 및 흉벽의 구체 자중으로 재하된다.

절점	수직하중
3	-105.195
4	-105.195

4) 교대구체(지진시) (SW-E)

: 교대구체는 기초를 제외한 벽체 및 흉벽의 구체 자중 및 관성력으로 재하된다.

절점	수직력	Mo	수직하중	수평하중
3	105.195	1.602	-115.768	8.100
4	105.195	1.602	-94.622	8.100

5) 뒷채움재(평상시) (BF-N)

: 절점별 분담폭으로 산정하여 기초상단절점에 분할하여 재하한다.

절점	수직력	분담폭	뒷굽	수직하중
5	216.890	2.492	3.200	-80.995
6	216.890	2.982	3.200	-96.923
7	216.890	2.982	3.200	-96.923
8	216.890	2.982	3.200	-96.923
9	216.890	1.908	3.200	-62.017

6) 뒷채움재(지진시) (BF-E)

: 절점별 분담폭으로 산정하여 기초상단절점에 분할하여 재하한다.

절점	수직력	분담폭	뒷굽	Mo	수직하중	수평하중
5	216.890	2.492	3.200	6.254	-80.995	-
6	216.890	2.982	3.200	6.254	-96.923	-
7	216.890	2.982	3.200	6.254	-96.923	-
8	216.890	2.982	3.200	6.254	-96.923	-
9	216.890	1.908	3.200	6.254	-62.017	-
3	216.890	1.270	3.200	6.254	-41.274	16.701
4	216.890	1.270	3.200	6.254	41.274	16.701

7) 배면토압(평상시) (TOS-N)

: 벽체에 전달되는 수평력과 수직력으로 재하된다.

절점	수직력	Mo	수직하중	수평하중
3	-	19.284	-127.272	89.341
4	-	19.284	127.272	89.341

8) 배면토압(지진시) (TOS-E)

: 벽체에 전달되는 수평력과 수직력으로 재하된다.

절점	수직력	Mo	수직하중	수평하중
3	-	33.515	-221.199	103.517
4	-	33.515	221.199	103.517

9) 토압의 연직분력 (QV)

: 절점별 분담폭으로 산정하여 기초상단절점에 분할하여 재하한다.

절점	수직력	분담폭	뒷굽	수직하중
5	12.745	0.027	3.200	-0.889
6	12.745	0.105	3.200	-3.399
7	12.745	0.183	3.200	-5.944
8	12.745	0.261	3.200	-8.489
9	12.745	0.208	3.200	-6.767

10) 뒷채움 상재하중 (SLS)

: 절점별 분담폭으로 산정하여 기초상단절점에 분할하여 재하한다.

절점	수직력	분담폭	뒷굽	수직하중
5	16.000	0.184	3.200	-5.975
6	16.000	0.220	3.200	-7.150
7	16.000	0.220	3.200	-7.150
8	16.000	0.220	3.200	-7.150
9	16.000	0.141	3.200	-4.575

11) 뒷채움 상재하중 : 수평력 (SLS-H)

: 벽체에 전달되는 수평력과 수직력으로 재하된다.

절점	수직력	Mo	수직하중	수평하중
3	16.000	3.562	-23.511	11.003
4	16.000	3.562	23.511	11.003

12) 상부 고정하중반력 (SHOE-D)

: 벽체에 전달되는 수직력으로 재하된다.

절점	수직하중
3	-125.000
4	-125.000

13) 상부 활하중반력 (SHOE-L)

: 벽체에 전달되는 수직력으로 재하된다.

절점	수직하중
3	-66.666
4	-66.666

14) 교량받침마찰력 (SHOE-F)

: 벽체에 전달되는 수평력과 수직력으로 재하된다.

절점	수직력	Mo	수직하중	수평하중
3	-	7.744	-51.109	18.750
4	-	7.744	51.109	18.750

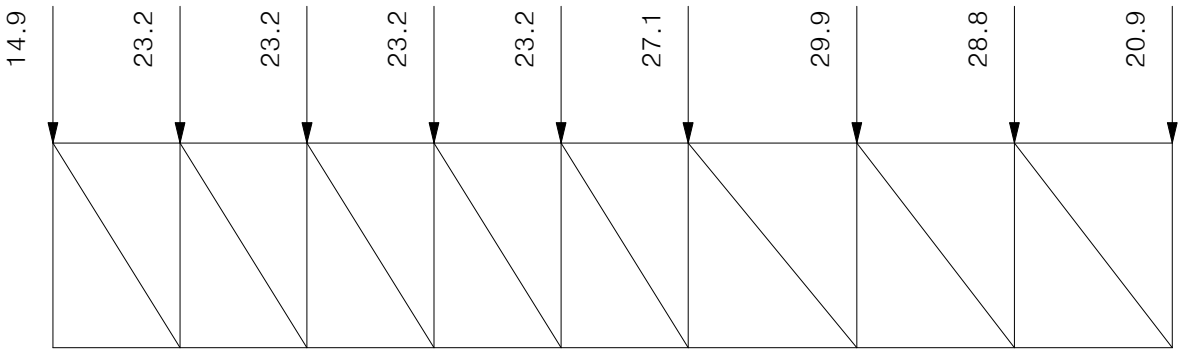
15) 상부관성력 (SHOE-I)

: 벽체에 전달되는 수평력과 수직력으로 재하된다.

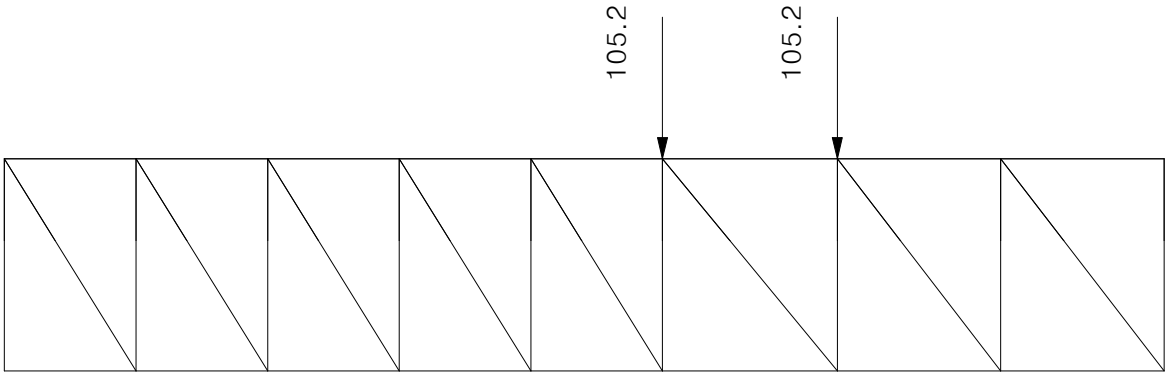
절점	수직력	Mo	수직하중	수평하중
3	-	7.744	-51.109	18.750
4	-	7.744	51.109	18.750

2.5 하중 재하도

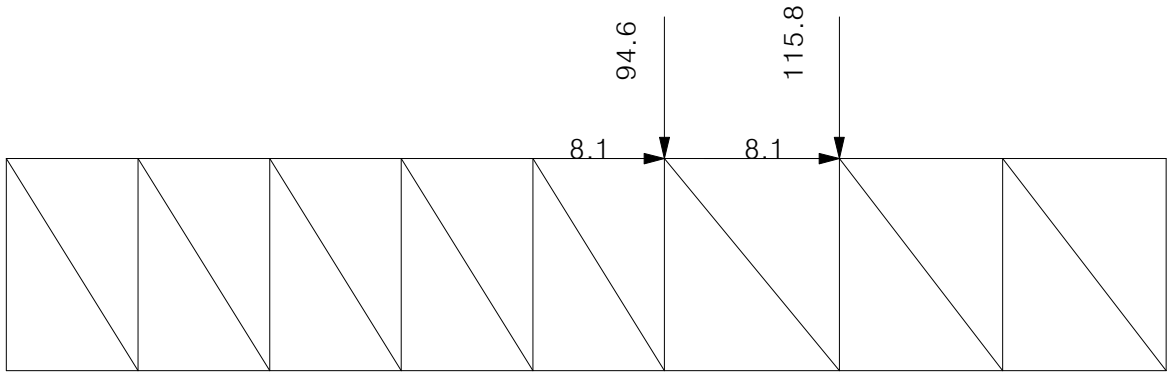
1) 기초자중 (SW-F)



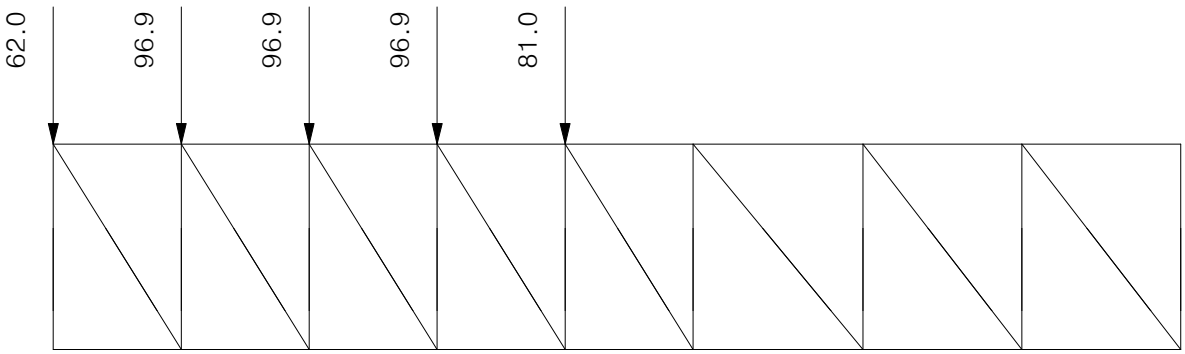
2) 교대구체(평상시) (SW-N)



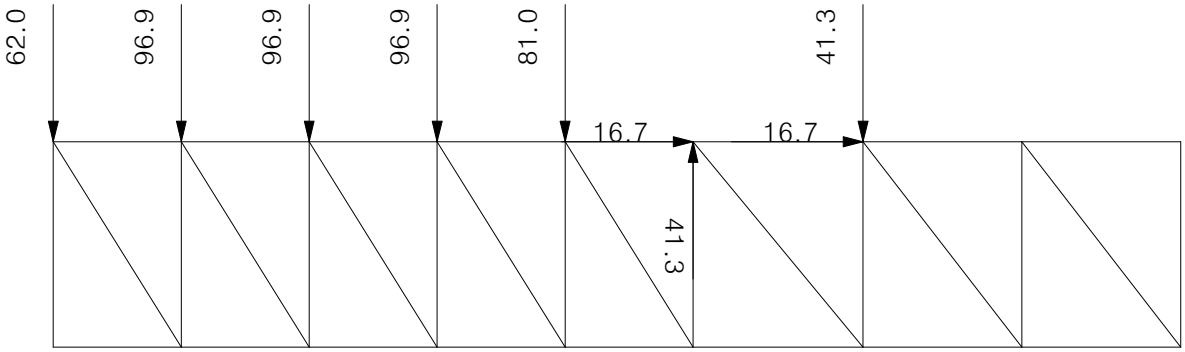
3) 교대구체(지진시) (SW-E)



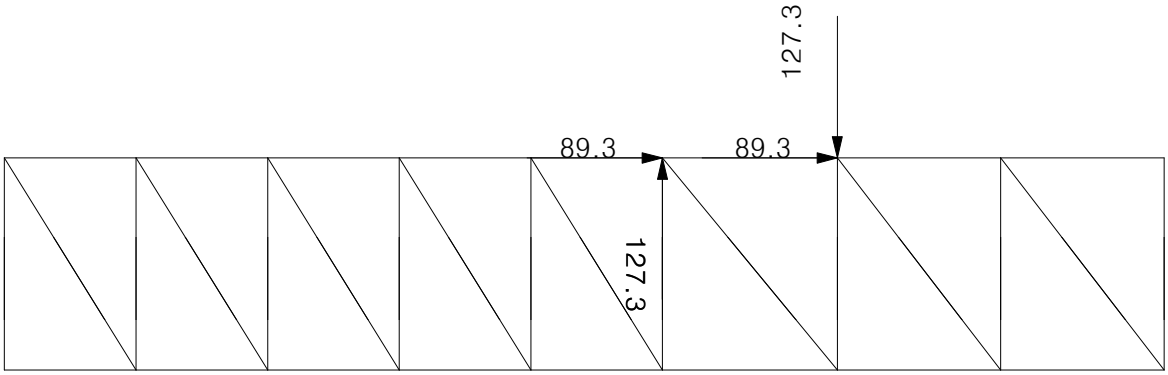
4) 뒷채움재(평상시) (BF-N)



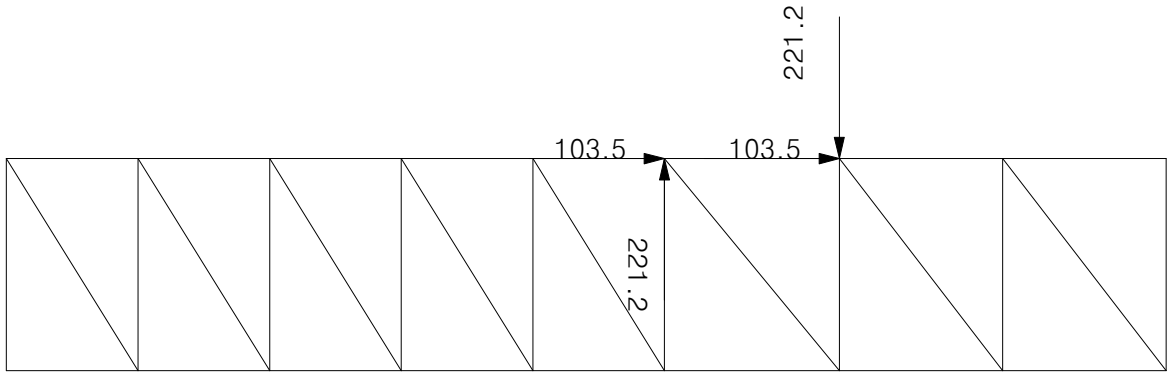
5) 뒷채움재(지진시) (BF-E)



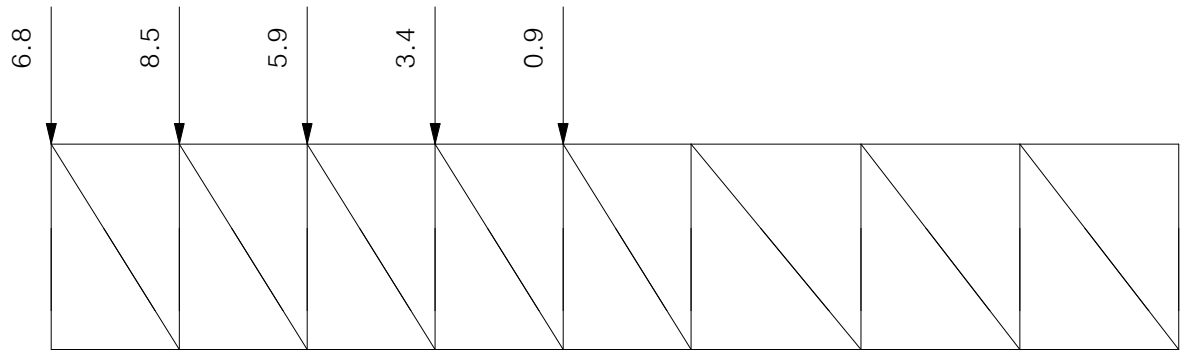
6) 배면토압(평상시) (TOS-N)



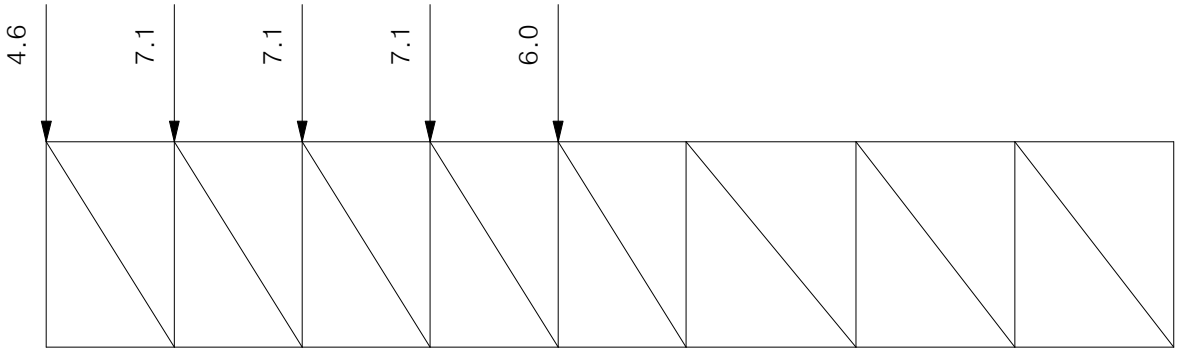
7) 배면토압(지진시) (TOS-E)



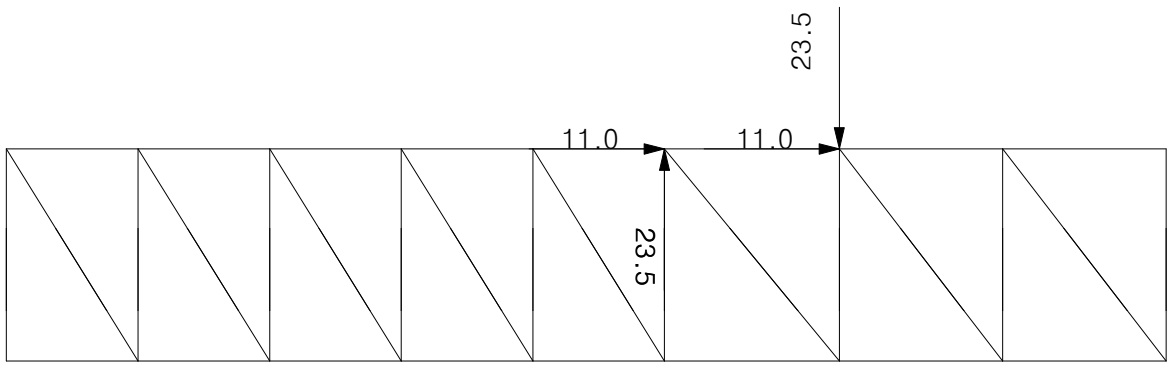
8) 토압의 연직분력 (QV)



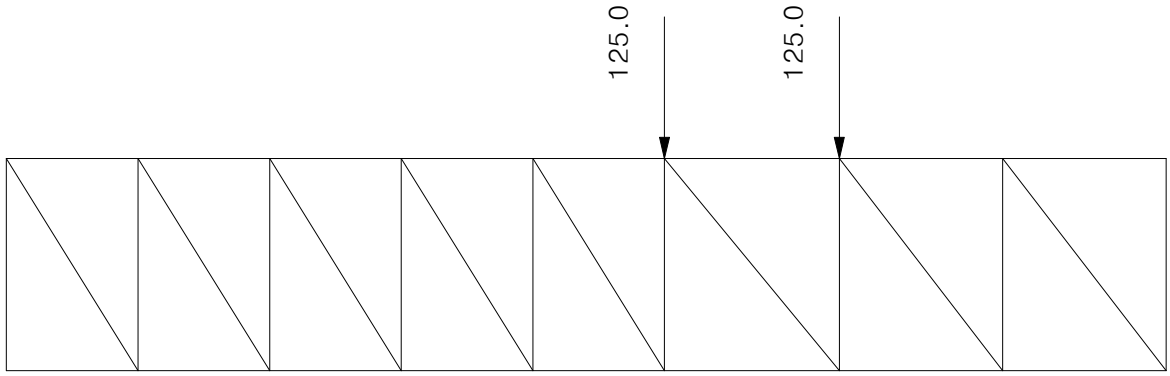
9) 뒷채움 상재하중 (SLS)



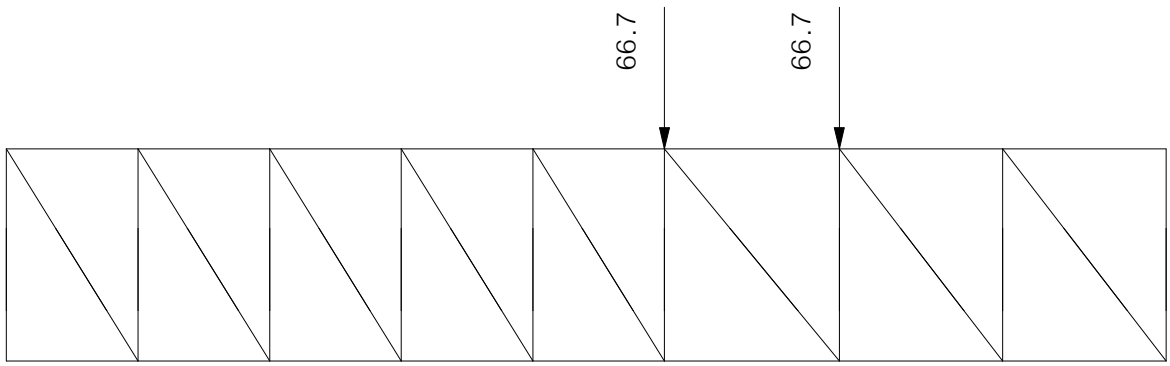
10) 뒷채움 상재하중 : 수평력 (SLS-H)



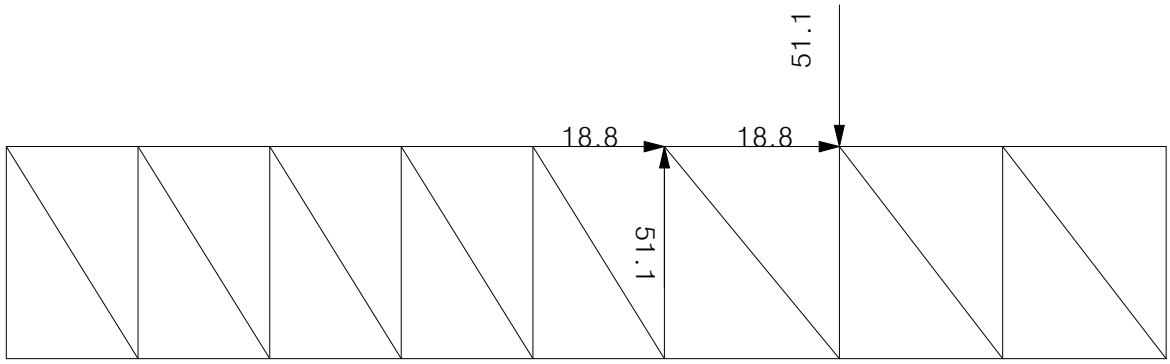
11) 상부 고정하중반력 (SHOE-D)



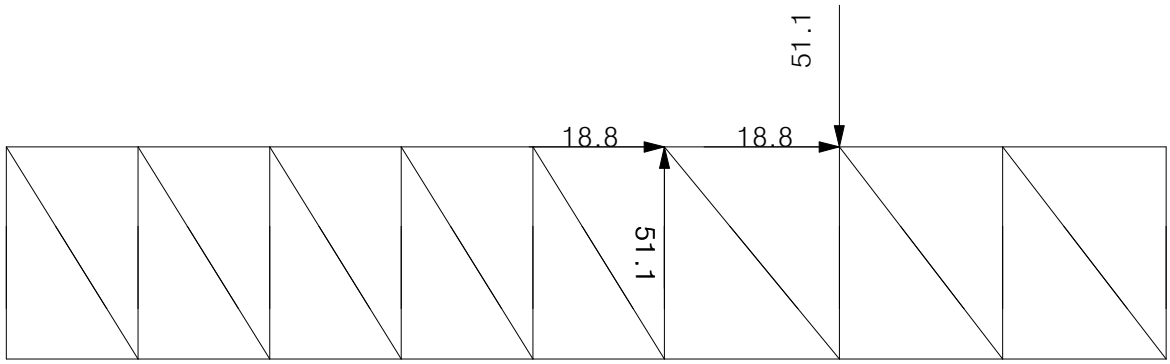
12) 상부 활하중반력 (SHOE-L)



13) 교량받침마찰력 (SHOE-F)



14) 상부관성력 (SHOE-I)



2.6 하중조합

구분	D	L	H	E	G
LC01	1.30	2.15	1.70		
LC02	1.00		1.00		1.00

D = 고정하중 또는 이에 따른 단면력

L = 활하중 또는 이에 따른 단면력

W = 풍하중 또는 이에 따른 단면력

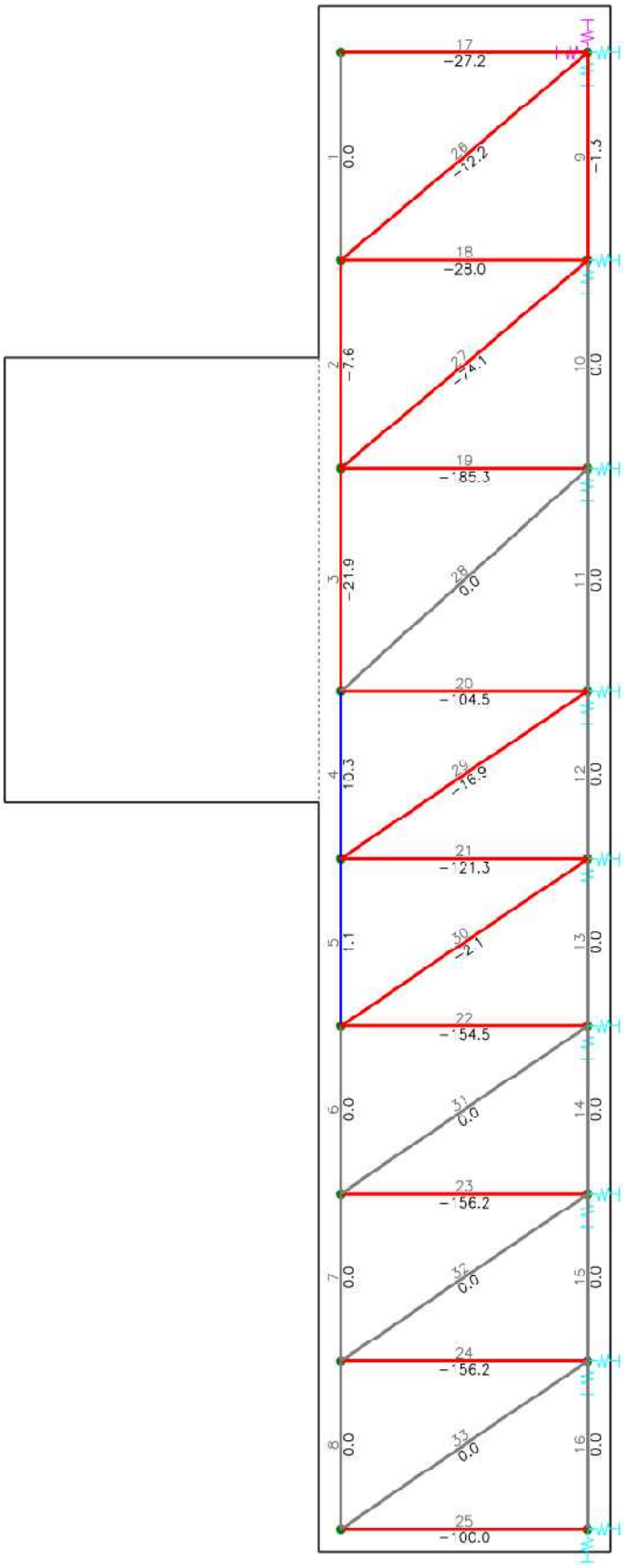
WL = 차량활하중에 작용하는 풍하중 또는 이에 따른 단면력

E = 지진하중 또는 이에 따른 단면력

CF = 원심하중 또는 이에 따른 단면력

ASTM

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

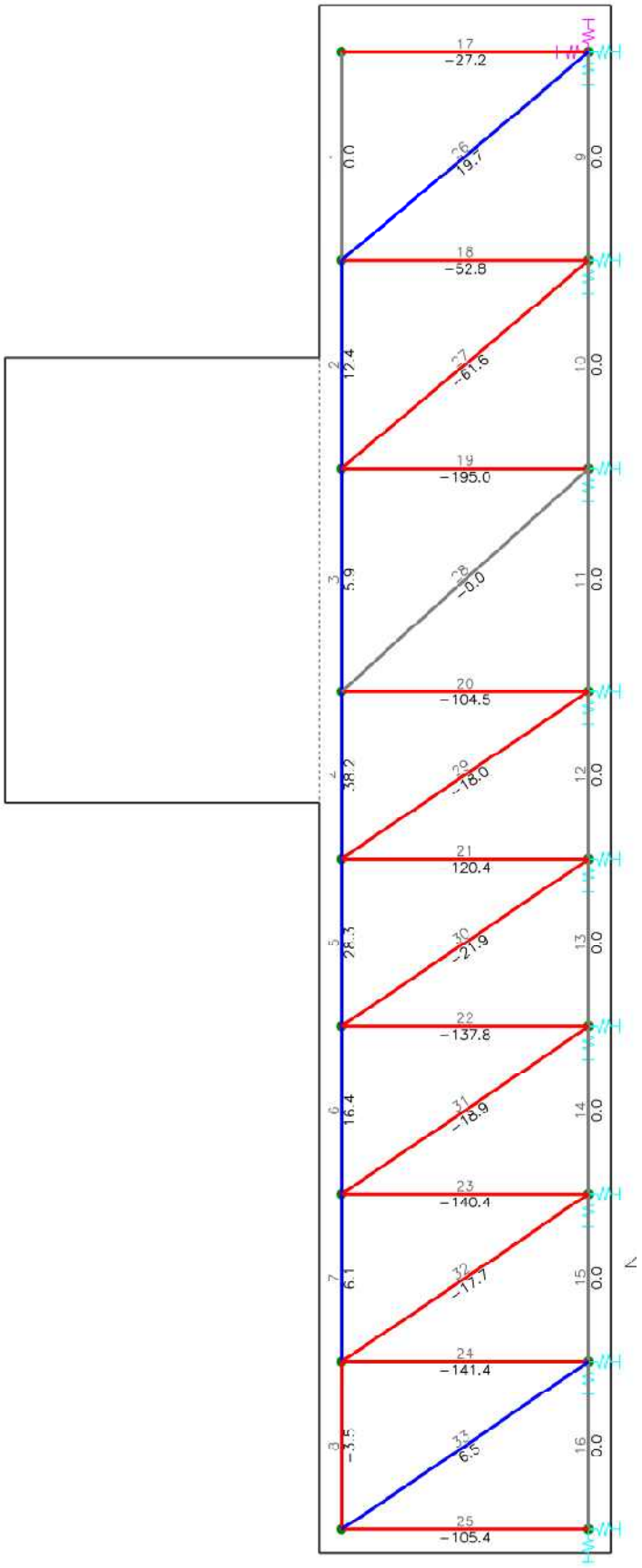


ASTM

Element	ASTM			SAP2000		SAP대비 Force
	Force	Material	Area	Force	Area	
01	0	STEEL1	0	0	0	0.0%
02	7.6	CONC1	0.0006	8.8	0.0007	-15.8%
03	21.9	CONC1	0.0018	23.5	0.0019	-7.3%
04	10.35	STEEL1	3.45E-05	8.73	2.91E-05	15.7%
05	1.14	STEEL1	3.8E-06	0	0	100.0%
06	0	STEEL1	0	0	0	0.0%
07	0	STEEL1	0	0	0	0.0%
08	0	STEEL1	0	0	0	0.0%
09	1.3	CONC1	0.0001	0	0	100.0%
10	0	STEEL1	0	0	0	0.0%
11	0	STEEL1	0	0	0	0.0%
12	0	STEEL1	0	0	0	0.0%
13	0	STEEL1	0	0	0	0.0%
14	0	STEEL1	0	0	0	0.0%
15	0	STEEL1	0	0	0	0.0%
16	0	STEEL1	0	0	0	0.0%
17	27.2	CONC1	0.0022	27.2	0.0022	0.0%
18	28	CONC1	0.0023	26.6	0.0022	5.0%
19	185.3	CONC1	0.0151	184.7	0.0151	0.3%
20	104.5	CONC1	0.0085	104.5	0.0085	0.0%
21	121.3	CONC1	0.0099	122.1	0.01	-0.7%
22	154.5	CONC1	0.0126	156.2	0.0128	-1.1%
23	156.2	CONC1	0.0128	156.2	0.0128	0.0%
24	156.2	CONC1	0.0128	156.2	0.0128	0.0%
25	100	CONC1	0.0082	100	0.0082	0.0%
26	12.2	CONC1	0.001	14	0.0011	-14.8%
27	74.1	CONC1	0.0061	74.8	0.0061	-0.9%
28	0	STEEL1	0	0	0	0.0%
29	16.9	CONC1	0.0014	16	0.0013	5.3%
30	2.1	CONC1	0.0002	0	0	100.0%
31	0	STEEL1	0	0	0	0.0%
32	0	STEEL1	0	0	0	0.0%
33	0	STEEL1	0	0	0	0.0%

SAP2000-STAGE01

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

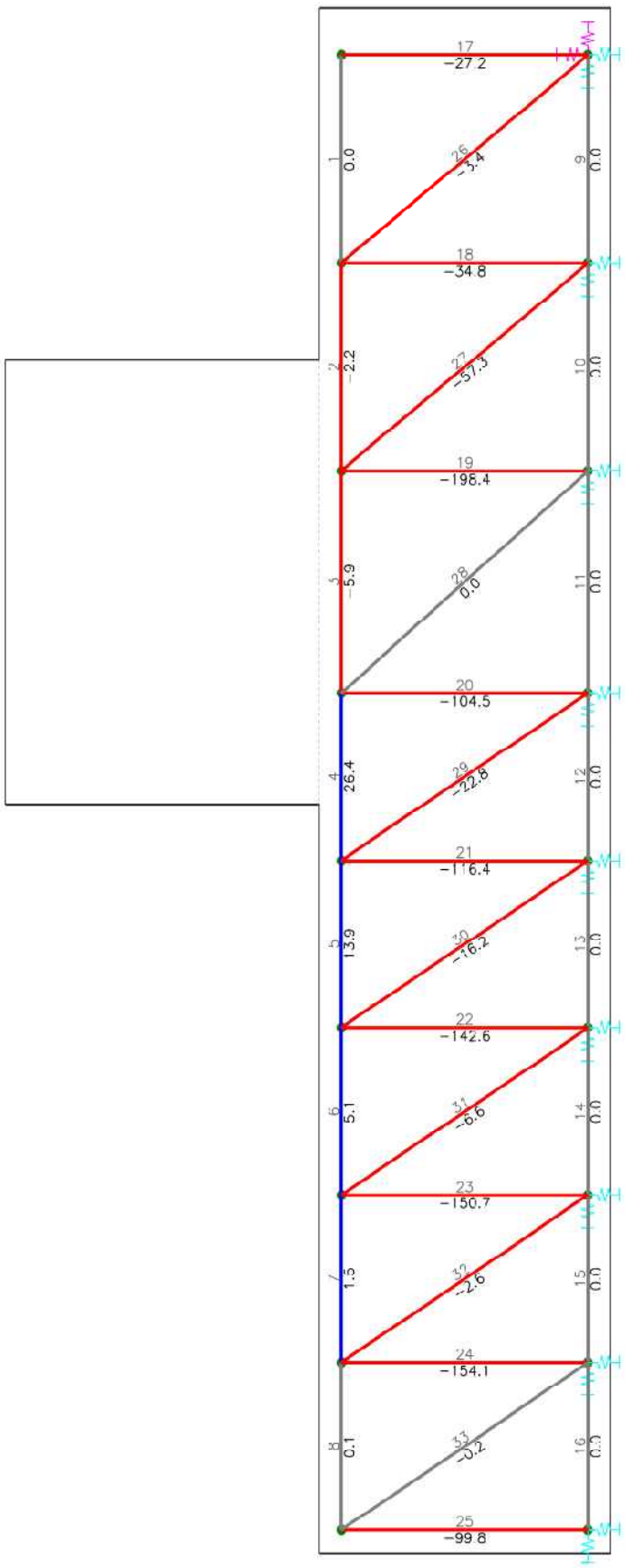


STAGE01

Element	Force	Material	Area
01	0	STEEL1	0
02	12.39	STEEL1	4.13E-05
03	5.94	STEEL1	1.98E-05
04	38.16	STEEL1	0.000127
05	28.32	STEEL1	9.44E-05
06	16.38	STEEL1	5.46E-05
07	6.1	STEEL1	2.03E-05
08	3.5	CONC1	0.0003
09	0	STEEL1	0
10	0	STEEL1	0
11	0	STEEL1	0
12	0	STEEL1	0
13	0	STEEL1	0
14	0	STEEL1	0
15	0	STEEL1	0
16	0	STEEL1	0
17	27.2	CONC1	0.0022
18	52.8	CONC1	0.0043
19	195	CONC1	0.0159
20	104.5	CONC1	0.0085
21	120.4	CONC1	0.0098
22	137.8	CONC1	0.0113
23	140.4	CONC1	0.0115
24	141.4	CONC1	0.0115
25	105.4	CONC1	0.0086
26	19.7	STEEL1	6.57E-05
27	61.6	CONC1	0.005
28	0	STEEL1	0
29	18	CONC1	0.0015
30	21.9	CONC1	0.0018
31	18.9	CONC1	0.0015
32	17.7	CONC1	0.0014
33	6.5	STEEL1	2.17E-05

SAP2000-STAGE02

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

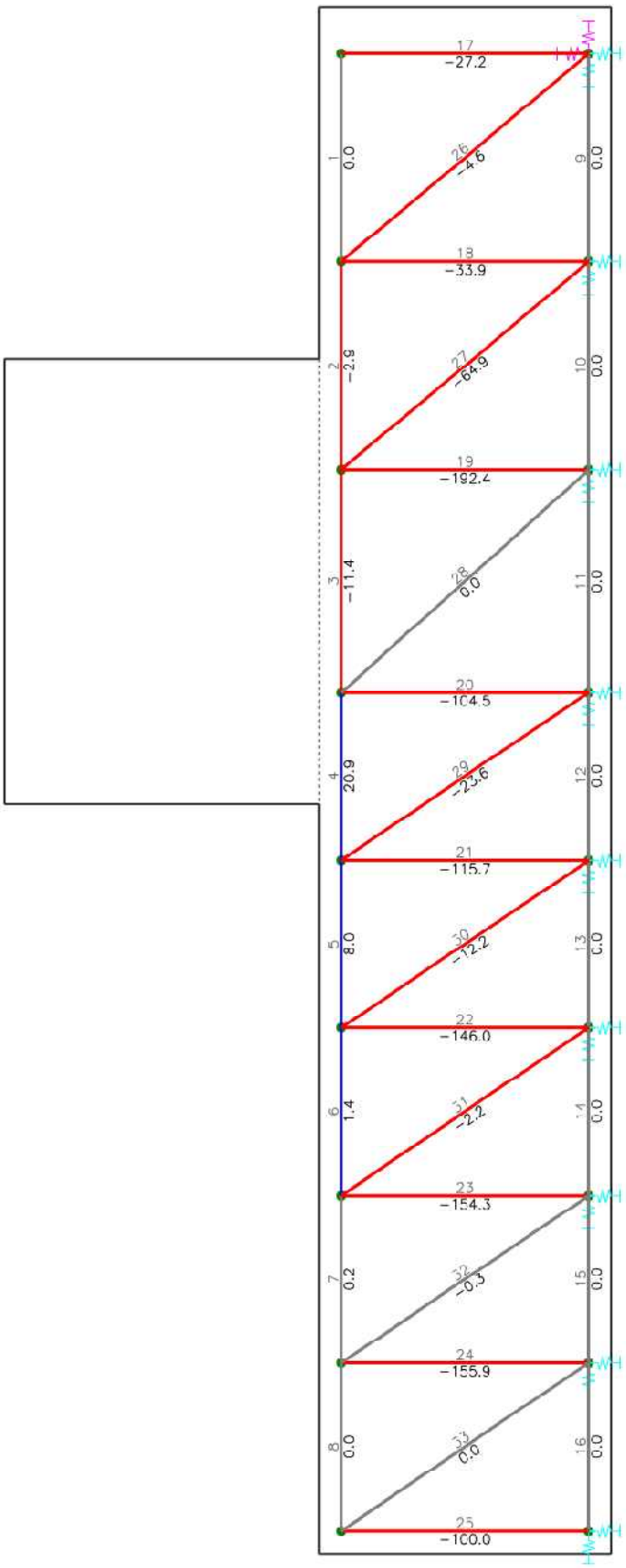


STAGE02

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	2.2	CONC1	0.0002	79.4%
03	5.9	CONC1	0.0005	96.0%
04	26.34	STEEL1	8.78E-05	-44.9%
05	13.92	STEEL1	4.64E-05	-103.4%
06	5.1	STEEL1	0.000017	-221.2%
07	1.5	STEEL1	0.000005	-306.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	34.8	CONC1	0.0028	-53.6%
19	198.4	CONC1	0.0162	1.9%
20	104.5	CONC1	0.0085	0.0%
21	116.4	CONC1	0.0095	-3.2%
22	142.6	CONC1	0.0117	3.4%
23	150.7	CONC1	0.0123	6.5%
24	154.1	CONC1	0.0126	8.7%
25	99.8	CONC1	0.0082	-4.9%
26	3.4	CONC1	0.0003	0.0%
27	57.3	CONC1	0.0047	0.0%
28	0	STEEL1	0	0.0%
29	22.8	CONC1	0.0019	0.0%
30	16.2	CONC1	0.0013	0.0%
31	6.6	CONC1	0.0005	0.0%
32	2.6	CONC1	0.0002	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE03

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

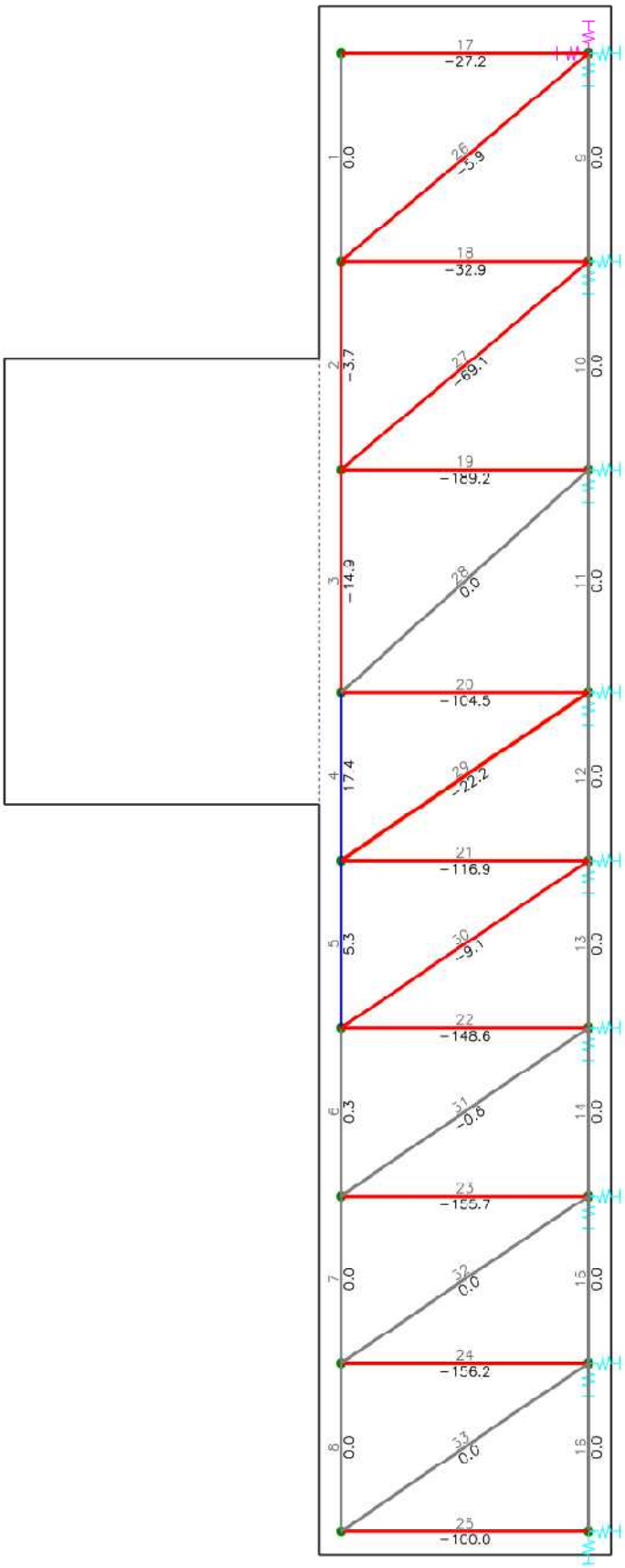


STAGE03

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	2.9	CONC1	0.0002	0.0%
03	11.4	CONC1	0.0009	44.4%
04	20.88	STEEL1	6.96E-05	-26.1%
05	8.01	STEEL1	2.67E-05	-73.8%
06	1.38	STEEL1	4.6E-06	-269.6%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	33.9	CONC1	0.0028	0.0%
19	192.4	CONC1	0.0157	-3.2%
20	104.5	CONC1	0.0085	0.0%
21	115.7	CONC1	0.0095	0.0%
22	146	CONC1	0.0119	1.7%
23	154.3	CONC1	0.0126	2.4%
24	155.9	CONC1	0.0127	0.8%
25	100	CONC1	0.0082	0.0%
26	4.6	CONC1	0.0004	25.0%
27	64.9	CONC1	0.0053	11.3%
28	0	STEEL1	0	0.0%
29	23.6	CONC1	0.0019	0.0%
30	12.2	CONC1	0.001	-30.0%
31	2.2	CONC1	0.0002	-150.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE04

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

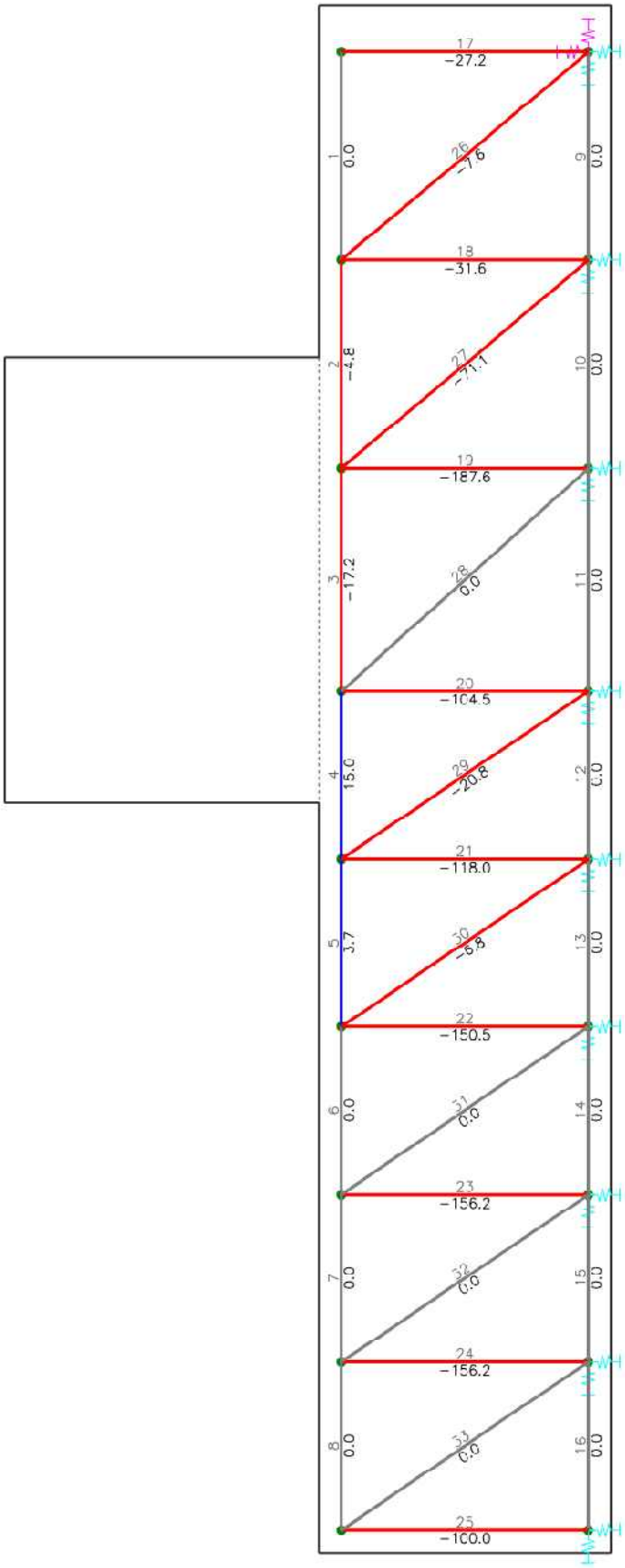


STAGE04

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	3.7	CONC1	0.0003	33.3%
03	14.9	CONC1	0.0012	25.0%
04	17.37	STEEL1	5.79E-05	-20.2%
05	5.31	STEEL1	1.77E-05	-50.8%
06	0	STEEL1	0	0.0%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	32.9	CONC1	0.0027	-3.7%
19	189.2	CONC1	0.0155	-1.3%
20	104.5	CONC1	0.0085	0.0%
21	116.9	CONC1	0.0096	1.0%
22	148.6	CONC1	0.0121	1.7%
23	155.7	CONC1	0.0127	0.8%
24	156.2	CONC1	0.0128	0.8%
25	100	CONC1	0.0082	0.0%
26	5.9	CONC1	0.0005	20.0%
27	69.1	CONC1	0.0056	5.4%
28	0	STEEL1	0	0.0%
29	22.2	CONC1	0.0018	-5.6%
30	9.1	CONC1	0.0007	-42.9%
31	0.6	CONC1	0	0.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE05

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

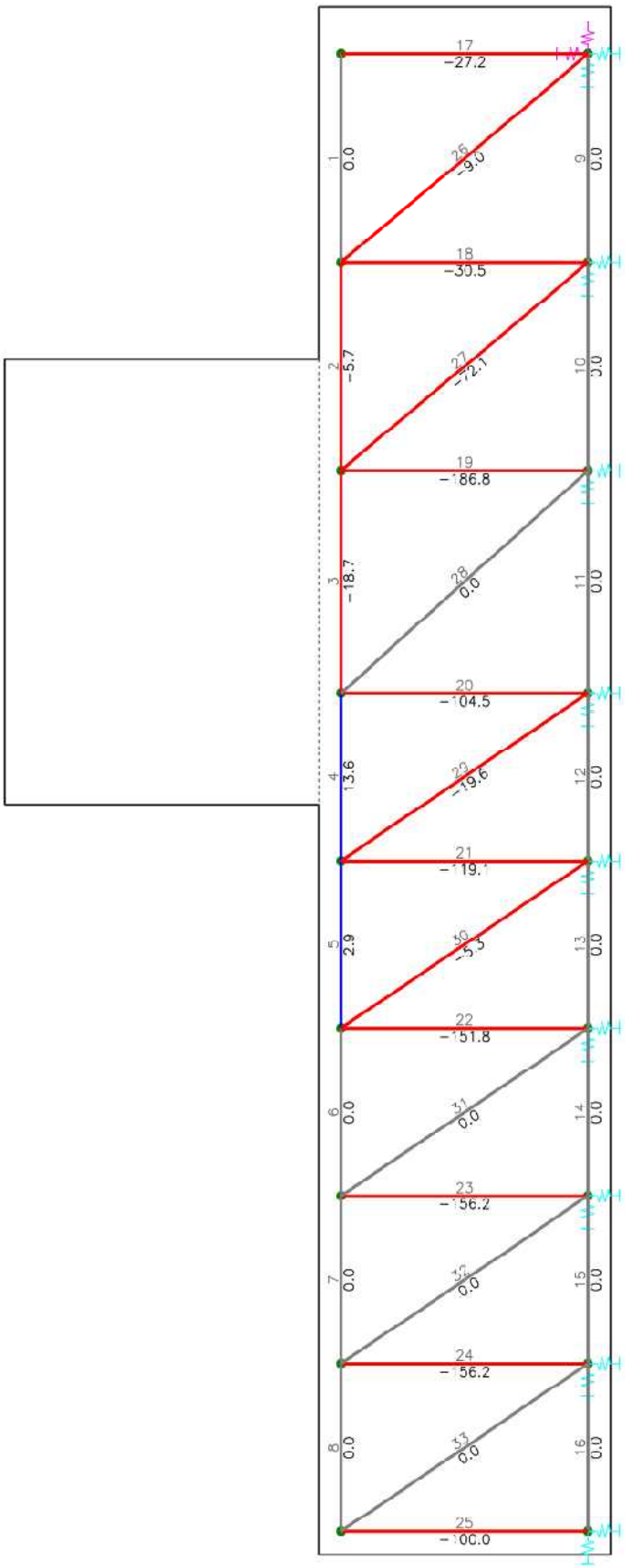


STAGE05

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	4.8	CONC1	0.0004	25.0%
03	17.2	CONC1	0.0014	14.3%
04	15.03	STEEL1	5.01E-05	-15.6%
05	3.69	STEEL1	1.23E-05	-43.9%
06	0	STEEL1	0	0.0%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	31.6	CONC1	0.0026	-3.8%
19	187.6	CONC1	0.0153	-1.3%
20	104.5	CONC1	0.0085	0.0%
21	118	CONC1	0.0096	0.0%
22	150.5	CONC1	0.0123	1.6%
23	156.2	CONC1	0.0128	0.8%
24	156.2	CONC1	0.0128	0.0%
25	100	CONC1	0.0082	0.0%
26	7.6	CONC1	0.0006	16.7%
27	71.1	CONC1	0.0058	3.4%
28	0	STEEL1	0	0.0%
29	20.8	CONC1	0.0017	-5.9%
30	6.8	CONC1	0.0006	-16.7%
31	0	STEEL1	0	0.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE06

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

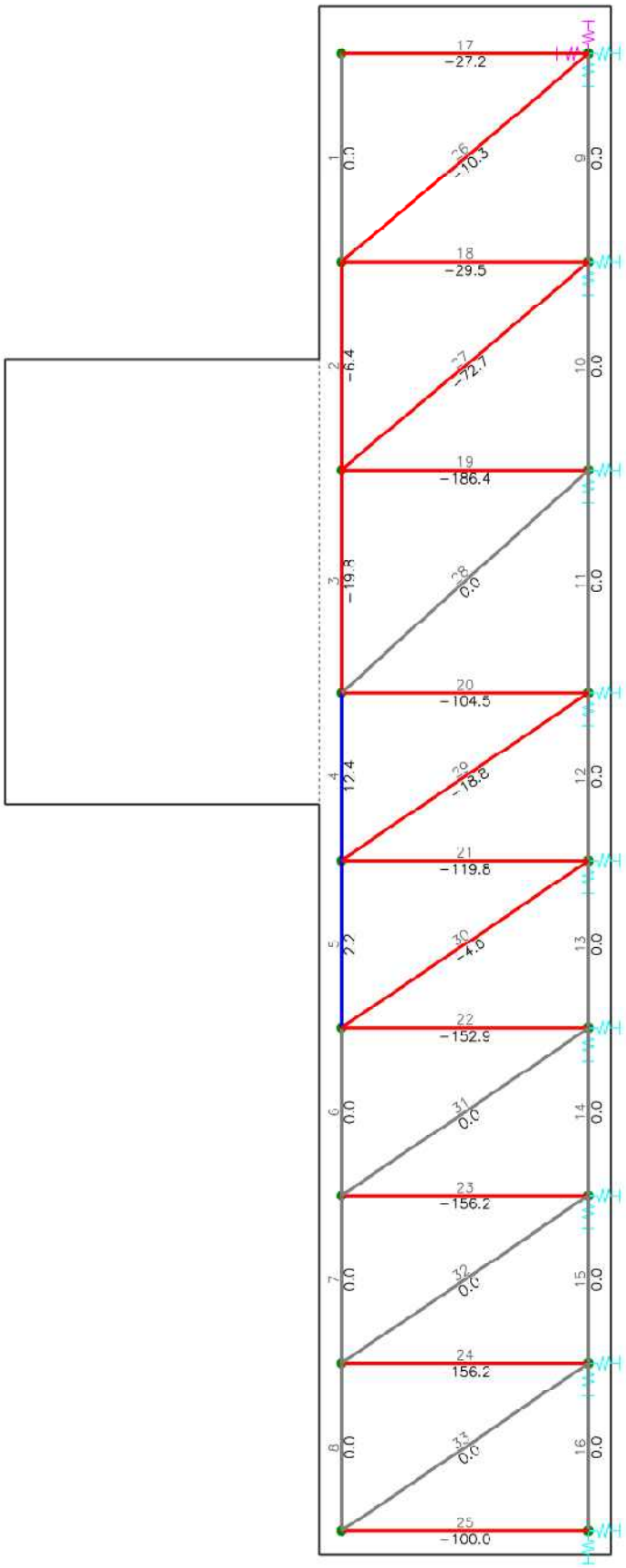


STAGE06

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	5.7	CONC1	0.0005	20.0%
03	18.7	CONC1	0.0015	6.7%
04	13.56	STEEL1	4.52E-05	-10.8%
05	2.88	STEEL1	9.6E-06	-28.1%
06	0	STEEL1	0	0.0%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	30.5	CONC1	0.0025	-4.0%
19	186.8	CONC1	0.0153	0.0%
20	104.5	CONC1	0.0085	0.0%
21	119.1	CONC1	0.0097	1.0%
22	151.8	CONC1	0.0124	0.8%
23	156.2	CONC1	0.0128	0.0%
24	156.2	CONC1	0.0128	0.0%
25	100	CONC1	0.0082	0.0%
26	9	CONC1	0.0007	14.3%
27	72.1	CONC1	0.0059	1.7%
28	0	STEEL1	0	0.0%
29	19.6	CONC1	0.0016	-6.2%
30	5.3	CONC1	0.0004	-50.0%
31	0	STEEL1	0	0.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE01

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

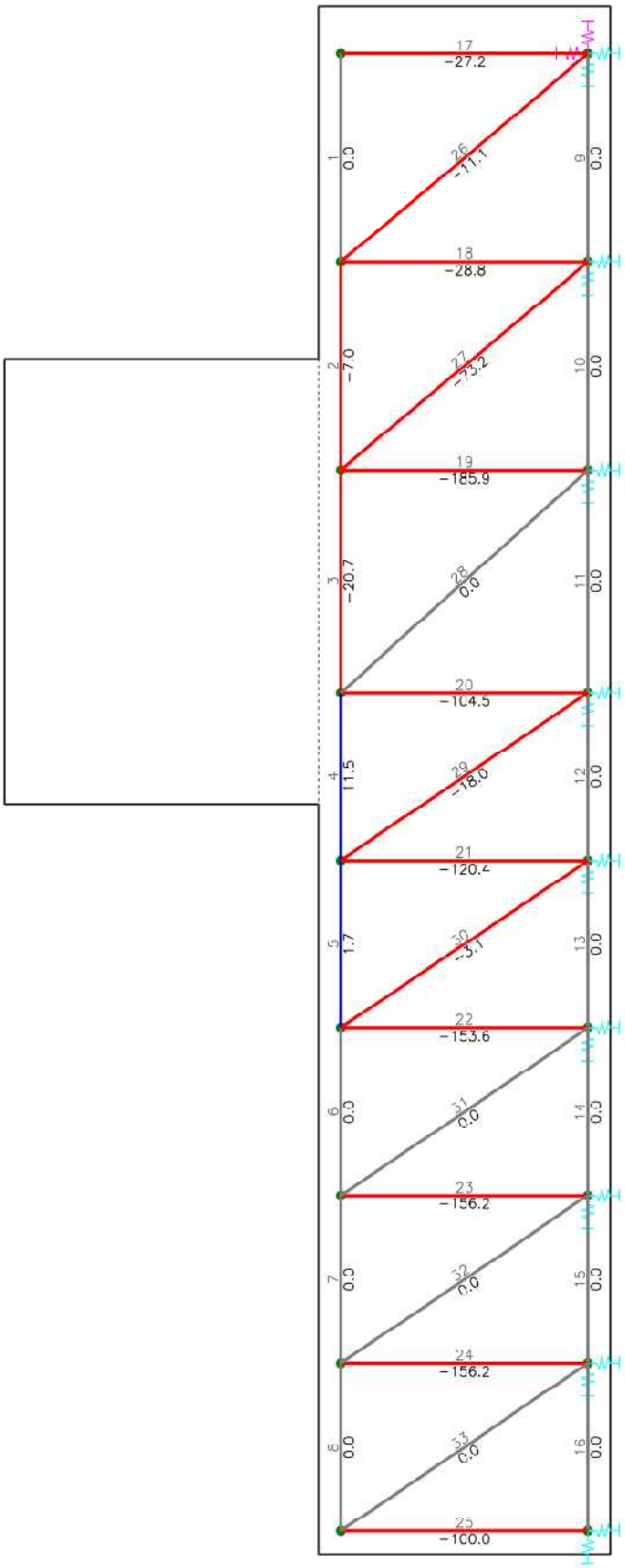


STAGE07

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	6.4	CONC1	0.0005	0.0%
03	19.8	CONC1	0.0016	6.3%
04	12.39	STEEL1	4.13E-05	-9.4%
05	2.19	STEEL1	7.3E-06	-31.5%
06	0	STEEL1	0	0.0%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	29.5	CONC1	0.0024	-4.2%
19	186.4	CONC1	0.0152	-0.7%
20	104.5	CONC1	0.0085	0.0%
21	119.8	CONC1	0.0098	1.0%
22	152.9	CONC1	0.0125	0.8%
23	156.2	CONC1	0.0128	0.0%
24	156.2	CONC1	0.0128	0.0%
25	100	CONC1	0.0082	0.0%
26	10.3	CONC1	0.0008	12.5%
27	72.7	CONC1	0.0059	0.0%
28	0	STEEL1	0	0.0%
29	18.8	CONC1	0.0015	-6.7%
30	4	CONC1	0.0003	-33.3%
31	0	STEEL1	0	0.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE01

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

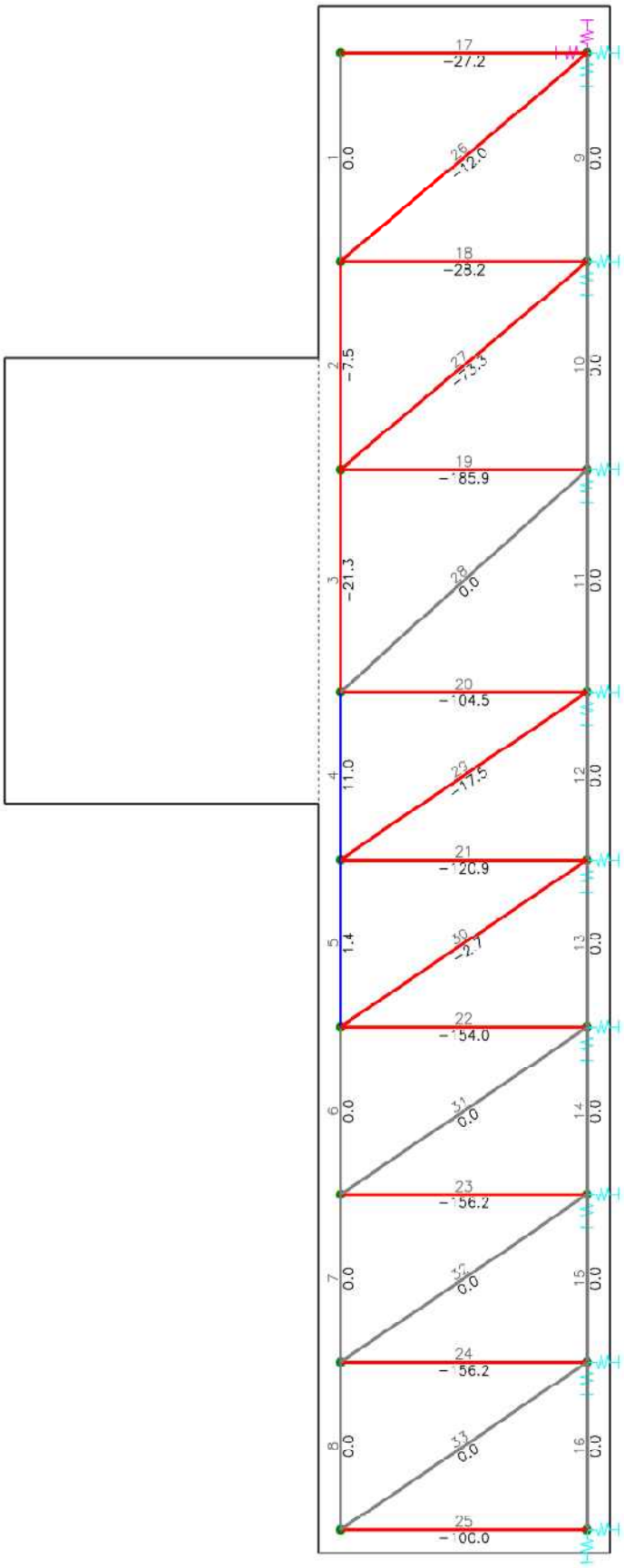


STAGE08

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	7	CONC1	0.0006	16.7%
03	20.7	CONC1	0.0017	5.9%
04	11.52	STEEL1	3.84E-05	-7.6%
05	1.68	STEEL1	5.6E-06	-30.4%
06	0	STEEL1	0	0.0%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	28.8	CONC1	0.0024	0.0%
19	185.9	CONC1	0.0152	0.0%
20	104.5	CONC1	0.0085	0.0%
21	120.4	CONC1	0.0098	0.0%
22	153.6	CONC1	0.0125	0.0%
23	156.2	CONC1	0.0128	0.0%
24	156.2	CONC1	0.0128	0.0%
25	100	CONC1	0.0082	0.0%
26	11.1	CONC1	0.0009	11.1%
27	73.2	CONC1	0.006	1.7%
28	0	STEEL1	0	0.0%
29	18	CONC1	0.0015	0.0%
30	3.1	CONC1	0.0003	0.0%
31	0	STEEL1	0	0.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE09

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

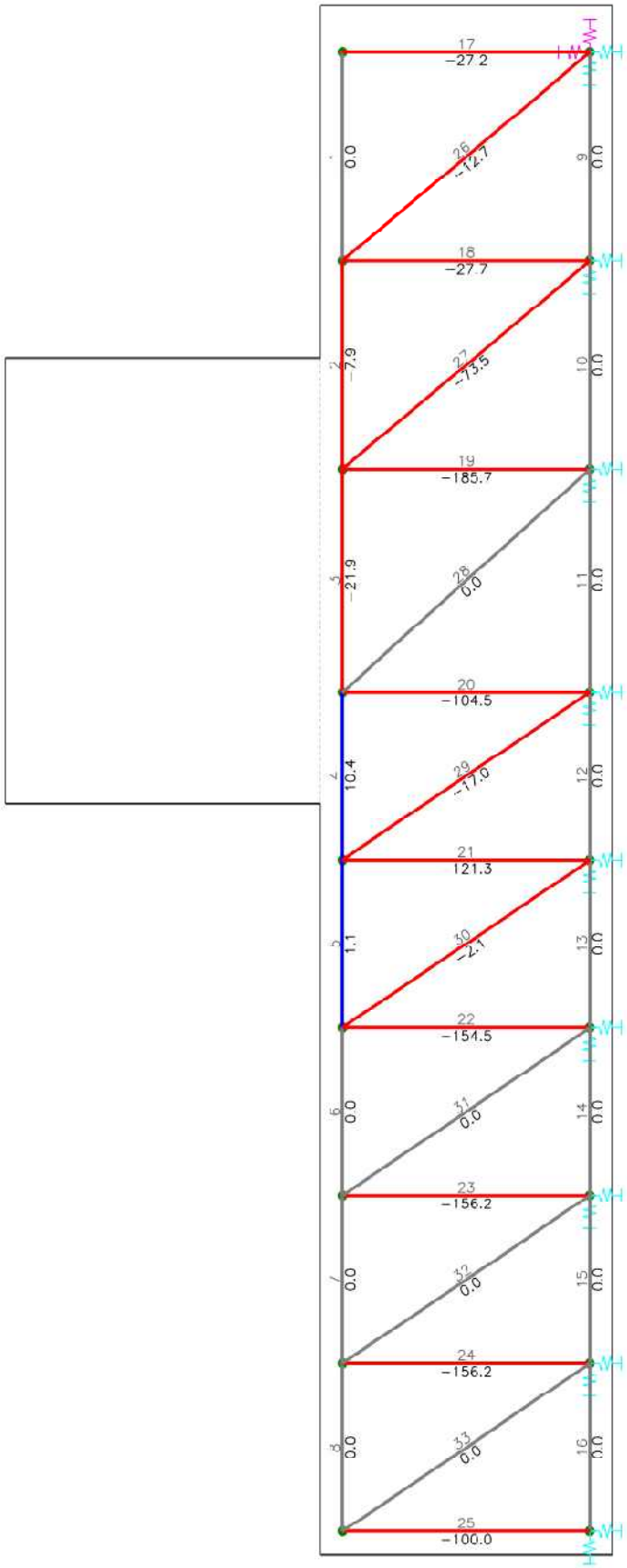


STAGE09

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	7.5	CONC1	0.0006	0.0%
03	21.3	CONC1	0.0017	0.0%
04	10.95	STEEL1	3.65E-05	-5.2%
05	1.44	STEEL1	4.8E-06	-16.7%
06	0	STEEL1	0	0.0%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	28.2	CONC1	0.0023	-4.3%
19	185.9	CONC1	0.0152	0.0%
20	104.5	CONC1	0.0085	0.0%
21	120.9	CONC1	0.0099	1.0%
22	154	CONC1	0.0126	0.8%
23	156.2	CONC1	0.0128	0.0%
24	156.2	CONC1	0.0128	0.0%
25	100	CONC1	0.0082	0.0%
26	12	CONC1	0.001	10.0%
27	73.3	CONC1	0.006	0.0%
28	0	STEEL1	0	0.0%
29	17.5	CONC1	0.0014	-7.1%
30	2.7	CONC1	0.0002	-50.0%
31	0	STEEL1	0	0.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE10

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

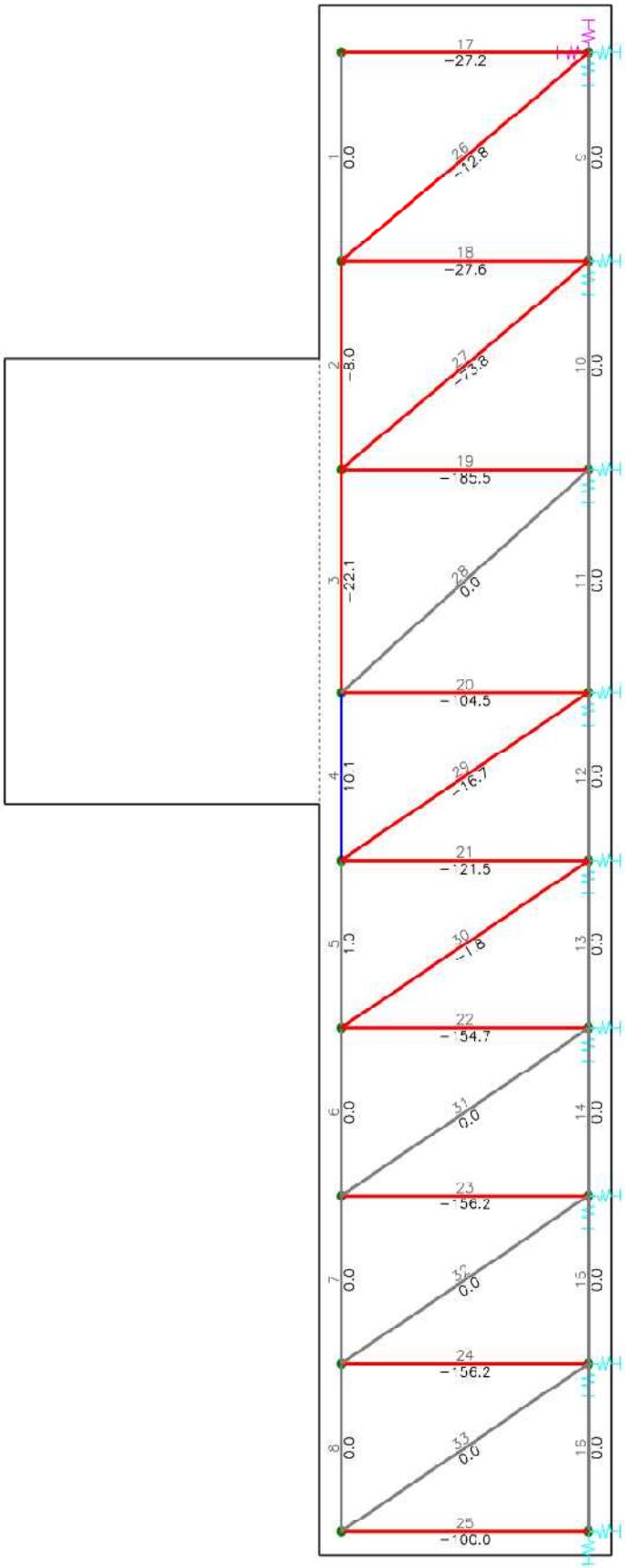


STAGE10

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	7.9	CONC1	0.0006	0.0%
03	21.9	CONC1	0.0018	5.6%
04	10.38	STEEL1	3.46E-05	-5.5%
05	1.14	STEEL1	3.8E-06	-26.3%
06	0	STEEL1	0	0.0%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	27.7	CONC1	0.0023	0.0%
19	185.7	CONC1	0.0152	0.0%
20	104.5	CONC1	0.0085	0.0%
21	121.3	CONC1	0.0099	0.0%
22	154.5	CONC1	0.0126	0.0%
23	156.2	CONC1	0.0128	0.0%
24	156.2	CONC1	0.0128	0.0%
25	100	CONC1	0.0082	0.0%
26	12.7	CONC1	0.001	0.0%
27	73.5	CONC1	0.006	0.0%
28	0	STEEL1	0	0.0%
29	17	CONC1	0.0014	0.0%
30	2.1	CONC1	0.0002	0.0%
31	0	STEEL1	0	0.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE01

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

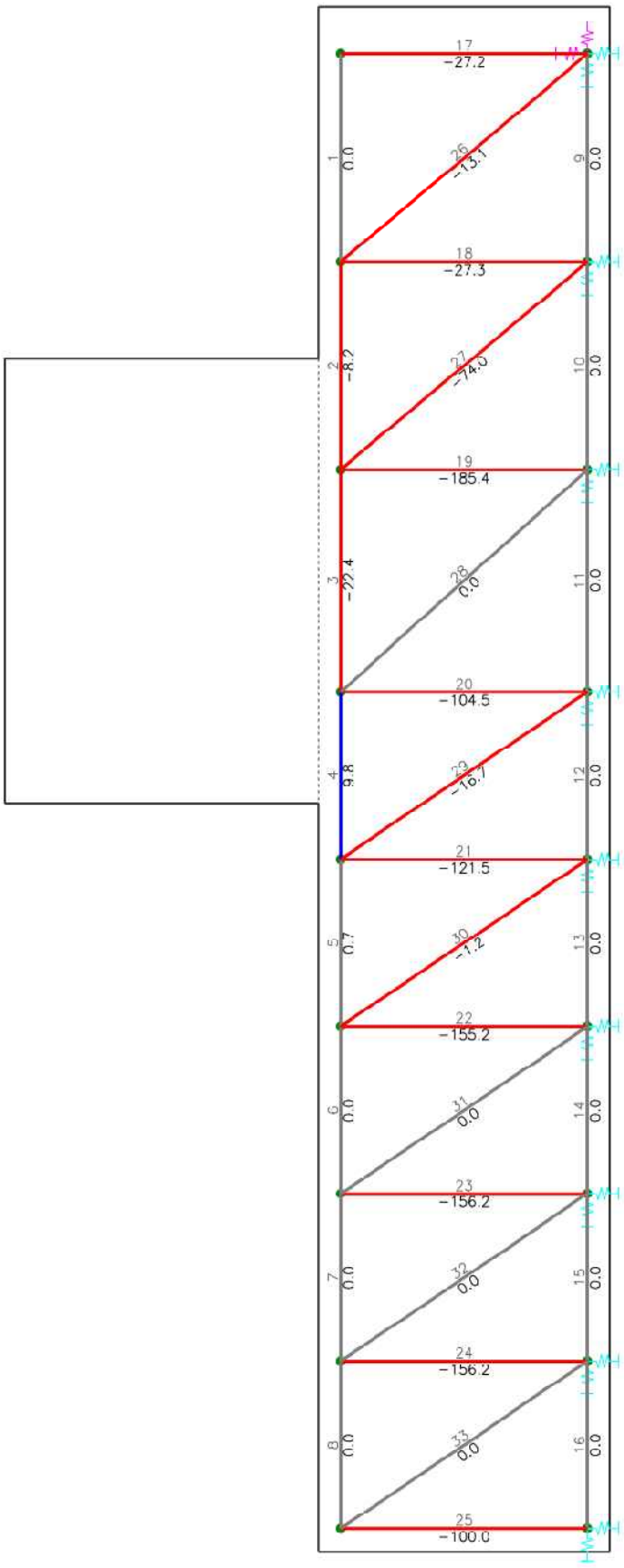


STAGE11

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	8	CONC1	0.0007	14.3%
03	22.1	CONC1	0.0018	0.0%
04	10.11	STEEL1	3.37E-05	-2.7%
05	0.99	STEEL1	3.3E-06	-15.2%
06	0	STEEL1	0	0.0%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	27.6	CONC1	0.0023	0.0%
19	185.5	CONC1	0.0152	0.0%
20	104.5	CONC1	0.0085	0.0%
21	121.5	CONC1	0.0099	0.0%
22	154.7	CONC1	0.0126	0.0%
23	156.2	CONC1	0.0128	0.0%
24	156.2	CONC1	0.0128	0.0%
25	100	CONC1	0.0082	0.0%
26	12.8	CONC1	0.001	0.0%
27	73.8	CONC1	0.006	0.0%
28	0	STEEL1	0	0.0%
29	16.7	CONC1	0.0014	0.0%
30	1.8	CONC1	0.0001	-100.0%
31	0	STEEL1	0	0.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE12

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

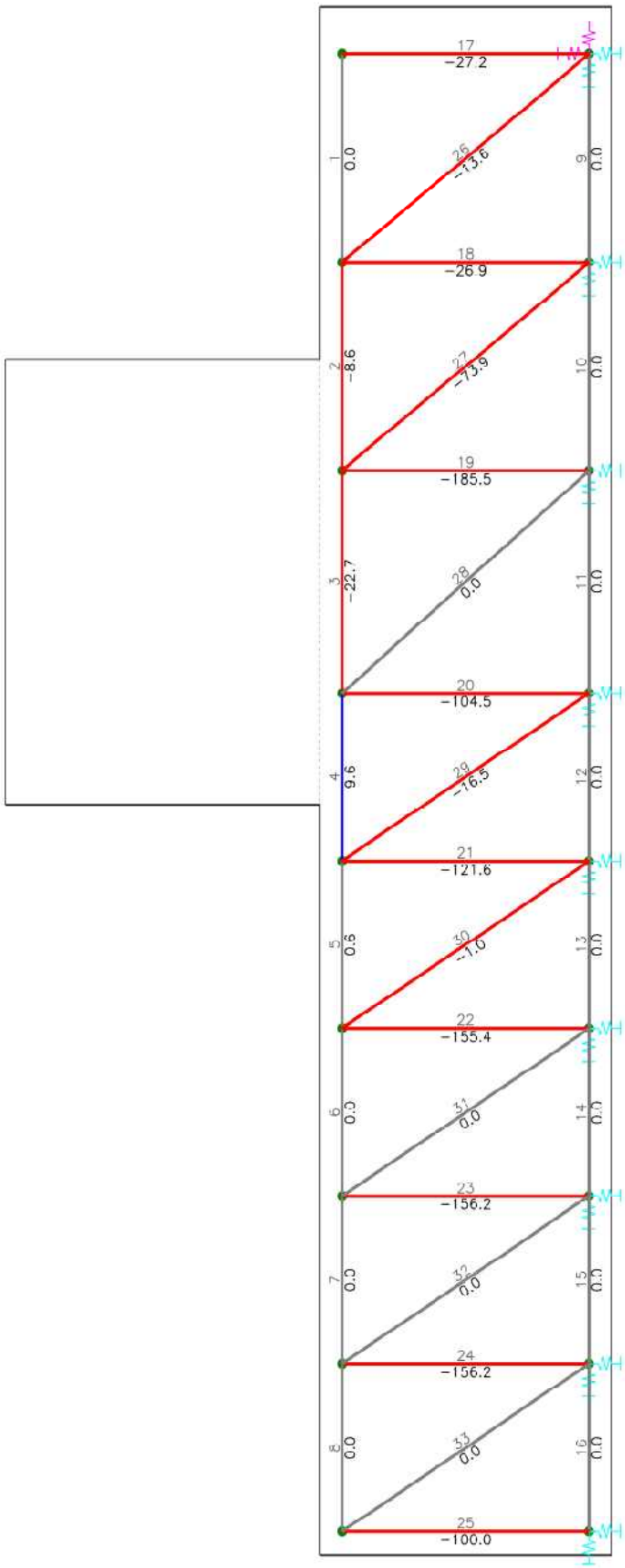


STAGE12

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	8.2	CONC1	0.0007	0.0%
03	22.4	CONC1	0.0018	0.0%
04	9.81	STEEL1	3.27E-05	-3.1%
05	0.66	STEEL1	2.2E-06	-50.0%
06	0	STEEL1	0	0.0%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	27.3	CONC1	0.0022	-4.5%
19	185.4	CONC1	0.0151	-0.7%
20	104.5	CONC1	0.0085	0.0%
21	121.5	CONC1	0.0099	0.0%
22	155.2	CONC1	0.0127	0.8%
23	156.2	CONC1	0.0128	0.0%
24	156.2	CONC1	0.0128	0.0%
25	100	CONC1	0.0082	0.0%
26	13.1	CONC1	0.0011	9.1%
27	74	CONC1	0.006	0.0%
28	0	STEEL1	0	0.0%
29	16.7	CONC1	0.0014	0.0%
30	1.2	CONC1	0.0001	0.0%
31	0	STEEL1	0	0.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE13

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

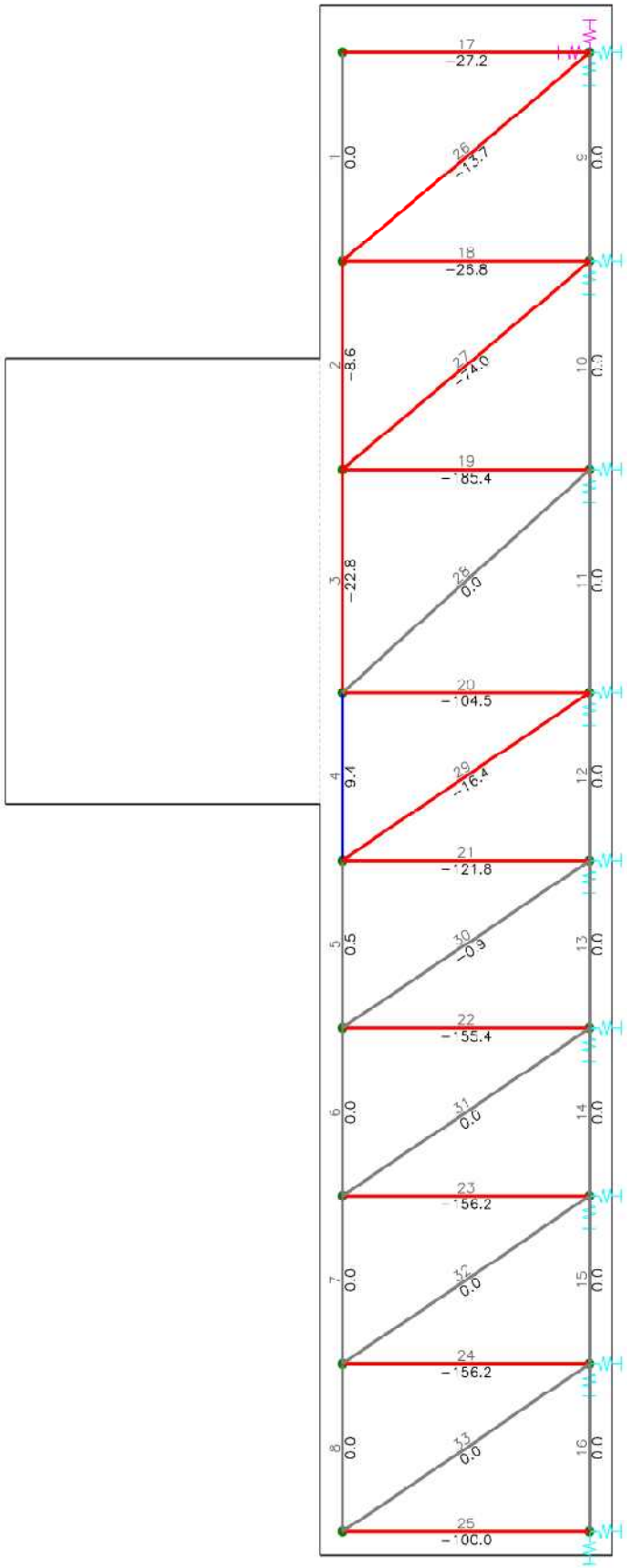


STAGE13

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	8.6	CONC1	0.0007	0.0%
03	22.7	CONC1	0.0019	5.3%
04	9.57	STEEL1	3.19E-05	-2.5%
05	0.54	STEEL1	1.8E-06	-22.2%
06	0	STEEL1	0	0.0%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	26.9	CONC1	0.0022	0.0%
19	185.5	CONC1	0.0152	0.7%
20	104.5	CONC1	0.0085	0.0%
21	121.6	CONC1	0.0099	0.0%
22	155.4	CONC1	0.0127	0.0%
23	156.2	CONC1	0.0128	0.0%
24	156.2	CONC1	0.0128	0.0%
25	100	CONC1	0.0082	0.0%
26	13.6	CONC1	0.0011	0.0%
27	73.9	CONC1	0.006	0.0%
28	0	STEEL1	0	0.0%
29	16.5	CONC1	0.0014	0.0%
30	1	CONC1	0.0001	0.0%
31	0	STEEL1	0	0.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE14

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

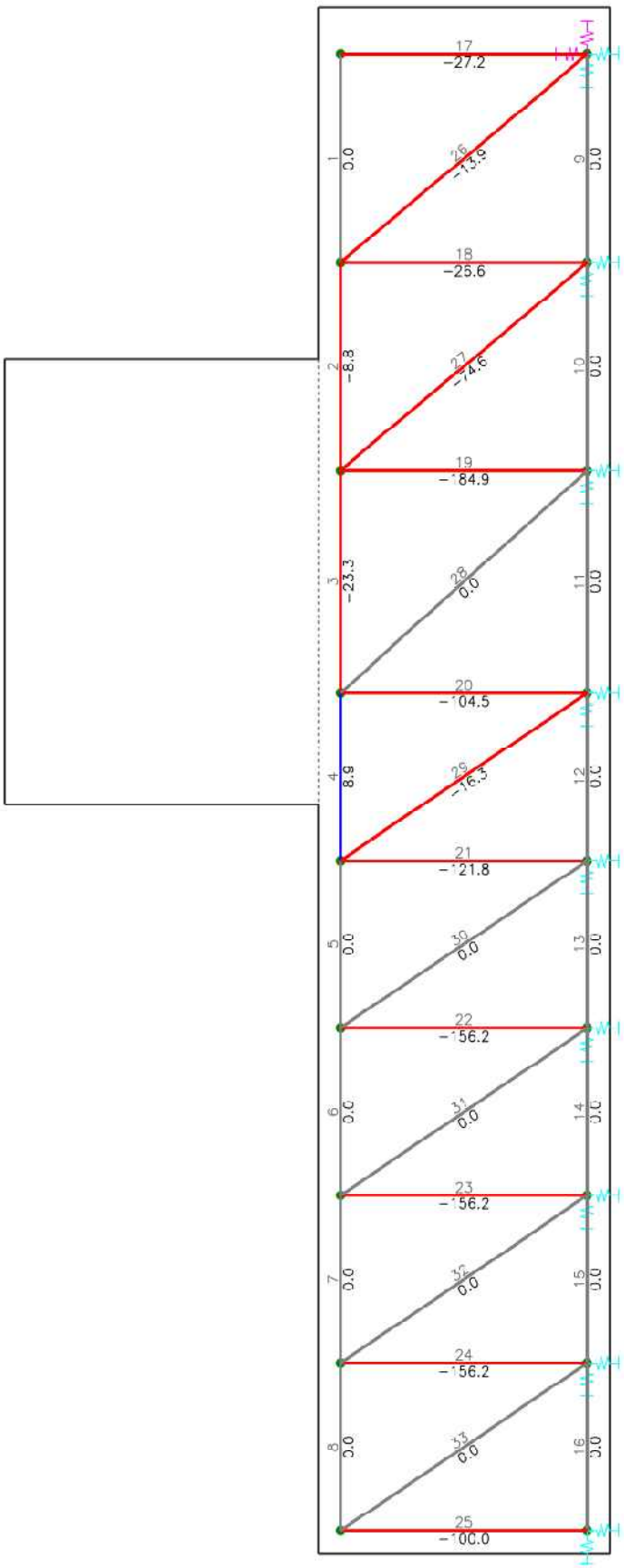


STAGE14

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	8.6	CONC1	0.0007	0.0%
03	22.8	CONC1	0.0019	0.0%
04	9.42	STEEL1	3.14E-05	-1.6%
05	0	STEEL1	0	0.0%
06	0	STEEL1	0	0.0%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	26.8	CONC1	0.0022	0.0%
19	185.4	CONC1	0.0151	-0.7%
20	104.5	CONC1	0.0085	0.0%
21	121.8	CONC1	0.0099	0.0%
22	155.4	CONC1	0.0127	0.0%
23	156.2	CONC1	0.0128	0.0%
24	156.2	CONC1	0.0128	0.0%
25	100	CONC1	0.0082	0.0%
26	13.7	CONC1	0.0011	0.0%
27	74	CONC1	0.006	0.0%
28	0	STEEL1	0	0.0%
29	16.4	CONC1	0.0013	-7.7%
30	0.9	CONC1	0.0001	0.0%
31	0	STEEL1	0	0.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE15

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E

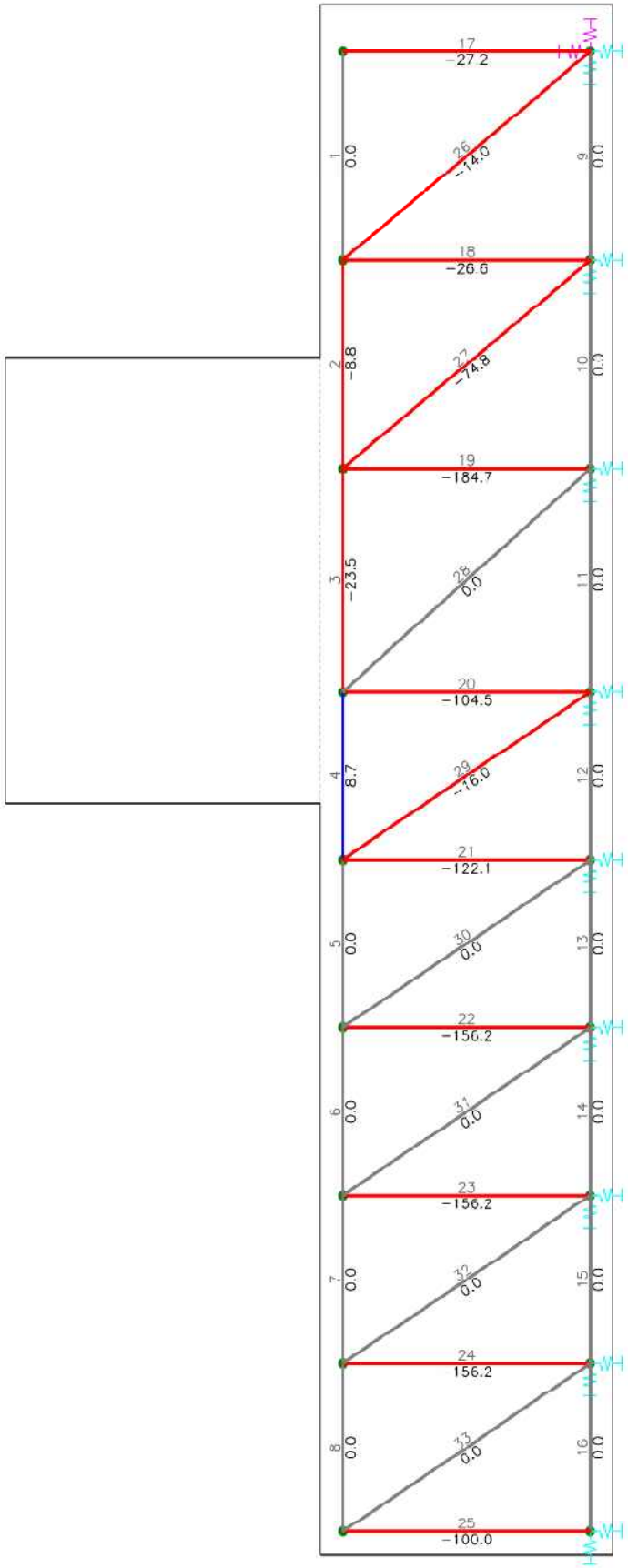


STAGE15

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	8.8	CONC1	0.0007	0.0%
03	23.3	CONC1	0.0019	0.0%
04	8.88	STEEL1	2.96E-05	-6.1%
05	0	STEEL1	0	0.0%
06	0	STEEL1	0	0.0%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	26.6	CONC1	0.0022	0.0%
19	184.9	CONC1	0.0151	0.0%
20	104.5	CONC1	0.0085	0.0%
21	121.8	CONC1	0.01	1.0%
22	156.2	CONC1	0.0128	0.8%
23	156.2	CONC1	0.0128	0.0%
24	156.2	CONC1	0.0128	0.0%
25	100	CONC1	0.0082	0.0%
26	13.9	CONC1	0.0011	0.0%
27	74.6	CONC1	0.0061	1.6%
28	0	STEEL1	0	0.0%
29	16.3	CONC1	0.0013	0.0%
30	0	STEEL1	0	0.0%
31	0	STEEL1	0	0.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%

SAP2000-STAGE16

하중조합 UL02 : 1.3 SW-F + 1.3 SW-E + 1.3 BF-E + 0.0 TOS-E



STAGE16

Element	Force	Material	Area	증감율
01	0	STEEL1	0	0.0%
02	8.8	CONC1	0.0007	0.0%
03	23.5	CONC1	0.0019	0.0%
04	8.73	STEEL1	2.91E-05	-1.7%
05	0	STEEL1	0	0.0%
06	0	STEEL1	0	0.0%
07	0	STEEL1	0	0.0%
08	0	STEEL1	0	0.0%
09	0	STEEL1	0	0.0%
10	0	STEEL1	0	0.0%
11	0	STEEL1	0	0.0%
12	0	STEEL1	0	0.0%
13	0	STEEL1	0	0.0%
14	0	STEEL1	0	0.0%
15	0	STEEL1	0	0.0%
16	0	STEEL1	0	0.0%
17	27.2	CONC1	0.0022	0.0%
18	26.6	CONC1	0.0022	0.0%
19	184.7	CONC1	0.0151	0.0%
20	104.5	CONC1	0.0085	0.0%
21	122.1	CONC1	0.01	0.0%
22	156.2	CONC1	0.0128	0.0%
23	156.2	CONC1	0.0128	0.0%
24	156.2	CONC1	0.0128	0.0%
25	100	CONC1	0.0082	0.0%
26	14	CONC1	0.0011	0.0%
27	74.8	CONC1	0.0061	0.0%
28	0	STEEL1	0	0.0%
29	16	CONC1	0.0013	0.0%
30	0	STEEL1	0	0.0%
31	0	STEEL1	0	0.0%
32	0	STEEL1	0	0.0%
33	0	STEEL1	0	0.0%