

3. 일광터널 안전성평가 자료

3.1 안전성평가 자료

구조물의 안전성 평가는 그 기능과 역할을 유지할 수 있는 구조적 및 사용상의 안전성에 대한 확보여부를 평가하는 것이므로 설계도서 검토 및 시공방법과 사용재료에 대한 검토, 부재별 상태 평가 결과 및 각종 계측·측정·조사·시험 등을 통한 충분한 기초자료를 확보하여 이를 바탕으로 수치해석에 의해 안전성 여부를 판단하여야 한다.

상태평가 결과 및 각종 계측·측정·조사·시험 등을 실시한 결과, 전회(2019년) 정밀안전진단과 해당 구조물의 현황이 이전과 근소한 차이 외 변화가 없는 것으로 확인되어 구조계산서 및 터널해석보고서 등 기초 자료를 활용하여 안전성여부를 판단하였고, 일부 자료를 발췌하여 첨부하였다.

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1. 설계조건

1.1 일반사항

1) 형식 : Precast Arch Box 13,450 m * 5,429 m
 지 간 : L = 13,450 m
 총 연 장 : 140 m
 토 피 고 : 3,000 m
 지하수위 : 1,000 m
 사각(skew) : 90 °
 기초형식 : 전면기초

2) 사용재료 및 설계기준강도

① 콘크리트

- 본체 Precast Arch Box
 $f_{ck} = 400 \text{ kgf/cm}^2$
 $E_c = 10,500 * \sqrt{f_{ck}} + 70,000 = 280,000 \text{ kgf/cm}^2$

- 기초 : 현장타설
 $f_{ck} = 270 \text{ kgf/cm}^2$
 $E_c = 15,000 * \sqrt{f_{ck}} = 246,475 \text{ kgf/cm}^2$

② 철근

* 본체 Precast Arch Box
 $f_y = 4000 \text{ kgf/cm}^2$
 $E_s = 2000000 \text{ kgf/cm}^2$ (Deformed Steel : 이형 철근)

* 기초 현장 타 설
 $f_y = 4000 \text{ kgf/cm}^2$
 $E_s = 2000000 \text{ kgf/cm}^2$ (Deformed Steel : 이형 철근)

3) 설계 방법

① P.A.B 본체 및 현장 타설 기초

* 단 면 검 토 : 극한 강도 설계법

* 사용성 검토 : 허용 응력 설계법

- a) 처짐 검토
- b) 균열 검토
- c) 피로 응력 검토

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② 배력근 (콘도 철근) 규정

A. 도로교설계기준 4.7 바닥판 적용시,

4.7.5.7 배력철근

1) 주철근이 차랑진행방향에 직각인 경우 (본 구조물의 기초 슬래브에 해당)

$$\text{백분율} = \frac{120}{\sqrt{L}} \text{ 과 } 67\% \text{ 중 작은 값 이상}$$

$$= 120 / \sqrt{15.20} = 30.7\% \quad (L = 30.5 / 2 = 15.25 \text{ m})$$

$$= \text{MIN}(30.7\%, 67\%) = 30.7\% \text{ 이므로 } A_{s, \text{req}} * 0.307 \text{ 을 배근함.}$$

단, 콘도철근 이상으로 배근함.

B. P.A.B 본체의 수축 및 콘도 철근 (콘크리트 구조 설계 기준(1999) - 5.7 p103)

철근비 $\rho = 0.0020$

$$\rho = \frac{A_s}{b \cdot d} \text{ 에서, } b = 100 \text{ cm}, d = 50 \text{ cm}$$

$$A_s = \rho \cdot b \cdot d = 0.0020 \cdot 100 \cdot 50 = 10.00 \text{ cm}^2/\text{m} \text{ 이상으로 하여야 한다.}$$

수축 및 콘도철근 간격은 슬래브 두께의 5배 이하 40cm이하로 하여야 한다.

C. 현장 타설 벽체의 최소수평철근비 (콘크리트 구조 설계 기준(1999) - 11.3 p221)

철근비 $\rho = 0.002$

$$\rho = \frac{A_s}{b \cdot d} \text{ 에서, } b = 100 \text{ cm}, d = 85 \text{ cm}$$

$$A_s = \rho \cdot b \cdot d = 0.0020 \cdot 100 \cdot 85 = 17.00 \text{ cm}^2/\text{m} \text{ 이상으로 하여야 한다.}$$

철근 배근 간격은 벽두께의 3배 이하, 40cm이하로 하여야 한다.

4) P.A.B 철근 덮개 기준 규정

: 콘크리트 구조 설계기준 5.4.2 프리캐스트 콘크리트 규정 참조

1.2 하중 조건

1) 고정 하중

- ① 철근 Con'c : 2.50 t/m³
- ② 토피 흙 : 1.90 t/m³
- ③ γ sub : 0.90 t/m³

2) 활하중 (한국 도로공사 교량 설계 기준 VI. 설계 일반사항 참조)

지중 RC RAHMEN교의 노면 활하중 적용

재하 방법

① 충격계수

토피두께 D(m)	충격계수 (i)
0.15 ≤ D ≤ 1	0.30
1 < D < 2	0.20
2 < D < 3	0.10
3 < D	0.00

② 노면 활하중 (Pv)

노면 활하중 Pv는 라멘을 단순보로 가정하여 활하중이 라멘 전폭에 작용한 경우와 2D + 0.2 m의 분포폭에 재하되는 경우와 모멘트가 같다고 보아 등가 등분포 활하중 Pv를 산출한 값임.

③ 활하중 영향 범위

활하중 분포폭이 라멘 전폭(B0)을 초과하는 부분의 활하중 영향은 무시.

④ 전륜하중 영향 범위

전륜하중은 무시하고 후륜하중에 대해서만 고려.

3) 토질 조건

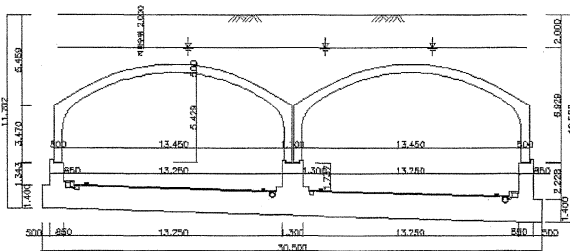
- 흙 내부 마찰각 $\Phi = 30^\circ$
- 정지 토압 계수 $K_0 = 1 - \sin \Phi = 0.500$
- 빗채움, 토피 흙 $\gamma_s = 1.9 \text{ t/m}^3$

1.3 참고 문헌

- ↳ 도로교 설계 기준 (2000) - 건설교통부
- ↳ 콘크리트구조설계기준(1999) - 건설교통부
- ↳ 콘크리트 표준 시방서 (1999) - 건설교통부
- ↳ 고속도로 양거 표준도 설계 기준 (1999) - 한국 도로 공사
- ↳ AASHTO (16th Edition, 1996)
- ↳ 한국도로공사 설계 실무 자료집

2. 단면 가정

1) 설계 단면



P.A.B 본체 제원	기초 구조물 제원
P.A.B Span 13.450 m	외측 P/W 두께 0.850 m
P.A.B 높이 5.429 m	중앙부 P/W 두께 1.300 m
토피고 3.000 m	기초내측거리 13.250 m
H.W.L 1.000 m	기초 두께 1.400 m
벽체 두께 0.500 m	기초 전폭 30.500 m
슬래브 두께 0.500 m	외측 P/W 높이 2.228 m
$f_{ck} = 4000 \text{ kg/cm}^2$	중앙부 P/W 높이 1.737 m
$f_y = 40000 \text{ kg/cm}^2$	$f_{ck} = 270 \text{ kg/cm}^2$
1 Seg. 길이 1.500 m	$f_y = 40000 \text{ kg/cm}^2$

2) 단면특성

부재 번호	단면적(A) (m ²)	단면2차모멘트(I) (m ⁴)	단면두께 (m)
1	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
2	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
3	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
4	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
5	1.0 * 0.542 = 0.542	1/12 * 1.0 * 0.542 ³ = 0.013	0.542
6	1.0 * 0.675 = 0.675	1/12 * 1.0 * 0.675 ³ = 0.026	0.675
7	1.0 * 0.916 = 0.916	1/12 * 1.0 * 0.916 ³ = 0.064	0.916
8	1.0 * 0.680 = 0.680	1/12 * 1.0 * 0.680 ³ = 0.026	0.680
9	1.0 * 0.553 = 0.553	1/12 * 1.0 * 0.553 ³ = 0.014	0.553
10	1.0 * 0.511 = 0.511	1/12 * 1.0 * 0.511 ³ = 0.011	0.511
11	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
12	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
13	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
14	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
15	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
16	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
17	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
18	1.0 * 0.511 = 0.511	1/12 * 1.0 * 0.511 ³ = 0.011	0.511
19	1.0 * 0.553 = 0.553	1/12 * 1.0 * 0.553 ³ = 0.014	0.553
20	1.0 * 0.680 = 0.680	1/12 * 1.0 * 0.680 ³ = 0.026	0.680
21	1.0 * 0.916 = 0.916	1/12 * 1.0 * 0.916 ³ = 0.064	0.916
22	1.0 * 0.675 = 0.675	1/12 * 1.0 * 0.675 ³ = 0.026	0.675
23	1.0 * 0.542 = 0.542	1/12 * 1.0 * 0.542 ³ = 0.013	0.542
24	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
25	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
26	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500
27	1.0 * 0.500 = 0.500	1/12 * 1.0 * 0.500 ³ = 0.010	0.500

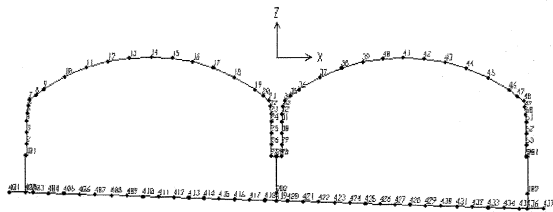
101	1.0 * 0.850 = 0.850	1/12 * 1.0 * 0.850 ³ = 0.051	0.850
102	1.0 * 0.850 = 0.850	1/12 * 1.0 * 0.850 ³ = 0.051	0.850
201	1.0 * 1.300 = 1.300	1/12 * 1.0 * 1.300 ³ = 0.183	1.300
202	1.0 * 1.300 = 1.300	1/12 * 1.0 * 1.300 ³ = 0.183	1.300

401	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
402	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
403	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
404	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
405	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
406	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
407	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
408	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
409	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
410	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
411	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
412	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
413	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
414	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
415	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
416	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
417	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400
418	1.0 * 1.400 = 1.400	1/12 * 1.0 * 1.400 ³ = 0.229	1.400

3. 상세해석

3.1 해석 모델링

1) P.A.B 단면 모델링



2) 절점자료

절점	X	Z	절점	X	Z	절점	X	Z	절점	X	Z
1	-14.250	-5.679	25	-0.300	-4.372	49	14.166	-2.860	413	-5.087	-8.042
2	-14.250	-5.026	26	-0.300	-5.026	50	14.230	-3.293	414	-4.184	-8.069
3	-14.250	-4.372	27	-0.300	-5.679	51	14.250	-3.719	415	-3.300	-8.096
4	-14.250	-3.719	28	0.300	-5.679	52	14.250	-4.372	416	-2.417	-8.122
5	-14.230	-3.293	29	0.300	-5.026	53	14.250	-5.026	417	-1.534	-8.148
6	-14.166	-2.860	30	0.300	-4.372	54	14.250	-5.679	418	-0.650	-8.175
7	-14.107	-2.444	31	0.300	-3.719	101	-14.325	-5.679	419	0.000	-8.194
8	-13.748	-2.165	32	0.318	-3.293	102	-14.325	-7.052	420	0.650	-8.214
9	-13.294	-1.832	33	0.389	-2.860	201	0.000	-5.679	421	1.534	-8.241
10	-12.092	-1.131	34	0.443	-2.444	202	0.000	-7.475	422	2.417	-8.267
11	-10.887	-0.608	35	0.795	-2.165	301	14.325	-5.679	423	3.300	-8.291
12	-9.683	-0.256	36	1.256	-1.832	302	14.325	-7.938	424	4.184	-8.320
13	-8.479	-0.057	37	2.458	-1.131	401	-15.250	-7.764	425	5.067	-8.347
14	-7.275	0.000	38	3.693	-0.608	402	-14.325	-7.764	426	5.950	-8.373
15	-6.071	-0.057	39	4.857	-0.256	403	-13.900	-7.777	427	6.834	-8.400
16	-4.867	-0.256	40	6.071	-0.057	404	-13.017	-7.804	428	7.717	-8.426
17	-3.663	-0.608	41	7.275	0.000	405	-12.133	-7.830	429	8.600	-8.453
18	-2.458	-1.131	42	8.479	-0.057	406	-11.250	-7.857	430	9.484	-8.479
19	-1.256	-1.832	43	9.683	-0.256	407	-10.367	-7.883	431	10.367	-8.506
20	-0.795	-2.165	44	10.887	-0.608	408	-9.484	-7.910	432	11.250	-8.532
21	-0.443	-2.444	45	12.092	-1.131	409	-8.600	-7.938	433	12.133	-8.559
22	-0.369	-2.660	46	13.294	-1.832	410	-7.717	-7.963	434	13.017	-8.585
23	0.318	-3.293	47	13.748	-2.165	411	-6.834	-7.989	435	13.900	-8.612
24	0.300	-3.719	48	14.107	-2.444	412	-5.950	-8.016	436	14.325	-8.625
						437	15.250	-8.625			

3) SPRING 계수

$$BV = \sqrt{A_v} = \sqrt{1500 \times 3050} = 2138.925 \text{ cm} \begin{cases} \text{신축이음거리 : 1500 cm} \\ \text{기초전폭 : 3050 cm} \end{cases}$$

$$K_v = K_{vo} \times (B_v / 30)^{(-3/4)}$$

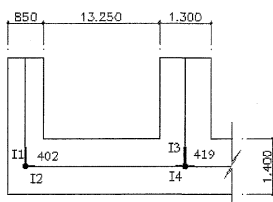
여기서,
 K_v = 연직방향 지반 반력 계수 (kgf/cm)
 K_{vo} = 지름 30cm 의 강재윤간에 의한 평판재하 시험에 상응하는 연직 방향 지반반력 계수(kgf/cm)
 B_v = 기초의 환산재하 폭 (m)
 E_o = 80,000 kgf/cm²
 α = 4.0 (지반반력 추정계수)

$$K_v = 1/30 \times 4 \times 80000 \times (2138.925/30)^{(-3/4)} = 434.7334 \text{ kgf/cm}^2 = 434733.4 \text{ t/m}^2$$

절점	분단폭	스프링계수
401	0.463	201064.2
402	0.675	293445.0
403	0.654	284315.6
404	0.884	384087.0
405	0.884	384087.0
406	0.883	383869.6
407	0.883	383869.6
408	0.884	384087.0
409	0.884	384087.0
410	0.883	383869.6
411	0.884	384087.0
412	0.884	384087.0
413	0.883	383869.6
414	0.884	384087.0
415	0.884	384087.0
416	0.883	383869.6
417	0.884	384087.0
418	0.767	333440.5
419	0.650	282576.7

수평 지반 반력 계수 : $K_h = 10000 \text{ ton/m}^2$

4) 기초 슬래브 절점부 강역 (도로교 설계 기준 (2000), 라멘교 P377)



$$I1 = 0.700 - 0.25 \times 0.85 = 0.4875 \text{ m}$$

$$I2 = 0.425 - 0.25 \times 1.40 = 0.075 \text{ m}$$

$$I3 = 0.700 - 0.25 \times 1.30 = 0.375 \text{ m}$$

$$I4 = 0.650 - 0.25 \times 1.40 = 0.3 \text{ m}$$

3.2 하중의 산정

1) 구조물 자체 산정

구조해석 입력값(SAP2000 input file) 참조

2) 상부에 작용하는 활하중

- * 활하중은 작용하지 않으므로 고려하지 않음.
- * 단 가설시 하중으로 활하중을 고려하여 적용함.
- 안전측 검토를 위해 가설하중에 의한 수평 토압은 고려하지 않음.

① 부분 등분포 하중 작용시

토피고 $D = 1.0 \text{ m}$
 충격계수 $I = 0.3 \text{ (} 0.15 \leq D \leq 1 \text{)}$
 $B0 = 14.45 \text{ m}$
 $W = (2D + 0.2 + 4 - 2D + D + 0.1) \times 2$
 $= (2 \times 1 + 0.2 + 4 - 2 \times 1 + 1 + 0.1) \times 2 = 10.6 \text{ m}$
 그러므로, $B0 > W$ 일 경우
 종방향 단위 길이당 하중 (DB-18)
 $P1 = (2 \times 7.2) / 3.0 = 4.8 \text{ tonf/m}$
 전폭에 작용하는 노면활하중
 $P_{vl} = \frac{8 \times P1 \times (1 + I) \times (0.75 B0 - 0.25 D - 4.225)}{B0^2}$
 $= \frac{8 \times 4.8 \times (1 + 0.3) \times (0.75 \times 14.45 - 0.25 \times 1.0 - 4.225)}{14.45^2} = 1.521$

② 연직 토압 + 활하중

$$= 2.0 \times 1.0 \times 1.5 + 1.521 \times 2.15 = 6.27 \text{ t/m}$$

② 등분포 하중 작용시

토피고 $D = 3.0 \text{ m}$
 충격계수 $I = 0.1 \text{ (} 2.0 \leq D \leq 3.0 \text{)}$
 $B0 = 14.45 \text{ m}$
 $W = (4.2 + 2D - 4 + 4.1 - D) \times 2$
 $= (4.20 + 2 \times 3.0 - 4 + 4.1 - 3) \times 2 = 14.6 \text{ m}$
 그러므로, $B0 < W$ 일 경우

종방향 단위 길이당 하중 (DB-18)

$$P1 = (2 \times 7.2) / 3.0 = 4.8 \text{ tonf/m}$$

분포폭에 작용하는 하중 (접지폭 0.2m, 분포각 45°)

$$P_{vl1} = \{P1(1+I)\} / (2D+0.2) = \{4.8 \times (1+0.1)\} / (2 \times 3 + 0.2) = 0.852$$

$$P_{vl2} = \{2P1(1+I)\} / (2D+0.2) = \{2 \times 4.8 \times (1+0.1)\} / (2 \times 3 + 0.2) = 1.703$$

전폭(B0)에 작용하는 노면 활하중

$$P_{vl} = \frac{8 \times P_{vl1} \{0.125 B0^2 + 2 \times B0 - 8.4 - (B0 - 4.2)D\}}{B0^2}$$

$$+ \frac{8 \times P_{vl2} \{8.4 - 2 B0 + (B0 - 4.2)D\}}{B0^2}$$

$$= \frac{0.852 \{0.125 \times 14.45^2 + 2 \times 14.45 - 8.4 - (14.45 - 4.2) \times 3\}}{14.45^2}$$

$$+ \frac{8 \times 1.703 \times \{8.4 - 2 \times 14.45 + (14.45 - 4.2) \times 3\}}{14.45^2}$$

$$= \frac{108.036 + 139.646}{208.803} = 1.186$$

③ 연직 토압 + 활하중

$$= 2.0 \times 3.0 \times 1.5 + 1.186 \times 2.15 = 11.55 \text{ t/m}$$

■ 비교 결과

11.55 t/m > 6.27 t/m 이므로,

토피고 3.00m의 경우가 더 불리한 경우 이므로 가설시 활하중은 토피고 3m일 때를 고려하여 $P_{vl} = 1.186 \text{ t/m}^2$ 을 적용함.

$$* P_{vl} = 1.186 \text{ t/m}^2 \text{ (P.A.B 슬래브에 재하)}$$

3) 연직토압(Pv) - 지하수 없을때

$$P_v = \alpha \cdot \gamma \cdot D$$

γ : 상재토의 단위중량(t/m³)

D: 암거상면의 토피 및 포장층 두께(m)

B₀: 암거 외측 폭(m)

* 흙의 자중 및 연직토압

근입계수(α): 암거 근입 특성에 따른 계수

$$\alpha = 1.0 + 0.2(D / B_0) \leq 1.15$$

$$= 1.0 + 0.2 \cdot (3 / (13.45 + 0.5 \cdot 2)) = 1.042 \approx 1.15 \quad \alpha = 1.042$$

절점 번호	$\gamma \cdot D$ t/m ²	$P_v = \alpha \cdot \gamma \cdot D$ t/m ²
5 23	1.9 * 6.293 = 11.957	1.042 * 11.957 = 12.459
6 22	1.9 * 5.860 = 11.134	1.042 * 11.134 = 11.602
7 21	1.9 * 5.444 = 10.344	1.042 * 10.344 = 10.778
8 20	1.9 * 5.165 = 9.814	1.042 * 9.814 = 10.228
9 19	1.9 * 4.832 = 9.181	1.042 * 9.181 = 9.566
10 18	1.9 * 4.131 = 7.849	1.042 * 7.849 = 8.179
11 17	1.9 * 3.608 = 6.855	1.042 * 6.855 = 7.143
12 16	1.9 * 3.256 = 6.186	1.042 * 6.186 = 6.446
13 15	1.9 * 3.057 = 5.808	1.042 * 5.808 = 6.062
14 -	1.9 * 3.000 = 5.700	1.042 * 5.700 = 5.939

4) 연직토압 (P_vw) - 지하수 있을때

$$P_v = \alpha \cdot \gamma \cdot D$$

$$\alpha = 1.042$$

$$\gamma t = 1.9 \quad t/m^2$$

$$\gamma_{sub} = 0.9 \quad t/m^2$$

절점 번호	지하수위	지하수 아래	α	ΣP_{vw}
5 23	3.80	3.864	1.042	7.986
6 22	3.80	3.474	1.042	7.580
7 21	3.80	3.100	1.042	7.189
8 20	3.80	2.849	1.042	6.928
9 19	3.80	2.549	1.042	6.615
10 18	3.80	1.918	1.042	5.958
11 17	3.80	1.447	1.042	5.468
12 16	3.80	1.130	1.042	5.137
13 15	3.80	0.951	1.042	4.951
14 -	3.80	0.900	1.042	4.897

ex) 5번 절점

$$\text{지하수 위} : \gamma \cdot h = 1.9 \cdot 2.0 = 3.8$$

$$\text{지하수 아래} : \gamma \cdot h = 0.9 \cdot (3.293 + 1.0) = 3.864$$

$$P_{vw} = 1.042 \cdot (3.8 + 3.864) = 7.986$$

5) 수평토압(Ph) - 지하수 없을때

절점 번호	수평토압 t/m ²
1 27	0.500 * 1.9 * 8.929 = 8.483
2 26	0.500 * 1.9 * 8.276 = 7.862
3 25	0.500 * 1.9 * 7.622 = 7.241
4 24	0.500 * 1.9 * 6.969 = 6.621
5 23	0.500 * 1.9 * 6.543 = 6.216
6 22	0.500 * 1.9 * 6.110 = 5.805
7 21	0.500 * 1.9 * 5.694 = 5.409
8 20	0.500 * 1.9 * 5.415 = 5.144
9 19	0.500 * 1.9 * 5.082 = 4.828
10 18	0.500 * 1.9 * 4.381 = 4.162
11 17	0.500 * 1.9 * 3.858 = 3.665
12 16	0.500 * 1.9 * 3.506 = 3.331
13 15	0.500 * 1.9 * 3.307 = 3.142
14	0.500 * 1.9 * 3.250 = 3.088
101	0.500 * 1.9 * 8.929 = 8.483
102	0.500 * 1.9 * 10.302 = 9.787
401	0.500 * 1.9 * 11.014 = 10.463
301	0.500 * 1.9 * 8.929 = 8.483
302	0.500 * 1.9 * 11.188 = 10.629
437	0.500 * 1.9 * 11.875 = 11.281

ex) 1번 절점

$$K_0 \cdot \gamma \cdot (h_1 + h_2 + t/2) = 0.5 \cdot 1.9 \cdot (5.679 + 3.0 + 0.5/2) = 8.483$$

$$h_1: 1\text{번절점 } z\text{축좌표 (5.679 m)}, h_2: \text{토피고 (3.0 m)}, t: \text{PAB 슬래브 두께 (0.5 m)}$$

6) 수평토압(Phw) - 지하수 있을때

절점 번호	지하수 위	지하수 아래	ΣPhw
1 27	1.900	3.118	5.018
2 26	1.900	2.824	4.724
3 25	1.900	2.530	4.430
4 24	1.900	2.236	4.136
5 23	1.900	2.044	3.944
6 22	1.900	1.850	3.750
7 21	1.900	1.662	3.562
8 20	1.900	1.537	3.437
9 19	1.900	1.387	3.287
10 18	1.900	1.071	2.971
11 17	1.900	0.836	2.736
12 16	1.900	0.678	2.578
13 15	1.900	0.588	2.488
14	1.900	0.563	2.463
101	1.900	3.118	5.018
102	1.900	3.736	5.636
401	1.900	4.056	5.956
301	1.900	3.118	5.018
302	1.900	4.135	6.035
435	1.900	4.444	6.344

ex) 1번 절점

$$\text{지하수 위} : K_0 \cdot \gamma \cdot h = 0.5 \cdot 1.9 \cdot 2.0 = 1.90$$

$$\text{지하수 아래} : K_0 \cdot \gamma \cdot (h_1 + h_2 + t/2) =$$

$$0.5 \cdot 0.9 \cdot (5.679 + 1.0 + 0.5/2) = 3.118$$

$$h_1: 1\text{번절점 } z\text{축좌표 (5.679 m)}$$

$$h_2: \text{구조물 상단에서의 지하수위 (1.0 m)}$$

$$t: \text{PAB 슬래브 두께 (0.5 m)}$$

7) 수압 (P_w) (GL - 2.0 m)

① 상판과 측벽에 작용하는 수압

절점 번호	지하수위
1 27	6.929
2 26	6.276
3 25	5.622
4 24	4.969
5 23	4.543
6 22	4.110
7 21	3.694
8 20	3.415
9 19	3.082
10 18	2.381
11 17	1.858
12 16	1.506
13 15	1.307
14	1.250
101	6.929
102	8.302
401	9.014
301	6.929
302	9.188
435	9.875

ex) 1번 절점

$$P_w = \gamma \cdot (h_1 + h_2 + t/2) = 1.0 \cdot (5.679 + 1.0 + 0.5/2) = 6.929$$

$$h_1: 1\text{번절점 } z\text{축좌표 (5.679 m)}$$

$$h_2: \text{구조물 상단에서의 지하수위 (1.0 m)}$$

$$t: \text{PAB 슬래브 두께 (0.5 m)}$$

② 기초 슬래브 저판에 작용하는 수압

절점	$\gamma_w \cdot H$	절점	$\gamma_w \cdot H$
401	9.714	420	10.164
402	9.714	421	10.191
403	9.727	422	10.217
404	9.754	423	10.241
405	9.780	424	10.270
406	9.807	425	10.297
407	9.833	426	10.323
408	9.860	427	10.350
409	9.886	428	10.376
410	9.913	429	10.403
411	9.939	430	10.429
412	9.966	431	10.456
413	9.992	432	10.482
414	10.019	433	10.509
415	10.048	434	10.535
416	10.072	435	10.562
417	10.098	436	10.575
418	10.125	437	10.575
419	10.144		

$$H = \text{각절점의 } Z\text{축좌표} + \text{기초두께 (1.4)/2} + \text{PAB두께 (0.5)/2} + \text{HWL (1.0)}$$

8) 기초 슬래브에 작용하는 활하중 (PL)

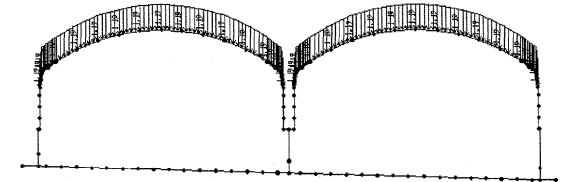
: 기초 슬래브에 작용하는 차량하중은 기초 부요모멘트를 감소시키므로 설계시에는 고려할 필요가 없고 지지력 계산시에만 고려한다. 그러므로 차하 하중은 점하중의 분담폭을 고려할 필요 없이 9.6 ton을 그대로 사용한다.

3.3 하중제하

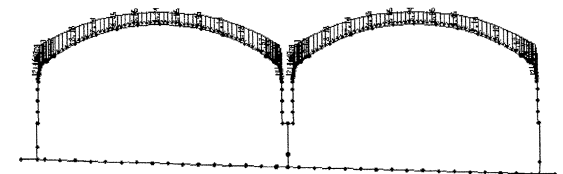
1) 구조물 자중

구조해석 PROGRAM내에 포함.

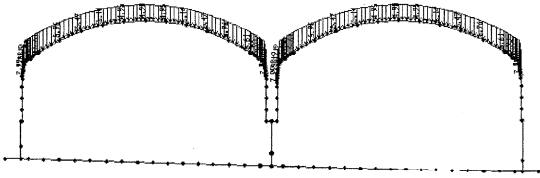
2) 상부에 작용하는 활하중 (가설 활하중 PVL)



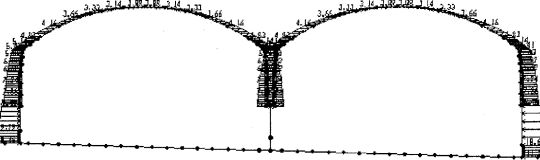
3) 연직토압(Pv) - 지하수 없을때



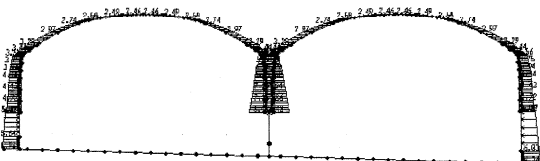
4) 연직토포입 (Pw) - 지하수 있을때



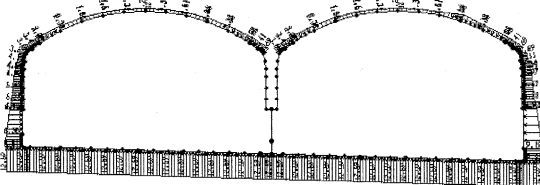
5) 수평토포입(Ph) - 지하수 없을때



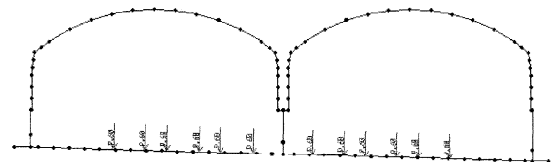
6) 수평토포입(Phw) - 지하수 있을때



7) 수압 (Pw)



8) 기초 슬래브에 작용하는 활하중 (PL)



9) 온도 및 건조 수축의 영향

온도는 지하 50cm정도 까지 일변화가 있으나 지중의 온도 변화량은 깊이에 따라 급격히 감소하므로 토파가 1m 이상인 터널에 대해서는 온도 변화의 영향이 미소하여 무시할 수 있을 정도이며 터널 입출구부의 온도차에 의한 영향을 고려하여 별도로 검토하였음.

10) 내진 검토

부산 - 울산의 개착식 터널은 풍화암층 이상의 균질한 지반에 위치하고 있으며 최소 토파고가 3.00m 이상으로 지진발생시 구조물이 지반과 거의 같은 진동을 하므로 지진의 영향을 크게 받지 않는다. 그러므로 내진검토는 제외함.

3.4 하중조합

3.4.1 노도보설계기준

1) 극한하중 검토시

하중조합	구체자중 (SW)	연직토포입(Pv) -수압 있을때	수평토포입 (Ph) -수압 있을때	연직토포입 (Pw) -수압 있을때	수평토포입 (Phw) -수압 있을때	수압 (PW)	활하중(가설시 PVL)
COMB.1	1.3	1.5		1.7			
COMB.2	1.3	1.5	0.65				
COMB.3	1.3			1.5	1.7	1.3	
COMB.4	1.3			1.5	0.65	1.3	
COMB.5	1.3	1.5	1.7				1.3
COMB.6	1.3	1.5	0.65				1.3

2) 사용하중 검토시

하중조합	구체자중 (SW)	연직토포입(Pv) -수압 있을때	수평토포입 (Ph) -수압 있을때	연직토포입 (Pw) -수압 있을때	수평토포입 (Phw) -수압 있을때	수압 (PW)	활하중 (PL)
COMB.7	1	1	1				
COMB.8	1	1	1				1
COMB.9	1	1	0.5				
COMB.10	1	1	0.5				1
COMB.11	1			1	1	1	
COMB.12	1			1	1	1	1

* 참조 SAP2000 Input File

하중 조합	Input File	하중 조합	Input File
COMB.1	MAT1.\$2K	COMB.7	MAT1.\$2K
COMB.2	MAT1.\$2K	COMB.8	MAT1.\$2K
COMB.3	MAT3.\$2K	COMB.9	MAT1.\$2K
COMB.4	MAT4.\$2K	COMB.10	MAT1.\$2K
COMB.5	MAT1.\$2K	COMB.11	MAT1.\$3K
COMB.6	MAT6.\$2K	COMB.12	MAT1.\$4K

3.5 해석 결과

1) 모멘트 하중조합 결과

극한 하중 상태							
절점	COMB.1	COMB. 2	COMB. 3	COMB. 4	COMB. 5	COMB. 6	MAX
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	10.69	21.64	6.71	12.73	14.33	25.27	26.27
3	27.11	45.50	20.36	30.28	34.39	52.77	52.77
4	48.76	71.33	40.31	52.15	59.67	82.24	82.24
5	63.21	86.89	54.35	66.45	76.24	99.92	99.92
6	75.19	98.78	66.58	78.21	89.83	113.42	113.42
7	89.23	111.64	81.03	91.50	105.50	127.91	127.91
8	70.46	91.39	63.72	73.26	84.30	105.23	105.23
9	51.20	69.45	45.94	53.79	62.24	80.49	80.49
10	13.99	23.21	11.09	13.28	16.39	27.61	27.61
11	6.84	7.57	8.89	12.85	7.89	8.32	12.85
12	18.40	27.41	20.01	29.04	22.86	31.87	31.87
13	24.07	38.69	26.37	37.44	30.79	45.41	45.41
14	26.30	42.76	26.90	39.21	33.82	50.27	50.27
15	24.07	38.68	23.43	33.23	30.78	45.40	45.40
16	18.38	27.39	16.14	20.62	22.84	31.84	31.84
17	6.91	7.53	3.09	0.22	7.86	8.28	8.28
18	14.03	23.27	18.83	30.13	18.44	27.67	30.13
19	51.29	69.55	56.86	74.88	82.34	80.60	80.60
20	71.18	92.12	74.78	96.57	85.12	106.06	106.06
21	89.35	111.78	92.08	115.46	105.63	128.05	128.05
22	76.83	100.43	79.03	103.52	91.66	115.26	115.26
23	63.43	87.12	65.05	89.53	76.49	100.17	100.17
24	48.75	71.32	49.97	73.21	59.66	82.23	82.23
25	27.11	45.50	27.92	46.75	34.38	52.77	52.77
26	10.69	21.64	11.10	22.27	14.32	25.27	25.27
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	10.74	21.57	11.91	23.00	14.35	25.19	25.19
30	27.20	45.36	29.55	48.21	34.44	52.60	52.60
31	48.89	71.12	52.41	75.40	59.75	81.98	81.98
32	63.60	86.87	68.05	92.22	76.59	99.86	99.86
33	77.03	100.13	82.76	106.86	91.76	114.89	114.89
34	89.58	111.44	96.41	119.36	105.77	127.63	127.63
35	71.44	91.77	79.12	100.45	85.28	105.61	105.61
36	14.40	22.84	22.79	33.51	18.68	27.12	33.51
37	6.51	8.01	0.28	2.50	7.39	8.89	8.89

38	17.97	27.92	13.58	18.75	22.57	32.52	32.52
39	23.65	39.25	21.87	32.39	30.52	46.12	46.12
40	25.90	43.34	26.52	39.56	33.57	51.01	51.01
41	23.69	39.29	26.30	39.09	30.56	46.16	46.16
42	18.05	28.00	22.44	32.16	22.85	32.60	32.60
43	6.62	8.13	12.42	17.03	7.51	9.02	17.03
44	14.27	22.70	8.75	10.36	18.54	26.97	26.97
45	51.45	69.03	45.41	62.76	62.38	79.06	79.06
46	51.45	69.03	45.41	62.76	62.38	79.06	79.06
47	70.69	91.01	63.85	72.94	84.45	104.77	104.77
48	89.47	111.32	81.69	91.75	105.65	127.50	127.50
49	75.39	98.49	67.22	78.49	89.96	113.06	113.06
50	63.38	86.64	54.98	66.77	76.34	99.61	99.61
51	46.90	71.12	40.85	52.44	59.75	81.98	81.98
52	27.20	45.95	20.72	30.47	34.44	52.60	52.60
53	10.74	21.57	8.86	12.83	14.35	25.19	25.19
54	0.00	0.00	0.00	0.00	0.00	0.00	0.00
101	8.84	8.84	8.21	8.14	9.79	9.79	9.79
102	6.96	28.79	19.18	1.03	0.27	35.47	35.47
301	8.84	8.84	8.33	8.25	9.79	9.79	9.79
302	21.97	46.57	45.80	7.05	10.41	58.12	58.12
401	0.00	0.00	0.00	0.00	0.00	0.00	0.00
402	36.43	38.49	85.29	56.26	31.23	44.05	85.29
403	16.36	20.07	67.26	39.35	10.67	25.76	67.26
404	6.46	24.17	26.18	1.11	10.69	28.41	28.41
405	10.60	16.86	8.63	30.83	12.89	18.95	30.83
406	8.00	8.64	37.00	56.36	8.92	9.56	56.36
407	4.46	3.33	59.00	75.50	4.66	3.53	75.50
408	1.86	0.68	74.55	88.21	1.78	0.80	88.21
409	0.44	0.35	83.69	94.48	0.30	0.50	94.48
410	0.16	0.54	86.30	94.26	0.29	0.87	94.26
411	0.14	0.28	82.45	87.54	0.21	0.36	87.54
412	0.61	0.60	72.01	74.27	0.64	0.63	74.27
413	2.80	2.60	65.06	54.46	2.84	2.84	55.06
414	6.38	6.37	31.50	28.05	6.99	7.00	31.50
415	11.75	11.84	1.21	5.03	12.95	13.05	13.05
416	16.25	16.26	35.51	44.65	17.90	17.92	44.65
417	11.50	11.54	78.95	90.97	12.67	12.70	90.97
418	20.11	20.01	129.20	144.05	22.19	22.09	144.05
419	51.85	51.97	159.48	175.49	57.19	57.37	175.49
420	20.01	20.17	126.84	144.75	22.13	22.30	144.75
421	11.50	11.49	76.25	90.23	12.66	12.65	90.23
422	16.23	16.27	32.45	42.53	17.86	17.92	42.53
423	11.84	11.80	4.64	1.59	13.03	12.99	13.03
424	6.32	6.40	34.05	32.41	6.96	7.04	34.05
425	2.55	2.63	57.87	59.56	2.80	2.87	59.56
426	0.62	0.59	74.25	79.84	0.65	0.60	79.84
427	0.10	0.31	83.67	93.19	0.18	0.45	93.19
428	0.00	0.63	86.19	99.60	0.15	0.91	99.60
429	0.78	0.51	81.68	99.01	0.56	0.87	99.01
430	2.42	0.43	70.19	91.43	2.24	0.16	91.43
431	5.05	3.14	51.63	76.81	5.15	3.50	76.81
432	8.05	8.84	26.07	55.16	8.99	10.38	55.16
433	8.54	18.07	6.61	26.40	11.25	20.82	26.40
434	0.39	28.04	46.40	9.49	5.16	33.47	46.40
435	31.57	27.75	93.34	52.49	23.07	36.16	93.34
436	55.49	42.09	113.92	71.52	46.83	48.81	113.92
437	0.00	0.00	0.00	0.00	0.00	0.00	0.00

사용 하중 상태							
절점	COMB. 7	COMB. 8	COMB. 9	COMB. 10	COMB. 11	COMB. 12	MAX
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	8.92	8.92	14.13	14.13	9.92	9.92	14.13
3	21.21	21.21	29.97	29.97	21.87	21.87	29.97
4	36.57	36.57	47.32	47.32	35.70	35.70	47.32
5	46.58	46.58	57.86	57.86	44.45	44.45	57.86
6	54.73	54.73	65.96	65.96	51.57	51.57	65.96
7	64.11	64.11	74.79	74.79	59.46	59.46	74.79
8	51.13	51.13	61.09	61.09	49.15	49.15	61.09
9	37.64	37.64	46.33	46.33	38.13	38.13	46.33
10	10.97	10.97	15.36	15.36	14.98	14.98	15.36
11	4.79	4.79	5.09	5.09	0.21	0.21	5.09
12	13.89	13.89	18.18	18.18	10.06	10.06	18.18
13	18.63	18.63	25.59	25.59	15.95	15.95	25.59
14	20.43	20.43	28.27	28.27	18.83	18.83	28.27
15	18.62	18.62	25.58	25.58	18.12	18.12	25.58
16	13.88	13.88	18.17	18.17	14.99	14.99	18.17
17	4.77	4.77	5.07	5.07	6.71	6.71	6.71
18	10.99	10.99	15.39	15.39	6.32	6.32	15.39
19	37.70	37.70	46.40	46.40	27.34	27.34	46.40
20	51.62	51.62	61.60	61.60	37.99	37.99	61.60
21	64.20	64.20	74.88	74.88	47.23	47.23	74.88
22	55.84	55.84	67.08	67.08	40.20	40.20	67.08
23	46.73	46.73	58.01	58.01	32.79	32.79	58.01
24	36.57	36.57	47.32	47.32	24.84	24.84	47.32
25	21.21	21.21	29.96	29.96	13.39	13.39	29.96
26	8.92	8.92	14.13	14.13	5.01	5.01	14.13
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	8.93	8.93	14.09	14.09	4.97	4.97	14.09
30	21.24	21.24	29.99	29.99	13.32	13.32	29.99
31	36.51	36.51	47.20	47.20	24.74	24.74	47.20
32	46.79	46.79	57.87	57.87	32.69	32.69	57.87
33	55.90	55.90	68.31	68.31	40.24	40.24	68.31
34	64.26	64.26	74.67	74.67	47.36	47.36	74.67
35	51.71	51.71	61.39	61.39	38.00	38.00	61.39
36	11.13	11.13	15.15	15.15	6.38	6.38	15.15
37	4.63	4.63	5.34	5.34	6.71	6.71	6.71
38	13.74	13.74	18.48	18.48	14.45	14.45	18.48
39	18.49	18.49	25.91	25.91	18.22	18.22	25.91
40	20.31	20.31	28.61	28.61	18.98	18.98	28.61
41	18.52	18.52	25.94	25.94	18.13	18.13	25.94
42	13.79	13.79	18.53	18.53	10.27	10.27	18.53
43	4.71	4.71	5.43	5.43	0.44	0.44	5.43
44	11.03	11.03	15.05	15.05	14.75	14.75	15.05
45	37.71	37.71	46.08	46.08	37.93	37.93	46.08
46	37.71	37.71	46.08	46.08	37.93	37.93	46.08
47	51.20	51.20	60.87	60.87	48.97	48.97	60.87
48	64.19	64.19	74.80	74.80	59.30	59.30	74.80
49	54.79	54.79	65.79	65.79	51.43	51.43	65.79
50	46.63	46.63	57.71	57.71	44.33	44.33	57.71
51	36.62	36.62	47.20	47.20	35.59	35.59	47.20
52	21.24	21.24	29.99	29.99	21.80	21.80	29.99

2) 전단력 하중조합 결과

극한 하중 상태							
절점	COMB. 1	COMB. 2	COMB. 3	COMB. 4	COMB. 5	COMB. 6	MAX
1	11.78	31.38	4.70	15.60	17.35	36.95	36.95
2	20.85	34.65	15.72	23.28	26.42	40.42	40.42
3	29.25	38.06	25.86	30.28	34.81	43.63	43.63
4	36.94	41.00	35.11	36.59	42.51	46.57	46.57
5	36.20	37.39	35.98	35.40	41.17	42.35	42.35
6	30.84	29.28	31.60	29.66	34.66	33.10	34.66
7	45.90	48.38	42.38	43.91	51.50	53.98	53.98
8	39.50	43.38	36.53	38.95	44.84	48.73	48.73
9	38.75	43.54	36.34	39.23	44.45	49.24	49.24
10	25.78	32.18	24.61	28.49	30.63	37.03	37.03
11	17.42	23.45	16.90	20.45	21.30	27.33	27.33
12	11.88	16.13	11.53	13.75	14.66	18.92	18.92
13	8.41	9.84	7.83	7.96	10.00	11.43	11.43
14	4.68	3.06	5.26	4.99	4.94	3.33	5.26
15	8.42	9.85	9.44	11.45	10.01	11.44	11.45
16	11.89	16.14	13.11	17.20	14.67	18.93	18.93
17	17.43	23.46	18.44	23.80	21.31	27.34	27.34
18	25.79	32.19	26.08	31.70	30.63	37.04	37.04
19	38.75	43.55	37.72	42.25	44.45	49.25	49.25
20	40.31	44.14	38.62	42.63	45.74	49.57	49.57
21	44.95	47.47	42.70	45.75	50.44	52.95	52.95
22	33.42	31.87	34.80	33.27	37.54	35.99	37.54
23	36.74	37.93	37.68	39.17	41.77	42.96	42.96
24	36.94	41.00	37.56	41.96	42.50	46.57	46.57
25	29.24	38.06	29.87	39.02	34.81	43.63	43.63
26	20.85	34.85	21.47	35.81	26.42	40.42	40.42
27	11.78	31.38	12.40	32.34	17.34	36.95	36.95
28	11.85	31.28	13.94	33.46	17.39	36.82	36.82
29	20.92	34.75	22.72	38.93	26.46	40.29	40.29
30	29.31	37.96	31.11	40.14	34.85	43.60	43.60
31	37.01	40.90	38.90	43.08	42.55	46.44	46.44
32	36.81	37.83	39.09	40.45	41.81	42.83	42.83
33	33.49	31.77	36.26	34.81	37.58	35.86	37.58
34	44.92	47.54	42.74	45.87	50.42	53.04	53.04
35	35.95	40.12	34.37	36.52	40.62	45.09	45.09
36	15.30	23.49	15.91	22.81	19.16	27.35	27.35
37	6.46	15.09	8.07	15.31	9.46	18.09	18.09
38	1.10	8.47	3.22	9.50	3.13	10.50	10.50
39	2.45	2.51	0.22	4.42	1.52	3.44	4.42
40	4.66	3.04	2.68	0.51	4.92	3.30	4.92
41	8.39	9.83	6.74	6.87	9.99	11.42	11.42
42	11.86	16.14	10.30	12.55	14.65	18.93	18.93
43	17.39	23.46	16.95	20.53	21.28	27.36	27.36
44	25.74	32.21	25.99	29.93	30.60	37.07	37.07
45	39.70	43.58	37.61	40.57	44.41	49.29	49.29
46	39.70	43.58	37.61	40.57	44.41	49.29	49.29
47	39.45	43.43	37.69	40.18	44.81	48.80	48.80
48	45.85	48.44	43.50	45.11	51.46	54.05	54.05
49	30.91	29.18	31.64	29.57	34.70	32.97	34.70
50	36.28	37.29	35.88	35.47	41.21	42.23	42.23

53	8.93	8.93	14.09	14.09	9.88	9.88	14.09
54	0.00	0.00	0.00	0.00	0.00	0.00	0.00
101	6.04	6.04	6.04	6.04	4.79	4.79	6.04
102	0.60	0.60	17.62	17.62	8.94	8.94	17.62
301	6.04	6.04	6.04	6.04	4.78	4.78	6.04
302	4.71	4.71	27.93	27.93	12.11	12.11	27.93
401	0.00	0.00	0.00	0.00	0.00	0.00	0.00
402	18.34	18.25	25.49	25.41	18.10	18.02	25.49
403	5.71	5.55	11.63	11.79	3.93	4.09	11.79
404	7.13	7.58	15.57	16.02	9.90	10.34	16.02
405	9.22	9.04	11.10	11.93	8.06	8.88	11.93
406	5.62	6.69	5.92	6.99	4.71	5.78	6.99
407	2.92	3.45	2.38	2.91	2.13	2.66	3.45
408	1.13	0.33	0.56	0.89	0.87	0.78	1.13
409	0.21	0.73	0.17	0.35	0.03	0.55	0.73
410	0.15	1.46	0.33	1.84	0.18	1.47	1.84
411	0.09	0.40	0.16	0.47	0.06	0.37	0.47
412	0.44	1.58	0.44	1.57	0.39	1.52	1.58
413	1.81	2.30	1.81	2.30	1.46	1.96	2.30
414	4.39	4.14	4.40	4.15	3.49	3.23	4.40
415	8.11	7.69	8.15	7.74	6.41	5.99	8.15
416	11.18	11.73	11.19	11.74	8.80	9.34	11.74
417	7.92	7.58	7.94	7.60	6.28	5.91	7.94
418	13.77	11.99	13.73	11.94	10.67	8.89	13.77
419	35.59	33.59	35.67	33.68	27.89	25.89	35.67
420	13.74	11.97	13.82	12.04	10.77	8.99	13.82
421	7.92	7.56	7.91	7.56	6.22	5.86	7.92
422	11.17	11.71	11.19	11.73	8.79	9.33	11.73
423	8.15	7.77	8.13	7.75	6.41	6.04	8.15
424	4.38	4.26	4.41	4.30	3.49	3.36	4.41
425	1.79	2.12	1.82	2.15	1.46	1.79	2.15
426	0.45	1.52	0.43	1.51	0.39	1.47	1.52
427	0.08	0.39	0.17	0.49	0.08	0.38	0.49
428	0.07	1.37	0.37	1.67	0.15	1.45	1.67
429	0.35	0.88	0.25	0.28	0.04	0.57	0.88
430	1.39	0.05	0.44	1.00	0.71	0.73	1.39
431	3.21	3.74	2.30	2.83	2.20	2.73	3.74
432	5.69	6.76	6.07	7.13	4.82	5.89	7.13
433	7.36	8.18	11.90	12.72	8.18	9.01	12.72
434	4.10	4.54	17.64	18.08	9.91	10.35	18.08
435	12.65	12.49	15.60	15.76	3.51	3.67	15.76
436	27.13	27.04	27.49	27.42	18.36	18.29	27.49
437	0.00	0.00	0.00	0.00	0.00	0.00	0.00

51	37.01	40.90	35.39	36.74	42.65	46.44	46.44
52	29.32	37.96	26.14	30.43	34.86	43.50	43.50

사용 하중 상태							
절점	COMB. 7	COMB. 8	COMB. 9	COMB. 10	COMB. 11	COMB. 12	MAX
1	10.96	10.96	20.29	20.29	13.58	13.58	20.29
2	16.29	16.29	22.96	22.96	16.76	16.76	22.96
3	21.23	21.23	25.43	25.43	19.76	19.76	25.43
4	25.76	25.76	27.69	27.69	22.55	22.55	27.69
5	24.83	24.83	25.39	25.39	21.40	21.40	25.39
6	20.77	20.77	20.03	20.03	17.74	17.74	20.77
7	31.58	31.58	32.76	32.76	24.82	24.82	32.76
8	27.43	27.43	29.28	29.28	22.05	22.05	29.28
9	27.07	27.07	29.35	29.35	22.40	22.40	29.35
10	18.52	18.52	21.57	21.57	16.58	16.58	21.57
11	12.80	12.80	15.67	15.67	12.30	12.30	15.67
12	8.76	8.76	10.79	10.79	8.89	8.89	10.79
13	5.96	5.96	6.64	6.64	6.18	6.18	6.64
14	2.94	2.94	2.17	2.17	3.19	3.19	3.19
15	5.96	5.96	6.64	6.64	4.38	4.38	6.64
16	8.76	8.76	10.79	10.79	7.12	7.12	10.79
17	12.80	12.80	15.67	15.67	10.57	10.57	15.67
18	16.53	16.53	21.58	21.58	14.93	14.93	21.58
19	27.07	27.07	29.35	29.35	20.85	20.85	29.35
20	27.97	27.97	29.79	29.79	21.02	21.02	29.79
21	30.94	30.94	32.14	32.14	22.89	22.89	32.14
22	22.53	22.53	21.79	21.79	18.53	18.53	22.53
23	25.20	25.20	25.76	25.76	20.00	20.00	25.76
24	25.76	25.76	27.69	27.69	19.77	19.77	27.69
25	21.23	21.23	25.43	25.43	15.24	15.24	25.43
26	16.29	16.29	22.96	22.96	10.31	10.31	22.96
27	10.95	10.95	20.29	20.29	4.97	4.97	20.29
28	10.98	10.98	20.23	20.23	4.92	4.92	20.23
29	16.31	16.31	22.90	22.90	10.25	10.25	22.90
30	21.25	21.25	25.37	25.37	15.19	15.19	25.37
31	25.78	25.78	27.63	27.63	19.72	19.72	27.63
32	25.22	25.22	25.70	25.70	20.08	20.08	25.70
33	22.55	22.55	21.73	21.73	18.64	18.64	22.55
34	30.93	30.93	32.18	32.18	22.94	22.94	32.18
35	25.06	25.06	27.05	27.05	18.78	18.78	27.05
36	11.65	11.65	15.55	15.55	9.56	9.56	15.55
37	5.72	5.72	9.83	9.83	5.08	5.08	9.83
38	1.89	1.89	5.39	5.39	1.79	1.79	5.39
39	0.90	0.90	1.46	1.46	0.93	0.93	1.46
40	2.93	2.93	2.16	2.16	3.16	3.16	3.16
41	5.95	5.95	6.63	6.63	6.15	6.15	6.63
42	8.75	8.75	10.79	10.79	8.87	8.87	10.79
43	12.78	12.78	15.67	15.67	12.29	12.29	15.67
44	18.51	18.51	21.59	21.59	16.57	16.57	21.59
45	27.05	27.05	29.37	29.37	22.40	22.40	29.37
46	27.05	27.05	29.37	29.37	22.40	22.40	29.37
47	27.41	27.41	29.31	29.31	22.06	22.06	29.31
48	31.56	31.56	32.79	32.79	24.83	24.83	32.79
49	20.79	20.79	19.97	19.97	17.69	17.69	20.79
50	24.85	24.85	25.33	25.33	21.35	21.35	25.33
51	25.78	25.78	27.63	27.63	22.50	22.50	27.63
52	21.25	21.25	25.37	25.37	19.70	19.70	25.37

53	16.31	16.31	22.90	22.90	16.71	16.71	22.90
54	10.98	10.98	20.23	20.23	13.53	13.53	20.23
101	10.96	10.96	20.29	20.29	13.58	13.58	20.29
102	1.59	1.59	14.02	14.02	6.27	6.27	14.02
301	10.98	10.98	20.23	20.23	13.53	13.53	20.23
302	10.61	10.61	9.44	9.44	1.05	1.05	10.61
401	20.99	20.91	29.18	29.09	21.19	21.10	29.19
402	35.44	35.64	25.94	25.66	23.23	23.43	35.64
403	36.66	38.86	26.12	26.32	24.45	24.66	38.86
404	16.09	16.41	6.60	6.32	8.30	8.82	16.41
405	4.49	4.22	7.41	7.14	5.34	5.06	7.41
406	4.60	5.21	5.55	6.16	4.47	5.07	6.16
407	3.57	6.54	3.61	6.57	3.19	6.15	6.57
408	2.58	6.15	2.37	6.11	2.28	6.53	6.53
409	1.95	4.38	1.72	4.15	1.76	4.19	4.38
410	1.48	8.31	1.37	8.53	1.44	8.50	8.53
411	1.61	5.82	1.73	5.75	1.65	5.92	5.92
412	2.15	6.87	2.22	6.94	2.08	6.77	6.94
413	3.09	5.08	3.10	5.07	2.76	5.71	5.71
414	4.47	7.61	4.48	7.61	3.84	6.97	7.61
415	5.74	12.44	5.79	12.49	4.85	11.55	12.49
416	5.23	8.59	5.22	8.58	4.42	7.78	8.59
417	26.08	23.67	26.05	23.64	20.69	18.29	26.08
418	62.89	62.29	62.90	62.30	49.40	48.79	62.90
419	61.67	61.06	61.76	61.15	48.25	47.64	61.76
420	62.85	62.24	62.99	62.37	49.48	48.87	62.99
421	26.04	23.83	26.12	23.71	20.76	18.34	26.12
422	5.23	8.60	5.25	8.62	4.45	7.82	8.62
423	5.81	12.40	5.75	12.33	4.85	11.43	12.40
424	4.48	7.41	4.48	7.41	3.84	6.77	7.41
425	3.05	5.28	3.12	5.27	2.76	5.91	5.91
426	2.14	6.80	2.23	6.89	2.08	6.72	6.89
427	1.54	5.89	1.77	5.80	1.65	5.97	5.97
428	1.55	8.23	1.41	8.57	1.44	8.49	8.57
429	2.03	4.46	1.68	4.12	1.77	4.20	4.46
430	2.72	6.11	2.33	6.07	2.30	6.49	6.49
431	3.61	6.57	3.66	6.62	3.23	6.20	6.62
432	4.35	4.96	5.81	6.41	4.52	5.12	6.41
433	5.23	5.66	6.15	7.87	5.35	5.08	8.15
434	20.50	20.82	6.03	7.60	8.79	9.11	20.82
435	41.96	42.16	24.17	24.37	25.41	25.61	42.16
436	40.74	40.94	28.10	28.02	24.19	24.39	40.94
437	16.50	16.42	31.34	31.26	21.47	21.39	31.34

3) 설계 단면력 산정

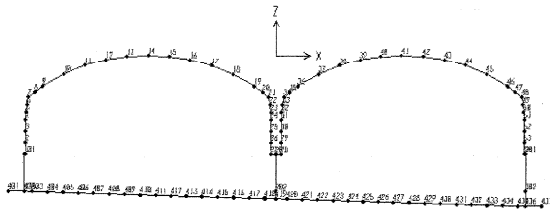
절점	모멘트		전단력	
	극한 하중 상태	사용하중 상태	극한 하중 상태	사용하중 상태
1	0.00	0.00	36.95	20.29
2	25.27	14.13	40.42	22.96
3	52.77	29.97	43.63	25.43
4	82.24	47.32	46.57	27.69
5	99.92	57.86	42.35	25.39
6	113.42	65.96	34.66	20.77
7	127.91	74.79	53.98	32.76
8	105.23	61.09	48.73	29.28
9	80.49	46.33	49.24	29.35
10	27.61	15.36	37.03	21.57
11	12.85	5.09	27.33	15.67
12	31.87	18.18	18.92	10.79
13	45.41	25.59	11.43	6.64
14	50.27	29.27	5.29	3.19
15	45.40	25.58	11.45	6.64
16	31.84	18.17	18.93	10.79
17	8.28	6.71	27.34	15.67
18	30.13	15.39	37.04	21.58
19	80.60	46.40	49.25	29.35
20	106.06	61.60	49.57	29.79
21	128.05	74.88	52.95	32.14
22	115.26	67.08	37.54	22.53
23	100.17	58.01	42.96	25.76
24	82.23	47.32	46.57	27.69
25	52.77	29.96	43.63	25.43
26	25.27	14.13	40.42	22.96
27	0.00	0.00	36.95	20.29
28	0.00	0.00	36.82	20.23
29	25.19	14.09	40.29	22.90
30	52.60	29.89	43.50	25.37
31	81.98	47.20	46.44	27.63
32	99.86	57.87	42.83	25.70
33	114.89	66.91	37.58	22.55
34	127.63	74.67	53.04	32.18
35	105.61	61.39	45.09	27.05
36	33.51	15.15	27.35	15.55
37	8.89	6.71	18.09	9.83
38	32.52	18.48	10.50	5.39
39	46.12	25.91	4.42	1.46
40	51.01	28.61	4.92	3.16
41	46.16	25.94	11.42	6.63
42	32.60	18.53	18.93	10.79
43	17.03	5.43	27.36	15.67
44	26.97	15.05	37.07	21.59
45	79.96	46.08	49.29	29.37
46	79.96	46.08	49.29	29.37
47	104.77	60.87	48.80	29.31
48	127.50	74.60	54.05	32.79
49	113.06	65.79	34.70	20.79

50	99.61	57.71	42.23	25.33
51	81.98	47.20	46.44	27.63
52	52.60	29.89	43.50	25.37
53	25.19	14.09	40.29	22.90
54	0.00	0.00	36.82	20.23
101	9.79	6.04	36.95	20.29
102	35.47	17.62	28.80	14.02
301	9.79	6.04	36.82	20.23
302	58.12	27.93	39.91	10.61
401	0.00	0.00	56.08	29.18
402	85.29	25.49	63.55	35.64
403	67.26	11.79	59.50	36.86
404	28.41	16.02	42.96	16.41
405	30.83	11.93	35.76	7.41
406	56.36	6.99	28.53	6.16
407	75.50	3.45	21.28	6.57
408	88.21	1.13	13.99	6.53
409	94.48	0.73	6.67	4.38
410	94.26	1.64	3.93	8.53
411	87.54	0.47	11.31	5.92
412	74.27	1.58	18.72	6.94
413	55.06	2.30	26.16	5.71
414	31.50	4.40	33.65	7.61
415	13.05	8.15	41.16	12.49
416	44.65	11.74	48.65	8.59
417	90.97	7.94	56.22	26.08
418	144.05	13.77	100.72	62.90
419	175.49	35.67	99.32	61.76
420	144.75	13.82	100.91	62.99
421	90.23	7.92	57.84	26.12
422	42.53	11.73	50.21	8.62
423	13.03	8.15	42.48	12.40
424	34.65	4.41	34.62	7.41
425	59.56	2.15	26.87	5.91
426	79.84	1.52	19.05	6.89
427	93.19	0.49	11.19	5.97
428	99.60	1.67	3.31	8.57
429	99.01	0.88	9.07	4.46
430	91.43	1.39	17.02	6.49
431	76.81	3.74	24.99	6.62
432	55.16	7.13	32.99	6.41
433	26.40	12.72	41.02	8.15
434	46.40	18.08	49.09	20.82
435	93.34	15.76	69.12	42.16
436	113.92	27.49	67.53	40.94
437	0.00	0.00	54.87	31.34

4. 단면 검토

4.1 Precast Arch Box 본체 검토

1) 단면력 집계



구분	극한 하중	사용 하중	비 고
집점 위치	모멘트 t-m/m	전단력 t/m	
PAB	5 번 100.17	42.96	58.01 25.76
	7 번 128.05	54.05	74.88 32.79
	14 번 50.27	11.42	28.27 6.63
기초	403 번 93.34	69.12	15.76 42.16
	428 번 99.60	3.31	1.67 8.57
	418 번 144.75	100.91	13.82 62.99
	102 번 58.12	39.91	27.93 14.02

* 위의 각절점과 공통으로 검토해야하는 절점

5 번 : 23 32 50 번

7 번 : 21 34 48 번

14 번 : 41 번

403 번 : 435 번

428 번 : 기초슬래브구간 중 최대 정모멘트가 발생하는 절점

418 번 : 420 번

102 번 : 302 번

* 설계에 필요한 값들은 위의 공통된 절점에서 최대값을 설계에 반영함.

2) 극한강 검토 극한 강도 설계법 검토

(1) P.A.B 검토

① 상부 슬래브 (정모멘트) (14 번 절점)

$$M_u = 50.270 \text{ t-m / m}, \quad V_u = 11.420 \text{ t/m}$$

$$d = 40.82 \text{ cm}, \quad d_n = 9.18 \text{ cm}, \quad b = 100 \text{ cm}$$

$$f_{ck} = 400 \text{ kgf/cm}^2, \quad f_y = 4000 \text{ kgf/cm}^2, \quad \beta_1 = 0.766$$

$$\Phi M_n = 0.9 * f_y * A_s * (d - a/2) \text{ 에서} \quad \Phi = 0.9 \text{ (Precast)}$$

$$A_{s,req} = \frac{M_u}{0.90 * f_y * (d - a/2)} \text{ 로 부터}$$

$$a = \frac{A_s * f_y}{0.85 * f_{ck} * b} = 4.245 \quad A_{s,req} = 36.08 \text{ cm}^2$$

$$\therefore H \ 19 \ @ \ 100 = 2.865 * 10.00$$

$$H \ 19 \ @ \ 100 = 2.865 * 10.00 \text{ (2단배근)}$$

$$= 57.30 \text{ cm}^2 \text{를 배근함.}$$

OK!

$$\text{단면 철근비} \quad \rho = \frac{A_s}{b * d} = 0.0140$$

$$\text{최대 철근비} \quad \rho_{max} = 0.64 * \beta_1 * \frac{f_{ck}}{f_y} * \frac{6000}{(6000 + f_y)} = 0.0294$$

$$\text{최소 철근비} \quad \rho_{min} = \frac{0.8 * \sqrt{f_{ck}}}{f_y} = 0.0040 > \frac{14}{f_y} = 0.0035$$

$\therefore$ 최대 철근비 규정 만족!

$\therefore$ 최소 철근비 규정 만족!

$$\Phi V_c = 0.8 * 0.53 * \sqrt{f_{ck}} * b_w * d$$

$$= 34.62 \text{ t/m} > V_u = 11.42 \text{ t/m}$$

$$\Phi V_c / 2 = 17.31 \text{ t/m} > V_u = 11.42 \text{ t/m}$$

$\therefore$ 전단 철근을 배근하지 않아도 된다.

② 험치부 (부도멘트) (7 번 절점)

$$M_u = 128.050 \text{ t-m / m}, \quad V_u = 54.050 \text{ t/m}$$

$$d = 82.11 \text{ cm}, \quad d_c = 9.49 \text{ cm}, \quad b = 100 \text{ cm}$$

$$f_{ck} = 400 \text{ kgf/cm}^2, \quad f_y = 4000 \text{ kgf/cm}^2, \quad \beta_1 = 0.766$$

$$\Phi M_n = 0.9 * f_y * A_s * (d - a/2) \text{ 에서} \quad \Phi = 0.9 \text{ (Precast)}$$

$$A_{s,req} = \frac{M_u}{0.90 * f_y * (d - a/2)} \text{ 로 부터}$$

$$a = \frac{A_s * f_y}{0.85 * f_{ck} * b} = 5.265 \quad A_{s,req} = 44.75 \text{ cm}^2$$

$$\therefore H \ 22 \ @ \ 100 = 3.871 * 10.00$$

$$H \ 22 \ @ \ 100 = 3.871 * 10.00 \text{ (2단배근)}$$

$$= 77.42 \text{ cm}^2 \text{를 배근함.}$$

OK!

$$\text{단면 철근비} \quad \rho = \frac{A_s}{b * d} = 0.0094$$

$$\text{최대 철근비} \quad \rho_{max} = 0.64 * \beta_1 * \frac{f_{ck}}{f_y} * \frac{6000}{(6000 + f_y)} = 0.0294$$

$$\text{최소 철근비} \quad \rho_{min} = \frac{0.8 * \sqrt{f_{ck}}}{f_y} = 0.0040 > \frac{14}{f_y} = 0.0035$$

$\therefore$ 최대 철근비 규정 만족!

$\therefore$ 최소 철근비 규정 만족!

$$\Phi V_c = 0.8 * 0.53 * \sqrt{f_{ck}} * b_w * d$$

$$= 69.63 \text{ t/m} > V_u = 54.05 \text{ t/m}$$

$$\Phi V_c / 2 = 34.81 \text{ t/m} < V_u = 54.05 \text{ t/m}$$

$\therefore$ 전단철근을 배근해야 한다.

③ 벽체 변화부 (5 번 절점)

$$M_u = 100.170 \text{ t-m / m}, \quad V_u = 42.960 \text{ t/m}$$

$$d = 44.71 \text{ cm}, \quad d_c = 9.49 \text{ cm}, \quad b = 100 \text{ cm}$$

$$f_{ck} = 400 \text{ kgf/cm}^2, \quad f_y = 4000 \text{ kgf/cm}^2, \quad \beta_1 = 0.766$$

$$\Phi M_n = 0.9 * f_y * A_s * (d - a/2) \text{ 에서} \quad \Phi = 0.9 \text{ (Precast)}$$

$$A_{s,req} = \frac{M_u}{0.90 * f_y * (d - a/2)} \text{ 로 부터}$$

$$a = \frac{A_s * f_y}{0.85 * f_{ck} * b} = 8.046 \quad A_{s,req} = 68.39 \text{ cm}^2$$

$$\therefore H \ 22 \ @ \ 100 = 3.871 * 10.00$$

$$H \ 22 \ @ \ 100 = 3.871 * 10.00 \text{ (2단배근)}$$

$$= 77.42 \text{ cm}^2 \text{를 배근함.}$$

OK!

$$\text{단면 철근비} \quad \rho = \frac{A_s}{b * d} = 0.0173$$

$$\text{최대 철근비} \quad \rho_{max} = 0.64 * \beta_1 * \frac{f_{ck}}{f_y} * \frac{6000}{(6000 + f_y)} = 0.0294$$

$$\text{최소 철근비} \quad \rho_{min} = \frac{0.8 * \sqrt{f_{ck}}}{f_y} = 0.0040 > \frac{14}{f_y} = 0.0035$$

$\therefore$ 최대 철근비 규정 만족!

$\therefore$ 최소 철근비 규정 만족!

$$\Phi V_c = 0.8 * 0.53 * \sqrt{f_{ck}} * b_w * d$$

$$= 37.91 \text{ t/m} < V_u = 42.96 \text{ t/m}$$

$$\Phi V_c / 2 = 18.96 \text{ t/m} < V_u = 42.96 \text{ t/m}$$

$\therefore$ 전단철근을 배근해야 한다.

□ 본체 전단면에 대한 단면력 검토

f _{ck} = 400 kgf/cm ² , f _y = 4000 kgf/cm ² , K ₁ = 0.766, b = 100 cm															
Node	사용 주철근				국한모멘트				a	A _{s,req}		공칭모멘트 t - m / m	철근비		결 과
	①	②	간격	단	t - m / m	cm	cm	cm		cm ²	cm ²		최대	최소	
1	22	22	100	2	0.000	50.0	40.5	9.49	0.000	0.00	100.183	만족	만족	OK	
2	22	22	100	2	25.270	50.0	40.5	9.49	2.406	20.45	100.183	만족	만족	OK	
3	22	22	100	2	52.770	50.0	40.5	9.49	5.160	43.86	100.183	만족	만족	OK	
4	22	22	100	2	82.240	50.0	40.5	9.49	8.326	70.76	100.183	만족	만족	OK	
5	22	22	100	2	99.920	54.2	44.7	9.49	8.853	75.25	111.893	만족	만족	OK	
6	22	22	100	2	113.420	67.5	58.0	9.49	7.629	64.85	148.994	만족	만족	OK	
7	22	22	100	2	127.910	91.6	82.1	9.49	5.875	49.94	216.158	만족	만족	OK	
8	22	22	100	2	105.230	68.0	58.5	9.49	6.911	58.74	150.374	만족	만족	OK	
9	22	22	100	2	80.490	55.3	45.8	9.49	6.925	58.01	114.947	만족	만족	OK	
10	22	22	100	2	27.610	51.1	41.6	9.49	2.309	19.63	103.245	만족	만족	OK	
11	19	19	100	2	12.850	50.0	40.8	9.18	1.387	11.79	77.248	만족	만족	OK	
12	19	19	100	2	31.870	50.0	40.8	9.18	3.539	30.08	77.248	만족	만족	OK	
13	19	19	100	2	45.410	50.0	40.8	9.18	4.991	42.42	77.248	만족	만족	OK	
14	19	19	100	2	50.270	50.0	40.8	9.18	5.524	46.95	77.248	만족	만족	OK	
15	19	19	100	2	45.400	50.0	40.8	9.18	4.995	42.46	77.248	만족	만족	OK	
16	19	19	100	2	31.840	50.0	40.8	9.18	3.538	30.07	77.248	만족	만족	OK	
17	19	19	100	2	8.280	50.0	40.8	9.18	1.160	9.86	77.248	만족	만족	OK	
18	22	22	100	2	30.130	51.1	41.6	9.49	2.578	21.91	103.245	만족	만족	OK	
19	22	22	100	2	80.600	55.3	45.8	9.49	6.826	58.02	114.947	만족	만족	OK	
20	22	22	100	2	106.060	68.0	58.5	9.49	6.913	58.76	150.374	만족	만족	OK	
21	22	22	100	2	128.050	91.6	82.1	9.49	5.876	49.95	216.158	만족	만족	OK	
22	22	22	100	2	115.260	67.5	58.0	9.49	7.632	64.87	148.994	만족	만족	OK	
23	22	22	100	2	100.170	54.2	44.7	9.49	8.941	76.00	111.893	만족	만족	OK	
24	22	22	100	2	82.230	50.0	40.5	9.49	8.324	70.75	100.183	만족	만족	OK	
25	22	22	100	2	52.770	50.0	40.5	9.49	5.160	43.86	100.183	만족	만족	OK	
26	22	22	100	2	25.270	50.0	40.5	9.49	2.406	20.45	100.183	만족	만족	OK	
27	22	22	100	2	0.000	50.0	40.5	9.49	0.000	0.00	100.183	만족	만족	OK	
28	22	22	100	2	0.000	50.0	40.5	9.5	0.000	0.00	100.183	만족	만족	OK	
29	22	22	100	2	25.190	50.0	40.5	9.49	0.000	0.00	100.183	만족	만족	OK	
30	22	22	100	2	52.600	50.0	40.5	9.49	0.000	0.00	100.183	만족	만족	OK	
31	22	22	100	2	81.980	50.0	40.5	9.49	0.000	0.00	100.183	만족	만족	OK	
32	22	22	100	2	99.860	54.2	44.7	9.49	0.000	0.00	111.893	만족	만족	OK	
33	22	22	100	2	114.890	67.5	58.0	9.49	0.000	0.00	148.994	만족	만족	OK	

34	22	22	100	2	127.630	91.6	82.1	9.49	0.000	0.00	216.158	만족	만족	OK	
35	22	22	100	2	105.810	68.0	58.5	9.49	0.000	0.00	150.374	만족	만족	OK	
36	22	22	100	2	33.510	55.3	45.8	9.49	0.000	0.00	114.947	만족	만족	OK	
37	22	22	100	2	8.890	51.1	41.6	9.49	0.000	0.00	103.245	만족	만족	OK	
38	19	19	100	2	32.520	50.0	40.8	9.18	0.000	0.00	77.248	만족	만족	OK	
39	19	19	100	2	46.120	50.0	40.8	9.18	0.000	0.00	77.248	만족	만족	OK	
40	19	19	100	2	51.010	50.0	40.8	9.18	0.000	0.00	77.248	만족	만족	OK	
41	19	19	100	2	46.160	50.0	40.8	9.18	0.000	0.00	77.248	만족	만족	OK	
42	19	19	100	2	32.600	50.0	40.8	9.18	0.000	0.00	77.248	만족	만족	OK	
43	19	19	100	2	17.030	50.0	40.8	9.18	0.000	0.00	77.248	만족	만족	OK	
44	19	19	100	2	26.970	50.0	40.8	9.18	0.000	0.00	77.248	만족	만족	OK	
45	22	22	100	2	79.960	51.1	41.6	9.49	0.000	0.00	103.245	만족	만족	OK	
46	22	22	100	2	79.960	55.3	45.8	9.49	0.000	0.00	114.947	만족	만족	OK	
47	22	22	100	2	104.770	68.0	58.5	9.49	0.000	0.00	150.374	만족	만족	OK	
48	22	22	100	2	127.500	91.6	82.1	9.49	0.000	0.00	216.158	만족	만족	OK	
49	22	22	100	2	113.060	67.5	58.0	9.49	0.000	0.00	148.994	만족	만족	OK	
50	22	22	100	2	99.610	54.2	44.7	9.49	0.000	0.00	111.893	만족	만족	OK	
51	22	22	100	2	81.980	50.0	40.5	9.49	0.000	0.00	100.183	만족	만족	OK	
52	22	22	100	2	52.600	50.0	40.5	9.49	0.000	0.00	100.183	만족	만족	OK	
53	22	22	100	2	25.190	50.0	40.5	9.49	0.000	0.00	100.183	만족	만족	OK	
54	22	22	100	2	0.000	50.0	40.5	9.49	0.000	0.00	100.183	만족	만족	OK	

④ 전단에 대한 검토 (5 번 절점)

$$V_u = 64.440 \text{ t/m} < -42.96 + 1.5 = 64.44 \text{ PAB전체측으로 계산함.}$$

$$d = 44.71 \text{ cm}, d_c = 9.49 \text{ cm}, b = 150 \text{ cm}$$

$$f_{ck} = 400 \text{ kgf/cm}^2, f_y = 4000 \text{ kgf/cm}^2, \beta_1 = 0.766$$

$$\Phi V_c = 0.8 \times 0.53 \times \sqrt{f_{ck}} \times b_w \times d$$

$$= 56.87 \text{ t/m} < V_u = 64.44 \text{ t/m}$$

$$\Phi V_c / 2 = 28.44 \text{ t/m} < V_u = 64.44 \text{ t/m}$$

∴ 전단 보강 철근을 배근해야 한다.

$$\frac{A_v}{s} > \frac{V_u - \Phi V_c}{\Phi f_y d} \text{에서, 철근의 간격 } s = 20 \text{ cm}$$

$$\therefore H \ 16 - 2 \text{ leg @ } 200$$

$$= 1.986 \times 2 = 3.972 \text{ cm를 배근.}$$

• Precast Arch Box 본체 전단면 전단 철근 검토

	V _u	d _c (cm)	d(cm)	Φ V _c	Φ + Φ V _c	결과	간격	필요철근량	사용철근량	Φ Vs	결과
1	55.43	9.49	40.5	51.53	25.76	전단보강	20	0.601	3.972	25.74	O.K
2	60.63	9.49	40.5	51.53	25.76	전단보강	20	1.404	3.972	25.74	O.K
3	65.45	9.49	40.5	51.53	25.76	전단보강	20	2.147	3.972	25.74	O.K
4	69.86	9.49	40.5	51.53	25.76	전단보강	20	2.827	3.972	25.74	O.K
5	63.53	9.49	44.7	56.87	28.44	전단보강	20	0.930	3.972	28.41	O.K
6	51.99	9.49	58.0	73.79	36.89	최소전단	20	1.750	3.972	36.87	O.K
7	80.97	9.49	82.1	104.44	52.22	최소전단	20	1.750	3.972	52.18	O.K
8	73.10	9.49	58.5	74.42	37.21	최소전단	20	1.750	3.972	37.18	O.K
9	73.88	9.49	45.8	58.27	29.14	전단보강	20	2.127	3.972	29.11	O.K
10	55.55	9.49	41.6	52.93	26.46	전단보강	20	0.393	3.972	26.44	O.K
11	41.00	9.18	40.8	51.92	25.96	최소전단	20	1.750	3.972	25.94	O.K
12	28.38	9.18	40.8	51.92	25.96	최소전단	20	1.750	3.972	25.94	O.K
13	17.15	9.18	40.8	51.92	25.96	필요없음	20	0.000	3.972	25.94	O.K
14	7.89	9.18	40.8	51.92	25.96	필요없음	20	0.000	3.972	25.94	O.K
15	17.18	9.18	40.8	51.92	25.96	필요없음	20	0.000	3.972	25.94	O.K
16	28.40	9.18	40.8	51.92	25.96	최소전단	20	1.750	3.972	25.94	O.K
17	41.01	9.18	40.8	51.92	25.96	최소전단	20	1.750	3.972	25.94	O.K
18	55.56	9.49	41.6	52.93	26.46	전단보강	20	0.395	3.972	26.44	O.K
19	73.88	9.49	45.8	58.27	29.14	전단보강	20	2.129	3.972	29.11	O.K
20	74.36	9.49	58.5	74.42	37.21	최소전단	20	1.750	3.972	37.18	O.K
21	79.43	9.49	82.1	104.44	52.22	최소전단	20	1.750	3.972	52.18	O.K
22	56.31	9.49	58.0	73.79	36.89	최소전단	20	1.750	3.972	36.87	O.K
23	64.44	9.49	44.7	56.87	28.44	전단보강	20	1.058	3.972	28.41	O.K
24	69.86	9.49	40.5	51.53	25.76	전단보강	20	2.827	3.972	25.74	O.K
25	65.45	9.49	40.5	51.53	25.76	전단보강	20	2.147	3.972	25.74	O.K
26	60.63	9.49	40.5	51.53	25.76	전단보강	20	1.404	3.972	25.74	O.K
27	55.43	9.49	40.5	51.53	25.76	전단보강	20	0.601	3.972	25.74	O.K
28	55.23	9.49	40.5	51.53	25.76	전단보강	20	0.571	3.972	25.74	O.K
29	60.44	9.49	40.5	51.53	25.76	전단보강	20	1.374	3.972	25.74	O.K
30	65.25	9.49	40.5	51.53	25.76	전단보강	20	2.117	3.972	25.74	O.K
31	69.66	9.49	40.5	51.53	25.76	전단보강	20	2.797	3.972	25.74	O.K
32	64.25	9.49	44.7	56.87	28.44	전단보강	20	1.031	3.972	28.41	O.K

33	56.37	9.49	58.0	73.79	36.89
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(도로교 설계 기준 (2000) - p380)

$$M_0 = 74.880 \text{ t-m / m}$$

$$f_{t,max} = \frac{5 \cdot M_0}{R^2 \cdot \omega} \quad R = 91.60 \text{ cm} \quad \omega = 100 \text{ cm}$$

$$= \frac{5 \cdot 7488000.00}{91.60^2 \cdot 100}$$

$$= 44.62 \text{ kgf/cm}^2 > 21.20 \text{ kgf/cm}^2 (1.06 \cdot \sqrt{f_{ck}})$$

(콘크리트 구조설계 기준 (1999) - 15.3 p243)

∴ 보강 철근을 배근 하여야 한다.

$$A_{s,req} = \frac{2 \cdot M_0}{R \cdot 1800}$$

$$= \frac{2 \cdot 7488000.00}{91.60 \cdot 1800}$$

$$= 90.83 \text{ cm}^2/\text{m}$$

보강 철근량

$$H \ 25 \ @ \ 100 = 5.067 \cdot 10.00$$

$$H \ 25 \ @ \ 100 = 5.067 \cdot 10.00$$

$$= 101.34 \text{ cm}^2 \text{를 배근.}$$

* P.A.B는 우각부에 정모멘트가 발생하지 않으므로 내측 인장 검토는 불필요함.

(1) 균열 검토

① 슬래브 중앙 (14 번 절점)

$$M_{slab} = 28.270 \text{ ton-m/m}$$

- 인장 철근의 제원

$$A_s = 57.30 \text{ cm}^2, \quad d = 40.82 \text{ cm} \quad b = 100 \text{ cm}$$

$$\rho = A_s / (b \cdot d) = 0.0140 \quad n = E_s / E_c = 7$$

$$k = -n \cdot \rho + \sqrt{((n \cdot \rho)^2 + 2 \cdot n \cdot \rho)}$$

$$= 0.356$$

$$j = 1 - k / 3$$

$$= 0.881$$

$$f_{s,slab} = \frac{M_{slab}}{A_s \cdot d \cdot j} = 1371 \text{ kg/cm}^2$$

$$\beta_c = 1.35 \quad d_c = 6.96 \quad A = 91.80$$

$$w = 1.08 \cdot \beta_c \cdot f_{s,slab}^3 \cdot \sqrt{(d_c \cdot A)} \cdot 10^{-5} \text{ mm}$$

콘크리트 구조 설계 기준 (1999) 4.2.4

$$\therefore w = 0.172 \text{ mm}$$

$$\text{허용 균열 폭} = 0.005 \cdot \text{덩개} \quad (\text{해당 절점에서 최외곽철근 기준 피복})$$

$$0.005 \cdot 60 = 0.3 \text{ mm} \quad \therefore \text{O.K.}$$

(콘크리트 구조 설계 기준 표 4.2.2)

② 한 치 부 (7 번 절점)

$$M_{slab} = 74.880 \text{ ton-m/m}$$

- 인장 철근의 제원

$$A_s = 77.42 \text{ cm}^2, \quad d = 82.11 \text{ cm} \quad b = 100 \text{ cm}$$

$$\rho = A_s / (b \cdot d) = 0.0094 \quad n = E_s / E_c = 7$$

$$k = -n \cdot \rho + \sqrt{((n \cdot \rho)^2 + 2 \cdot n \cdot \rho)}$$

$$= 0.303$$

$$j = 1 - k / 3$$

$$= 0.899$$

$$f_{s,slab} = \frac{M_{slab}}{A_s \cdot d \cdot j} = 1310 \text{ kg/cm}^2$$

$$\beta_c = 1.35 \quad d_c = 7.11 \quad A = 94.90$$

$$w = 1.08 \cdot \beta_c \cdot f_{s,slab}^3 \cdot \sqrt{(d_c \cdot A)} \cdot 10^{-5} \text{ mm}$$

콘크리트 구조 설계 기준 (1999) 4.2.4

$$\therefore w = 0.168 \text{ mm}$$

$$\text{허용 균열 폭} = 0.005 \cdot \text{덩개} \quad (\text{해당 절점에서 최외곽철근 기준 피복})$$

$$0.005 \cdot 60 = 0.3 \text{ mm} \quad \therefore \text{O.K.}$$

(콘크리트 구조 설계 기준 표 4.2.2)

③ 벽체 변화부 (5 번 절점)

$$M_{slab} = 58.010 \text{ ton-m/m}$$

- 인장 철근의 제원

$$A_s = 77.42 \text{ cm}^2, \quad d = 44.71 \text{ cm} \quad b = 100 \text{ cm}$$

$$\rho = A_s / (b \cdot d) = 0.0173 \quad n = E_s / E_c = 7$$

$$k = -n \cdot \rho + \sqrt{((n \cdot \rho)^2 + 2 \cdot n \cdot \rho)}$$

$$= 0.386$$

$$j = 1 - k / 3$$

$$= 0.871$$

$$f_{s,slab} = \frac{M_{slab}}{A_s \cdot d \cdot j} = 1923 \text{ kg/cm}^2$$

$$\beta_c = 1.35 \quad d_c = 7.11 \quad A = 94.90$$

$$w = 1.08 \cdot \beta_c \cdot f_{s,slab}^3 \cdot \sqrt{(d_c \cdot A)} \cdot 10^{-5} \text{ mm}$$

콘크리트 구조 설계 기준 (1999) 4.2.4

$$\therefore w = 0.246 \text{ mm}$$

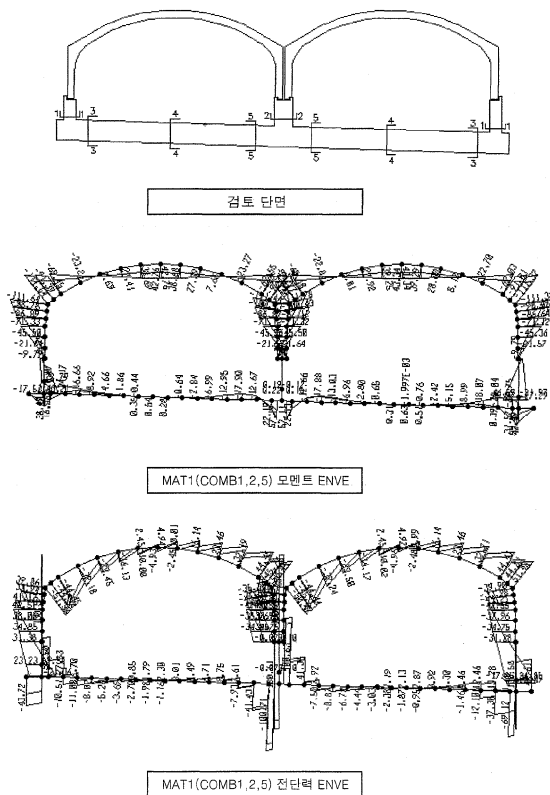
$$\text{허용 균열 폭} = 0.005 \cdot \text{덩개} \quad (\text{해당 절점에서 최외곽철근 기준 피복})$$

$$0.005 \cdot 60 = 0.3 \text{ mm} \quad \therefore \text{O.K.}$$

(콘크리트 구조 설계 기준 표 4.2.2)

본체 전체 균열 검토				균열제한폭 = 0.005 * 60 mm (당개) = 0.3 mm													
모멘트	A _s	d _c	d	ρ	k	j	f _t	인장철근					d _c	A	균열	결과	
트랩	복합판	cm	cm				kgf/cm ²	H	H	간격	당개	개수	cm	mm			
1	0.00	77.42	9.49	40.51	0.019	0.401	0.866	0.00	22	22	100	60	20	7.11	94.9	0.00	OK!
2	14.13	77.42	9.49	40.51	0.019	0.401	0.866	519.95	22	22	100	60	20	7.11	94.9	0.07	OK!
3	29.97	77.42	9.49	40.51	0.019	0.401	0.866	1102.82	22	22	100	60	20	7.11	94.9	0.14	OK!
4	47.32	77.42	9.49	40.51	0.019	0.401	0.866	1741.25	22	22	100	60	20	7.11	94.9	0.22	OK!
5	57.86	77.42	9.49	44.71	0.017	0.386	0.871	1918.28	22	22	100	60	20	7.11	94.9	0.25	OK!
6	65.96	77.42	9.49	58.01	0.013	0.349	0.884	1661.90	22	22	100	60	20	7.11	94.9	0.21	OK!
7	74.79	77.42	9.49	82.11	0.009	0.303	0.899	1308.81	22	22	100	60	20	7.11	94.9	0.17	OK!
8	61.09	77.42	9.49	58.51	0.013	0.348	0.884	1525.37	22	22	100	60	20	7.11	94.9	0.20	OK!
9	46.33	77.42	9.49	45.81	0.017	0.382	0.873	1497.10	22	22	100	60	20	7.11	94.9	0.19	OK!
10	15.36	77.42	9.49	41.61	0.019	0.396	0.868	549.42	22	22	100	60	20	7.11	94.9	0.07	OK!
11	5.09	57.30	9.18	40.82	0.014	0.356	0.881	246.90	19	19	100	60	20	6.96	91.8	0.03	OK!
12	18.18	57.30	9.18	40.82	0.014	0.356	0.881	881.85	19	19	100	60	20	6.96	91.8	0.11	OK!
13	25.59	57.30	9.18	40.82	0.014	0.356	0.881	1241.28	19	19	100	60	20	6.96	91.8	0.16	OK!
14	26.27	57.30	9.18	40.82	0.014	0.356	0.881	1371.28	19	19	100	60	20	6.96	91.8	0.17	OK!
15	25.58	57.30	9.18	40.82	0.014	0.356	0.881	1240.80	19	19	100	60	20	6.96	91.8	0.16	OK!
16	18.17	57.30	9.18	40.82	0.014	0.356	0.881	881.36	19	19	100	60	20	6.96	91.8	0.11	OK!
17	6.71	57.30	9.18	40.82	0.014	0.356	0.881	325.48	19	19	100	60	20	6.96	91.8	0.04	OK!
18	15.39	77.42	9.49	41.61	0.019	0.396	0.868	550.49	22	22	100	60	20	7.11	94.9	0.07	OK!
19	46.40	77.42	9.49	45.81	0.017	0.382	0.873	1499.36	22	22	100	60	20	7.11	94.9	0.19	OK!
20	61.60	77.42	9.49	58.51	0.013	0.348	0.884	1538.10	22	22	100	60	20	7.11	94.9	0.20	OK!
21	74.88	77.42	9.49	82.11	0.009	0.303	0.899	1310.39	22	22	100	60	20	7.11	94.9	0.17	OK!
22	67.08	77.42	9.49	58.01	0.013	0.349	0.884	1690.12	22	22	100	60	20	7.11	94.9	0.22	OK!
23	58.01	77.42	9.49	44.71	0.017	0.386	0.871	1923.25	22	22	100	60	20	7.11	94.9	0.25	OK!
24	47.32	77.42	9.49	40.51	0.019	0.401	0.866	1741.25	22	22	100	60	20	7.11	94.9	0.22	OK!
25	29.96	77.42	9.49	40.51	0.019	0.401	0.866	1102.45	22	22	100	60	20	7.11	94.9	0.14	OK!
26	14.13	77.42	9.49	40.51	0.019	0.401	0.866	519.95	22	22	100	60	20	7.11	94.9	0.07	OK!
27	0.00	77.42	9.49	40.51	0.019	0.401	0.866	0.00	22	22	100	60	20	7.11	94.9	0.00	OK!
28	0.00	77.42	9.49	40.51	0.019	0.401	0.866	0.00	22	22	100	60	20	7.11	94.9	0.00	OK!
29	14.09	77.42	9.49	40.51	0.019	0.401	0.866	518.47	22	22	100	60	20	7.11	94.9	0.07	OK!
30	29.89	77.42	9.49	40.51	0.019	0.401	0.866	1099.87	22	22	100	60	20	7.11	94.9	0.14	OK!

4.2 현장타설 벽체 및 기초 검토



31	47.20	77.42	9.49	40.51	0.019	0.401	0.866	1736.83	22	22	100	60	20	7.11	94.9	0.22	OK!
32	57.87	77.42	9.49	44.71	0.017	0.386	0.871	1918.61	22	22	100	60	20	7.11	94.9	0.25	OK!
33	66.91	77.42	9.49	58.01	0.013	0.349	0.884	1665.94	22	22	100	60	20	7.11	94.9	0.22	OK!
34	74.87	77.42	9.49	82.11	0.009	0.303	0.899	1306.71	22	22	100	60	20	7.11	94.9	0.17	OK!
35	61.39	77.42	9.49	58.51	0.013	0.348	0.884	1532.86	22	22	100	60	20	7.11	94.9	0.20	OK!
36	15.15	77.42	9.49	45.81	0.017	0.382	0.873	489.55	22	22	100	60	20	7.11	94.9	0.06	OK!
37	6.71	77.42	9.49	41.61	0.019	0.396	0.868	240.01	22	22	100	60	20	7.11	94.9	0.03	OK!
38	18.48	57.30	9.18	40.82	0.014	0.356	0.881	896.40	19	19	100	60	20	6.96	91.8	0.11	OK!
39	25.91	57.30	9.18	40.82	0.014	0.356	0.881	1256.80	19	19	100	60	20	6.96	91.8	0.16	OK!
40	28.61	57.30	9.18	40.82	0.014	0.356	0.881	1387.77	19	19	100	60	20	6.96	91.8	0.17	OK!
41	25.94	57.30	9.18	40.82	0.014	0.356	0.881	1258.26	19	19	100	60	20	6.96	91.8	0.16	OK!
42	18.53	57.30	9.18	40.82	0.014	0.356	0.881	898.83	19	19	100	60	20	6.96	91.8	0.11	OK!
43	5.43	57.30	9.18	40.82	0.014	0.356	0.881	263.39	19	19	100	60	20	6.96	91.8	0.03	OK!
44	15.05	57.30	9.18	40.82	0.014	0.356	0.881	730.02	19	19	100	60	20	6.96	91.8	0.09	OK!
45	46.08	77.42	9.49	41.61	0.019	0.396	0.868	1648.25	22	22	100	60	20	7.11	94.9	0.21	OK!
46	46.08	77.42	9.49	45.81	0.017	0.382	0.873	1489.02	22	22	100	60	20	7.11	94.9	0.19	OK!
47	60.87	77.42	9.49	58.51	0.013	0.348	0.884	1519.87	22	22	100	60	20	7.11	94.9	0.19	OK!
48	74.60	77.42	9.49	82.11	0.009	0.303	0.899	1305.49	22	22	100	60	20	7.11	94.9	0.17	OK!
49	65.79	77.42	9.49	58.01	0.013	0.349	0.884	1657.62	22	22	100	60	20	7.11	94.9	0.21	OK!
50	57.71	77.42	9.49	44.71	0.017	0.386	0.871	1913.31	22	22	100	60	20	7.11	94.9	0.24	OK!
51	47.20	77.42	9.49	40.51	0.019	0.401	0.866	1736.83	22	22	100	60	20	7.11	94.9	0.22	OK!
52	29.89	77.42	9.49	40.51	0.019	0.401	0.866	1099.87	22	22	100	60	20	7.11	94.9	0.14	OK!
53	14.09	77.42	9.49	40.51	0.019	0.401	0.866	518.47	22	22	100	60	20	7.11	94.9	0.07	OK!
54	0.00	77.42	9.49	40.51	0.019	0.401	0.866	0.00	22	22	100	60	20	7.11	94.9	0.00	OK!

(2) 상부 처짐 검토 (도로고 설계 기준 (2000) 4.4.9.5)

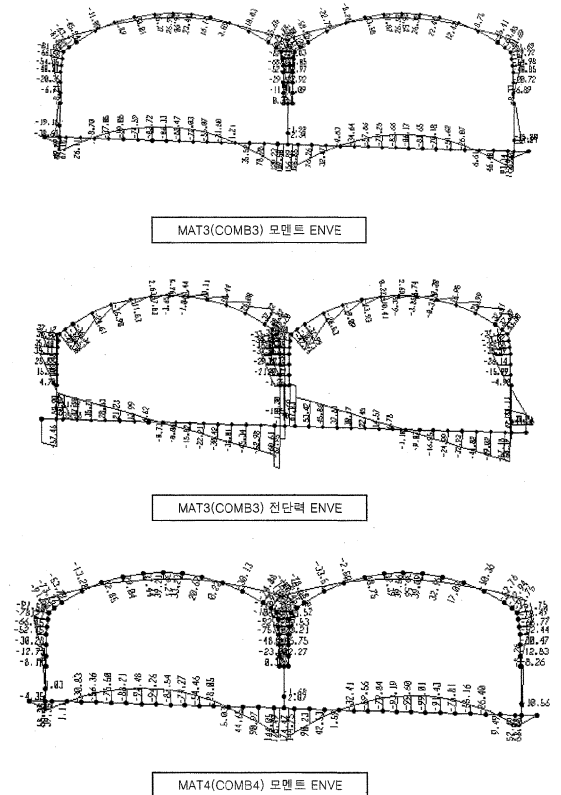
: 사용시 활하중이 작용하지 않으므로 고려하지 않음.

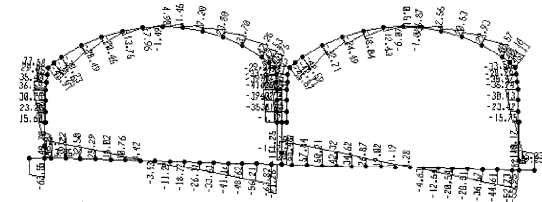
(3) 피로 검토

: F.A.B는 사용시 활하중이 작용하지 않으므로 고려하지 않고,

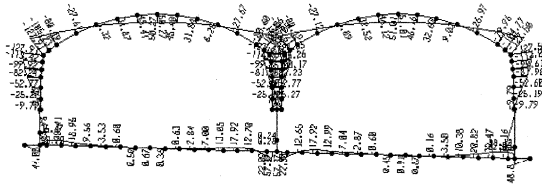
기초 슬래브에 작용하는 활하중(PL)에 의한 피로만 검토함.

4.2 (8) 기초 슬래브 피로 검토 참조

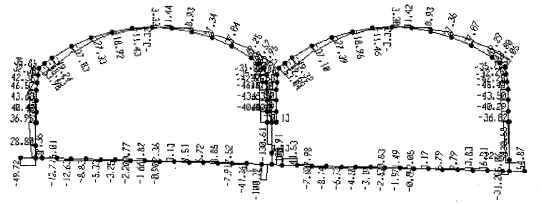




MAT4(COMB4) 전단력 ENVE



MAT6(COMB6) 모멘트 ENVE



MAT6(COMB6) 전단력 ENVE

(1) 외측 벽체 검토 (절점 102, 302번, 단면 1-1)

① 휨강도 검토

↳ 검토조건

$$\begin{aligned} f_{ck} &= 270.0 \text{ kgf/cm}^2 & f_y &= 4000.0 \text{ kgf/cm}^2 \\ \beta_1 &= 0.850 & \phi_b &= 0.85 & \phi_s &= 0.80 \\ p_b &= (0.85 \times \beta_1 \times f_{ck} / f_y) \times [6000 / (6000 + f_y)] = 0.02926 \\ p_{max} &= 0.75 \times p_b = 0.02195 \\ p_{min} &= \max(0.80 \sqrt{f_{ck}} / f_y, 14 / f_y) = 0.00350 \end{aligned}$$

$$\begin{aligned} \text{계수 모멘트 } M_u &= 58.120 \text{ tf}\cdot\text{m} & \text{계수 전단력 } V_u &= 39.910 \text{ tonf} \\ \text{단면의 두께 } H &= 85.000 \text{ cm} & \text{단 면 폭 } B &= 100.000 \text{ cm} \\ \text{유효 깊이 } D &= 75.000 \text{ cm} & \text{피복 두께 } D_c &= 10.000 \text{ cm} \end{aligned}$$

소요등가응력깊이 $a = 4.084 \text{ cm}$ 로 가정

$$\begin{aligned} A_s &= M_u / \{ \phi_b \cdot f_y \cdot (D - a/2) \} = 23.430 \text{ cm}^2 \\ a &= (A_s \cdot f_y) / (0.85 \cdot f_{ck} \cdot B) = 4.084 \text{ cm} \quad \therefore \text{가정과 비슷함 O.K} \\ P_{req} &= [M_u / \{ \phi_b \cdot f_y \cdot (D - a/2) \}] / (B \cdot D) = 0.00312 \Rightarrow 4/3 P_{req} = 0.00417 \\ \therefore \text{필요철근량 req. } A_s &= P_{req} \times (B \cdot D) = 23.430 \text{ cm}^2 \\ \text{Used } A_s &= H22 @ 12.50 \text{ cm} \quad (D_c = 10.00 \text{ cm}) \\ &= 30.968 \text{ cm}^2 \quad \therefore P = A_s / (B \cdot D) = 0.00413 \\ P_{min} &\leq P \leq P_{max} \quad \therefore \text{O.K} \\ a &= (A_s \cdot f_y) / (0.85 \cdot f_{ck} \cdot B) = 5.397 \text{ cm} \\ \phi M_n &= \phi_b \cdot f_y \cdot A_s \cdot (D - a/2) = 7612687.000 \text{ kgf}\cdot\text{cm} \\ &= 76.127 \text{ tf}\cdot\text{m} \geq M_u = 58.120 \text{ tf}\cdot\text{m} \quad \therefore \text{O.K} \end{aligned}$$

↳ 전단력 검토

$$\begin{aligned} \phi_s V_u &= \phi_s \cdot 0.53 \cdot \sqrt{f_{ck}} \cdot B \cdot d / 1000 = 52.253 \text{ tf} \\ \phi_s V_c &= 52.253 \text{ tf} > V_u \quad \therefore \text{전단철근 필요없음.} \end{aligned}$$

② 벽체 검토

↳ 벽체 검토조건

$$\begin{aligned} f_{ck} &= 270.0 \text{ kgf/cm}^2 & f_y &= 4000.0 \text{ kgf/cm}^2 \\ \phi_c &= 0.70 & \phi_v &= 0.80 & \alpha &= 0.80 \\ \text{극한 모멘트 } M_u &= 58.120 \text{ tf}\cdot\text{m} & \text{극한 축력 } P_u &= 136.820 \text{ tonf} \\ \text{단면의 두께 } H &= 85.000 \text{ cm} & \text{단 면 폭 } B &= 100.000 \text{ cm} \\ \text{유효 깊이 } D &= 75.000 \text{ cm} & \text{피복 두께 } D_c &= 10.000 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{작응력심 } e &= 42.479 \text{ cm} \\ \text{인장축 철근 } A_{st} &= 30.968 \text{ cm}^2 \\ \text{1단 } (d_c = 10 \text{ cm}) : H &22 @ 12.5 \text{ cm} \end{aligned}$$

$$\text{압축축 철근 } A_{sc} = 0.000 \text{ cm}^2$$

↳ 평형상태 검토

$$\begin{aligned} c &= 6000 / (6000 + f_y) \cdot d = 45.000 \text{ cm} \\ k_1 &= 0.850 & a &= k_1 \cdot c = 38.25 \text{ cm} \\ C_{ck} &= 0.85 \cdot f_{ck} \cdot B \cdot H = 1950750.0 \text{ kgf} \\ \text{소성중심 } x &= (C_{ck} \cdot H/2 + f_y \cdot A_{sc} \cdot d_c + f_y \cdot A_{st} \cdot d) / (C_{ck} + f_y \cdot A_{sc} + f_y \cdot A_{st}) \\ &= 44.44 \text{ cm} \end{aligned}$$

$$\text{콘크리트 } C_c = 0.85 \cdot f_{ck} \cdot a \cdot b = 877837.5 \text{ kgf}$$

$$\text{압축철근 } C_s = (f_s - 0.85 \cdot f_{ck}) \cdot A_{sc} = 0.0 \text{ kgf}$$

$$(e_{sc} > e_y \rightarrow f_s = f_y = 4000.00 \text{ kgf/cm}^2)$$

$$\text{인장철근 } T_s = f_y \cdot A_{st} = 123872.0 \text{ kgf}$$

$$\text{평형축력 } P_b = C_c + C_s - T_s = 753965.5 \text{ kgf}$$

$$\text{평형모멘트 } M_b = C_c \cdot (x - a/2) + C_s \cdot (x - d_c) + T_s \cdot (d - x) = 26008370.0 \text{ kgf}\cdot\text{cm}$$

$$\text{평형편심 } e_b = M_b / P_b = 34.50 \text{ cm}$$

$$e \geq e_b \rightarrow \text{인장파괴영역}$$

↳ 기동강도 검토

철근의 응력을 Trial & Error Method로 계산한다.

$$c = 35.42 \text{ cm로 가정하면.. } a = k_1 \cdot c = 30.11 \text{ cm}$$

$$e_{sc} = 0.0020 \quad f_s = 4000.00 \text{ kgf/cm}^2$$

$$P_n = 0.85 \cdot f_{ck} \cdot a \cdot b + A_{sc} \cdot (f_{sc} - 0.85 \cdot f_{ck}) - A_{st} \cdot f_y$$

$$= 567125.0 \text{ kgf}$$

$$M_n = 0.85 \cdot f_{ck} \cdot a \cdot b \cdot (x - a/2) + A_{sc} \cdot f_{sc} \cdot (x - d_c) + A_{st} \cdot f_y \cdot (d - x)$$

$$= 24091180.0 \text{ kgf}\cdot\text{cm}$$

$$e' = M_n / P_n = 42.480 \text{ cm} \approx e = 42.479 \text{ cm} \rightarrow \text{say O.K.}$$

$$\phi P_n > 0.1 \cdot f_{ck} \cdot B \cdot H = 229500.0 \text{ kgf} \quad \dots \quad \phi = 0.70$$

$$\phi P_n = 396.988 \text{ tonf} \geq P_u = 136.820 \text{ tonf} \quad \therefore \text{O.K}$$

$$\phi M_n = 168.638 \text{ tf}\cdot\text{m} \geq M_u = 58.120 \text{ tf}\cdot\text{m} \quad \therefore \text{O.K}$$

③ 배력철근 검토 (1.1 일반사항 참조)

A. 수축 및 온도 철근

$$\begin{aligned} A_s &= p \cdot b \cdot d \quad 0.002 \quad * \quad 100 \quad * \quad 75 \\ &= 15.00 \text{ cm}^2 \end{aligned}$$

$$\text{배력 철근 : H19 @ 150 (2단) = 38.2 cm}^2$$

(2) 중앙부벽체 (절점 202번, 단면 2-2) - 가설시 검토

: P.A.B 가설중(한쪽에만 P.A.B를 설치하였을경우) 발생하는 모멘트에 대한 검토.
INPUTDATA : 가설.\$2K 참조

① 휨강도 검토

$$\begin{aligned} f_{ck} &= 270.0 \text{ kgf/cm}^2 & f_y &= 4000.0 \text{ kgf/cm}^2 \\ \beta_1 &= 0.850 & \phi_b &= 0.85 & \phi_s &= 0.80 \\ p_b &= (0.85 \times \beta_1 \times f_{ck} / f_y) \times [6000 / (6000 + f_y)] = 0.02926 \\ p_{max} &= 0.75 \times p_b = 0.02195 \\ p_{min} &= \max(0.80 \sqrt{f_{ck}} / f_y, 14 / f_y) = 0.00350 \end{aligned}$$

$$\begin{aligned} \text{계수 모멘트 } M_u &= 5.122 \text{ tf}\cdot\text{m} & \text{계수 전단력 } V_u &= 5.980 \text{ tonf} \\ \text{단면의 두께 } H &= 130.000 \text{ cm} & \text{단 면 폭 } B &= 100.000 \text{ cm} \\ \text{유효 깊이 } D &= 120.000 \text{ cm} & \text{피복 두께 } D_c &= 10.000 \text{ cm} \end{aligned}$$

↳ 휨모멘트 검토

소요등가응력깊이 $a = 0.219 \text{ cm}$ 로 가정

$$\begin{aligned} A_s &= M_u / \{ \phi_b \cdot f_y \cdot (D - a/2) \} = 1.257 \text{ cm}^2 \\ a &= (A_s \cdot f_y) / (0.85 \cdot f_{ck} \cdot B) = 0.219 \text{ cm} \quad \therefore \text{가정과 비슷함 O.K} \\ P_{req} &= [M_u / \{ \phi_b \cdot f_y \cdot (D - a/2) \}] / (B \cdot D) = 0.00010 \Rightarrow 4/3 P_{req} = 0.00014 \end{aligned}$$

$\therefore$ 필요철근량 $req.A_s = P_{req} \times (B \cdot D) = 1.257 \text{ cm}^2$
 Used $A_s = H16 @ 12.50 \text{ cm}$ ($D_c = 10.00 \text{ cm}$)
 $= 15.888 \text{ cm}^2 \quad \therefore P = A_s / (B \cdot D) = 0.00132$
 $4/3 P_{req} \leq P \leq P_{min} \quad \therefore O.K$
 $a = (A_s \cdot f_y) / (0.85 \cdot f_{ck} \cdot B) = 2.769 \text{ cm}$
 $\phi M_n = \phi b \cdot f_y \cdot A_s \cdot (D - a/2) = 6407511.000 \text{ kgf} \cdot \text{cm}$
 $= 64.075 \text{ tf} \cdot \text{m} \geq M_u = 5.122 \text{ tf} \cdot \text{m} \quad \therefore O.K$

↳ 전단력 검토

$\phi_s \cdot V_c = \phi_s \cdot 0.53 \cdot \sqrt{f_{ck}} \cdot B \cdot d / 1000 = 83.604 \text{ tf}$
 $\phi_s \cdot V_c = 83.604 \text{ tf} > V_u \quad \therefore$ 전단철근 필요없음.

② 벽체 검토

$f_{ck} = 270.0 \text{ kgf/cm}^2 \quad f_y = 4000.0 \text{ kgf/cm}^2$
 $\phi_c = 0.70 \quad \phi_v = 0.80 \quad \alpha = 0.80$
 극한 모멘트 $M_u = 5.122 \text{ tf} \cdot \text{m}$ 극한 축력 $P_u = 26.299 \text{ tonf}$
 단면의 두께 $H = 130.000 \text{ cm}$ 단 위 폭 $B = 100.000 \text{ cm}$
 유효 깊이 $D = 120.000 \text{ cm}$ 피복 두께 $D_c = 10.000 \text{ cm}$
 작용 편심 $e = 19.476 \text{ cm}$
 인장철근 $A_{st} = 15.888 \text{ cm}^2$
 1단 ($d_c = 10 \text{ cm}$) : H 16 @ 12.5 cm
 압축철근 $A_{sc} = 0.000 \text{ cm}^2$

↳ 평형상태 검토

$c = 6000 / (6000 + f_y) \cdot d = 72.000 \text{ cm}$
 $k_1 = 0.850 \quad a = k_1 \cdot c = 61.20 \text{ cm}$
 $C_{ck} = 0.85 \cdot f_{ck} \cdot B \cdot H = 2983500.0 \text{ kgf}$
 소성중심 $x = (C_{ck} \cdot H/2 + f_y \cdot A_{sc} \cdot dc + f_y \cdot A_{st} \cdot d) / (C_{ck} + f_y \cdot A_{sc} + f_y \cdot A_{st})$
 $= 66.15 \text{ cm}$
 콘크리트 $C_c = 0.85 \cdot f_{ck} \cdot a \cdot b = 1404540.0 \text{ kgf}$
 압축철근 $C_s = (f_s - 0.85 \cdot f_{ck}) \cdot A_{sc} = 0.0 \text{ kgf}$
 ($\epsilon_{sc} > \epsilon_y \rightarrow f_s = f_y = 4000.00 \text{ kgf/cm}^2$)
 인장철근 $T_s = f_y \cdot A_{st} = 63552.0 \text{ kgf}$
 평형축력 $P_b = C_c + C_s - T_s = 1340988.0 \text{ kgf}$
 평형모멘트 $M_b = C_c(x - a/2) + C_s(x - dc) + T_s(d - x) = 53349830.0 \text{ kgf} \cdot \text{cm}$
 평형편심 $eb = M_b / P_b = 39.78 \text{ cm}$

인장철근 $A_{st} = 15.888 \text{ cm}^2$
 1단 ($d_c = 10 \text{ cm}$) : H 16 @ 12.5 cm
 압축철근 $A_{sc} = 0.000 \text{ cm}^2$

↳ 평형상태 검토

$c = 6000 / (6000 + f_y) \cdot d = 72.000 \text{ cm}$
 $k_1 = 0.850 \quad a = k_1 \cdot c = 61.20 \text{ cm}$
 $C_{ck} = 0.85 \cdot f_{ck} \cdot B \cdot H = 2983500.0 \text{ kgf}$
 소성중심 $x = (C_{ck} \cdot H/2 + f_y \cdot A_{sc} \cdot dc + f_y \cdot A_{st} \cdot d) / (C_{ck} + f_y \cdot A_{sc} + f_y \cdot A_{st})$
 $= 66.15 \text{ cm}$
 콘크리트 $C_c = 0.85 \cdot f_{ck} \cdot a \cdot b = 1404540.0 \text{ kgf}$
 압축철근 $C_s = (f_s - 0.85 \cdot f_{ck}) \cdot A_{sc} = 0.0 \text{ kgf}$
 ($\epsilon_{sc} > \epsilon_y \rightarrow f_s = f_y = 4000.00 \text{ kgf/cm}^2$)
 인장철근 $T_s = f_y \cdot A_{st} = 63552.0 \text{ kgf}$
 평형축력 $P_b = C_c + C_s - T_s = 1340988.0 \text{ kgf}$
 평형모멘트 $M_b = C_c(x - a/2) + C_s(x - dc) + T_s(d - x) = 53349830.0 \text{ kgf} \cdot \text{cm}$
 평형편심 $eb = M_b / P_b = 39.78 \text{ cm}$
 $e < eb \rightarrow$ 압축파괴영역

↳ 기둥 강도 검토

$e_{min} = 13.10 \text{ cm} \geq e = 0.00 \text{ cm}$
 편심이 최소편심보다 작으므로..
 $P_n = 0.85 \cdot f_{ck} \cdot (A_g - A_s) + f_y \cdot A_s = 3043406.0 \text{ kgf}$
 $M_n = P_n \cdot e_{min} = 39877350.0 \text{ kgf} \cdot \text{cm}$
 $\phi = 0.700 \quad \alpha = 0.800$
 $\phi P_n = 1704.307 \text{ tonf} \geq P_u = 268.820 \text{ tonf} \quad \therefore O.K$
 $\phi M_n = 223.313 \text{ tf} \cdot \text{m} \geq M_u = 0.000 \text{ tf} \cdot \text{m} \quad \therefore O.K$

② 배력 철근 검토

A. 수축 및 온도 철근
 $A_s = \rho \cdot b \cdot d = 0.002 \cdot 100 \cdot 130 = 26.00 \text{ cm}^2$
 배력 철근 : H19 @ 150 (2단) = 38.2 cm

$e < eb \rightarrow$ 압축파괴영역

↳ 기둥 강도 검토

$e_{min} = 13.10 \text{ cm} < e = 19.48 \text{ cm}$
 $\rightarrow$ 철근의 응력을 Trial & Error Method로 계산한다.
 $c = 110.47 \text{ cm}$ 로 가정하면.. $a = k_1 \cdot c = 93.90 \text{ cm}$
 $f_{sc} = 4000.00 \text{ kgf/cm}^2, \quad f_{st} = 517.4 \text{ kgf/cm}^2$
 $P_n = 0.85 \cdot f_{ck} \cdot a \cdot B + A_{sc} \cdot f_{sc} - A_{st} \cdot f_{st} = 2146834.0 \text{ kgf}$
 $M_n = 0.85 \cdot f_{ck} \cdot a \cdot B \cdot (x - a/2) + A_{sc} \cdot f_{sc} \cdot (x - d_{cc}) - A_{st} \cdot f_{st} \cdot (d - x)$
 $= 41811240.0 \text{ kgf} \cdot \text{cm}$
 $e' = M_n / P_n = 19.476 \text{ cm} \approx e = 19.476 \text{ cm} \rightarrow \text{say } O.K.$
 $\phi = 0.700$
 $\phi P_n = 1502.784 \text{ tonf} \geq P_u = 26.299 \text{ tonf} \quad \therefore O.K$
 $\phi M_n = 292.679 \text{ tf} \cdot \text{m} \geq M_u = 5.122 \text{ tf} \cdot \text{m} \quad \therefore O.K$

↳ 전단력 검토

$V_u = 5.980 \text{ tonf}$
 $\phi V_c = \phi_s \cdot 0.53 \cdot (1 + 0.0071 \cdot P_u / A_g) \cdot \sqrt{f_{ck}} \cdot B \cdot D / 1000 = 84.805 \text{ tf}$
 $\phi_s \cdot V_c = 84.805 \text{ tf} > V_u \quad \therefore$ 전단철근 필요없음.

(3) 중앙부벽체 (절점 202번, 단면 2-2) - 완공후 검토

: 완공 후엔 좌우가 대칭인 구조물이므로 모멘트와 전단력은 발생하지 않고 축력만 발생한다.
 그러므로 활검토는 생략함.
 해석 결과 COMB6.에서 $P_u = 268.82 \text{ tonf}$ 가 최대값임.

① 벽체 검토

$f_{ck} = 270.0 \text{ kgf/cm}^2 \quad f_y = 4000.0 \text{ kgf/cm}^2$
 $\phi_c = 0.70 \quad \phi_v = 0.80 \quad \alpha = 0.80$
 극한 모멘트 $M_u = 0.000 \text{ tf} \cdot \text{m}$ 극한 축력 $P_u = 268.820 \text{ tonf}$
 단면의 두께 $H = 130.000 \text{ cm}$ 단 위 폭 $B = 100.000 \text{ cm}$
 유효 깊이 $D = 120.000 \text{ cm}$ 피복 두께 $D_c = 10.000 \text{ cm}$
 작용 편심 $e = 0.000 \text{ cm}$

(4) 바닥 슬래브 (절점 403, 435번, 단면 3-3)



$M_u = 93.340 \text{ t} \cdot \text{m} / \text{m}, \quad V_u = 69.120 \text{ t/m}$
 $d = 102.70 \text{ cm}, \quad d_c = 10.00 \text{ cm}, \quad b = 100 \text{ cm}$
 $f_{ck} = 270 \text{ kgf/cm}^2, \quad f_y = 4000 \text{ kgf/cm}^2, \quad \beta_1 = 0.857$
 $\Phi M_n = 0.85 \cdot f_y \cdot A_s \cdot (d - a/2)$ 에서
 $A_{s,req} = \frac{M_u}{0.85 \cdot f_y \cdot (d - a/2)}$ 로 부터
 $a = \frac{A_s \cdot f_y}{0.85 \cdot f_{ck} \cdot b} = 4.770 \quad A_{s,req} = 27.37 \text{ cm}^2$

$\therefore H 25 @ 125 = 5.067 \cdot 8.00$
 $= 40.54 \text{ cm}^2$ 를 배근함.

OK!

단면 철근비 $\rho = \frac{A_s}{b \cdot d} = 0.0039$

최대 철근비 $\rho_{max} = 0.64 \cdot \beta_1 \cdot \frac{f_{ck}}{f_y} \cdot \frac{6000}{(6000 + f_y)} = 0.0222$

최소 철근비 $\rho_{min} = \frac{0.8 \cdot \sqrt{f_{ck}}}{f_y} = 0.0033 < \frac{14}{f_y} = 0.0035$

$\therefore$ 최대 철근비 규정 만족!

$\therefore$ 최소 철근비 규정 만족!

$\Phi V_c = 0.8 \cdot 0.53 \cdot \sqrt{f_{ck}} \cdot b_w \cdot d$
 $= 71.55 \text{ t/m} > V_u = 69.12 \text{ t/m}$

$\Phi V_c / 2 = 35.78 \text{ t/m} < V_u = 69.12 \text{ t/m}$

$\therefore$ 전단철근을 배근해야 한다.

(5) 바닥 슬래브 (절점 428번, 단면 4-4)

$$M_u = 99.600 \text{ t-m / m}, \quad V_u = 3.310 \text{ t/m}$$

$$d = 130.00 \text{ cm}, \quad d_c = 10.00 \text{ cm}, \quad b = 100 \text{ cm}$$

$$f_{ck} = 270 \text{ kgf/cm}^2, \quad f_y = 4000 \text{ kgf/cm}^2, \quad \beta_1 = 0.857$$

$$\Phi M_n = 0.85 * f_y * A_s * (d - a/2) \text{ 에서}$$

$$A_{s,req} = \frac{M_u}{0.85 * f_y * (d - a/2)} \text{ 로 부터}$$

$$a = \frac{A_s * f_y}{0.85 * f_{ck} * b} = 3.988, \quad A_{s,req} = 22.88 \text{ cm}^2$$

$$\therefore H 25 @ 125 = 5.067 * 8.00$$

$$= 40.54 \text{ cm}^2 \text{를 배근함.}$$

OK!

$$\text{단면 철근비} \quad \rho = \frac{A_s}{b * d} = 0.0031$$

$$\text{최대 철근비} \quad \rho_{max} = 0.64 * \beta_1 * \frac{f_{ck}}{f_y} * \frac{6000}{(6000 + f_y)} = 0.0222$$

$$\text{최소 철근비} \quad \rho_{min} = \frac{0.8 * \sqrt{f_{ck}}}{f_y} = 0.0033 < \frac{14}{f_y} = 0.0035$$

∴ 최대 철근비 규정 만족!

∴ 최소 철근비 규정 불만족!

* 배근된 철근량(40.54cm²)이 필요한 철근량(22.88cm²)의 4/3이상이므로 최소철근비를 따르지 않아도 됨.

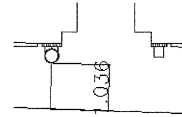
$$\Phi V_c = 0.8 * 0.53 * \sqrt{f_{ck}} * b_w * d$$

$$= 90.57 \text{ t/m} > V_u = 3.31 \text{ t/m}$$

$$\Phi V_c / 2 = 45.29 \text{ t/m} > V_u = 3.31 \text{ t/m}$$

∴ 전단 철근을 배근하지 않아도 된다.

(6) 바닥 슬래브 (절점 418, 420번, 단면 5-5)



단면 5-5 형상

$$M_u = 144.750 \text{ t-m / m}, \quad V_u = 100.910 \text{ t/m}$$

$$d = 93.60 \text{ cm}, \quad d_c = 10.00 \text{ cm}, \quad b = 100 \text{ cm}$$

$$f_{ck} = 270 \text{ kgf/cm}^2, \quad f_y = 4000 \text{ kgf/cm}^2, \quad \beta_1 = 0.857$$

$$\Phi M_n = 0.85 * f_y * A_s * (d - a/2) \text{ 에서}$$

$$A_{s,req} = \frac{M_u}{0.85 * f_y * (d - a/2)} \text{ 로 부터}$$

$$a = \frac{A_s * f_y}{0.85 * f_{ck} * b} = 8.295, \quad A_{s,req} = 47.59 \text{ cm}^2$$

$$\therefore H 29 @ 125 = 6.424 * 8.00$$

$$= 51.39 \text{ cm}^2 \text{를 배근함.}$$

OK!

$$\text{단면 철근비} \quad \rho = \frac{A_s}{b * d} = 0.0055$$

$$\text{최대 철근비} \quad \rho_{max} = 0.64 * \beta_1 * \frac{f_{ck}}{f_y} * \frac{6000}{(6000 + f_y)} = 0.0222$$

$$\text{최소 철근비} \quad \rho_{min} = \frac{0.8 * \sqrt{f_{ck}}}{f_y} = 0.0033 < \frac{14}{f_y} = 0.0035$$

∴ 최대 철근비 규정 만족!

∴ 최소 철근비 규정 만족!

$$\Phi V_c = 0.8 * 0.53 * \sqrt{f_{ck}} * b_w * d$$

$$= 65.21 \text{ t/m} < V_u = 100.91 \text{ t/m}$$

$$\Phi V_c / 2 = 32.61 \text{ t/m} < V_u = 100.91 \text{ t/m}$$

∴ 전단철근을 배근해야 한다.

* 현장타설 기초 바닥 전단면 전단 철근 검토

	V _u	d _c (cm)	d(cm)	Φ V _c	± Φ V _c	결과	간격	필요철근량	사용철근량	Φ V _s	결과
403	42.83	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
404	37.58	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
405	53.04	10.0	130.0	90.57	45.29	최소전단	40	3.500	3.972	41.31	O.K
406	45.09	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
407	27.35	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
408	18.09	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
409	10.50	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
410	4.42	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
411	4.92	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
412	11.42	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
413	18.93	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
414	27.36	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
415	37.07	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
416	49.29	10.0	130.0	90.57	45.29	최소전단	40	3.500	3.972	41.31	O.K
417	49.29	10.0	130.0	90.57	45.29	최소전단	40	3.500	3.972	41.31	O.K
418	48.80	10.0	130.0	90.57	45.29	최소전단	40	3.500	3.972	41.31	O.K
420	34.70	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
421	42.23	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
422	46.44	10.0	130.0	90.57	45.29	최소전단	40	3.500	3.972	41.31	O.K
423	43.50	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
424	40.29	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
425	36.82	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
426	36.95	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
427	28.80	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
428	36.82	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
429	39.91	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
430	56.08	10.0	130.0	90.57	45.29	최소전단	40	3.500	3.972	41.31	O.K
431	63.55	10.0	130.0	90.57	45.29	최소전단	40	3.500	3.972	41.31	O.K
432	59.50	10.0	130.0	90.57	45.29	최소전단	40	3.500	3.972	41.31	O.K
433	42.96	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
434	35.76	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K
435	28.53	10.0	130.0	90.57	45.29	필요없음	40	0.000	3.972	41.31	O.K

* 배근된 전단철근

16	-	2	LEG	@	40
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$$\text{Used } A_v = H16 \times 2 \text{ ea/m} = 3.972 \text{ cm}^2 \text{ (간격 } s = 40.0 \text{ cm)} \quad (es = 0.80)$$

$$es \cdot Vs = es \cdot A_v \cdot f_y \cdot D / (s \times 1000) = 41.309 \text{ tf}$$

$$es \cdot V_n = es \cdot V_c + es \cdot Vs = 90.57 + 41.309 = 131.880 \text{ tf}$$

* 현장 타설 기초 슬래브 배력 철근량 검토 (1.1 일반사항 참조)

A. 도로교설계기준 4.7 바닥판 적용시.

$$= 0.307 * 47.59 = 14.62 \text{ cm}^2$$

$$(A_{s,req} = 36.42 \text{ cm}^2 \text{ 가 최대, 절점 418번})$$

B. P.A.B 본체의 수축 및 온도 철근

$$A_s = \rho * b * d * 0.002 * 100 * 140$$

$$= 28.00 \text{ cm}^2$$

$$\text{배근된 배력 철근: H19 @ 150(2단) = 38.2 cm}^2$$

(7) 기초 우각부 검토 (402, 436 번 절점)

① 외측 인장 검토

$$\text{콘크리트 기준강도} \quad f_{ck} = 270 \text{ kg/cm}^2$$

$$\text{콘크리트 허용인장응력} \quad f_{ta} = 1.06 \sqrt{f_{ck}}$$

$$= 17.42 \text{ kg/cm}^2$$

$$\text{철근항복강도} \quad f_y = 4000 \text{ kg/cm}^2$$

$$\text{철근허용응력} \quad f_{sa} = 1800 \text{ kg/cm}^2$$

$$\text{설계단면력: 사용하중 모멘트 } M_o = 27.49 \text{ t.m}$$

$$\text{구조물단면: 슬라브 두께 } A = 140.0 \text{ cm} \quad \text{벽 두께 } B = 85.0 \text{ cm}$$

$$\text{한치수치거리 } C = 0.0 \text{ cm} \quad \text{수령거리 } D = 0.0 \text{ cm}$$

$$\text{사용철근: } 2 - D19 @ 125 \quad (A_g = 45.84 \text{ cm}^2)$$

$$a = B = 85.0 \text{ cm} \quad b = A = 140.0 \text{ cm}$$

$$R = \sqrt{(a^2 + b^2)} = 163.8 \text{ cm}$$

최대인장응력 $\sigma_{max} = 5 \cdot M_o / (I \cdot B) = 5.12 \text{ kg/cm}^2 < \sigma_{ta} \dots$ 철근보강 필요없음

③ 내측 인장 검토 (절점 403, 435번) (참고도서 : 구조물 설계 기준 - 교량편, P.4-26)

* 435번 절점에서 내측인장을 발생시키는 모멘트가 15.76 t-m (COMB.10) 가 발생하며, 해석에 필요한 단면은 불리한 경우인 벽체를 기준으로 해석함.

$Ast = T / Fsa \quad T = \sqrt{2} \times Th$

Ast = 스트랩 필요 단면적

T = 대각선 방향의 인장응력의 합력 (kgf)

Th = 수평 부재 또는 연직부재에 작용하는 인장응력의 합력 (kgf)

$Th = fs \times As$

$fs = M / (As \cdot (d - x/3)) \quad M : \text{수평 또는 연직 부재에 발생한 모멘트 (tf - m)}$

$x = k \cdot d$

$k = -np + \sqrt{(np)^2 + 2np}$

$p = As / (bd)$

$As = H22 - 8EA = 30.97 \text{ cm}^2$

$d = 85 - 10 = 75 \text{ cm}$

$b = 100 \text{ cm}$

$p = 30.97 / (100 \times 75) = 0.00413$

$n = Es / Ec = 2000000 / 246475 = 8.11 = 8$ (가장 가까운 정수 적용)

$k = -np + \sqrt{(np)^2 + 2np} = 8 \times 0.00413 + \sqrt{(8 \times 0.00413)^2 + 2 \times 8 \times 0.00413} = 0.2922$

$x = k \cdot d = 0.2922 \times 75 = 21.915$

$fs = M / (As \cdot (d - x/3)) = 15.76 \times 10^5 / (30.97 \cdot (75 - 21.915/3)) = 751.724 \text{ kg/cm}^2$

$Th = fs \times As = 751.724 \times 30.97 = 23280.89 \text{ kgf}$

$T = \sqrt{2} \times Th = \sqrt{2} \times 23280.89 = 32924.15 \text{ kgf}$

$Ast = T / f_{sa} = 31963.05 / 1500 = 21.95 \text{ cm}^2$

$\therefore$ 사용 스트랩 H19 - 8EA = 22.92 cm

(8) 기초 슬래브 피로 검토

① 기초 슬래브에 작용하는 활하중에 의한 피로 검토

* 피로에 대한 안전성을 검토 할 경우, 응력을 포함한 사용 활하중에

의한 철근의 응력 범위가 피로를 고려하지 않아도 되는 철근의

응력 범위 이내에 들면 피로에 대하여 검토 할 필요가 없다.

(콘크리트 구조 설계 기준 4.4.2 (1) 참조)

* 피로를 고려하지 않아도 되는 철근의 인장 및 압축 범위

$SD \quad 40 \quad (\quad 1500 \quad \text{kg/cm}^2)$

	기초슬래브	단위
$f_{s,max}$	194	kg/cm ²
$f_{s,min}$	223	kg/cm ²
Δf	-29	kg/cm ²
검토 여부	필요없음	

(콘크리트 구조 설계 기준 4.4.2 '피로에 대한 검토' 참조)

기초 슬래브에 작용하는 활하중에 의한 모멘트의 변화량이 가장 많은 418번 절점을 기준으로 검토함.

Mcomb7, =	11.99	ton-m/m	Mcomb8, =	13.77	ton-m/m
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- 인장 철근의 제원

$A_s =$	51.39	cm ²	$d =$	130.00	cm	$b =$	100	cm
$\rho = A_s / (b \cdot d)$				0.0040		$n = E_s / E_c$		8

$k = -n \cdot \rho + \sqrt{(n \cdot \rho)^2 + 2 \cdot n \cdot \rho}$

$= 0.222$

$j = 1 - k / 3$

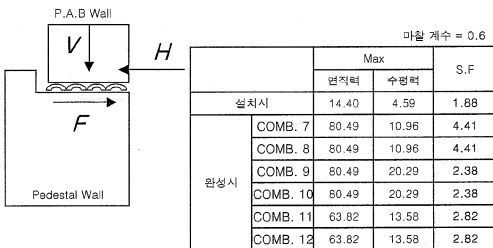
$= 0.926$

$f_{s,max} = \frac{M_{max}}{A_s \cdot d \cdot j} = 194 \text{ kg/cm}^2$

$f_{s,min} = \frac{M_{min}}{A_s \cdot d \cdot j} = 223 \text{ kg/cm}^2$

4.3 P.A.B 벽체 연결부 검토

① P.A.B & 현장 타설 벽체 연결부 SLIDING검토



* 5. SAP2000 OUTPUT 참조

P.A.B 벽체로부터 전달되는 수평력에 비해 마찰력이 커 SLIDING에 안전함!

② P.A.B & 현장 타설 벽체 연결부 전단마찰 검토

$f_{cx} = 270 \text{ kg/cm}^2$

$f_y = 4000 \text{ kg/cm}^2$

수평력	마찰저항력
$H_u' = H_u / 0.8$	$F = \mu \cdot V$
(t/m)	(t/m)
25.36	48.29

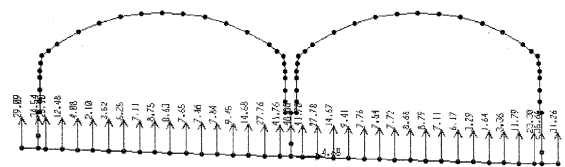
$\Phi_v = 0.8$

마찰계수 = 0.6

$\mu = 1.0 \cdot \lambda, \lambda = 1.0$

$\therefore$ 마찰저항력 > 수평력 이므로 전단마찰 철근 필요 없음.

4.4 지지력 검토



COMB 10. Spring force

기초 저면에서의 최대반력은 COMB. 10 (활하중 고려시)에서 중앙부 벽체 하면에서 약 48.88 ton/m²의 결과를 보이고 있음.

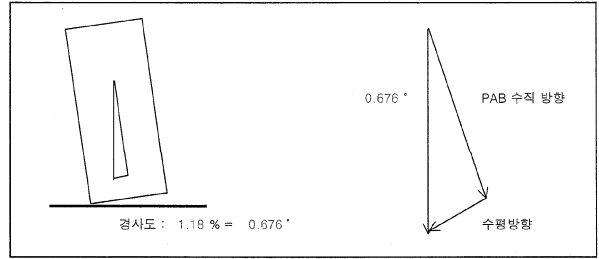
$(q_{max} = 48.88 \text{ tonf/m}^2 < q_a = 85 \text{ tonf/m}^2) \therefore O.K$

* 허용지지력은 "말반에 지지되는 직립기초의 허용지지력" 참조

4.5 부력에 대한 안정성 검토

- 1) 조건
기초저면의 깊이(지표로부터) : 12.145 m
지하수위(지표하) m : 2.000 m
기초의 저판 폭 : 30.500 m (부력의 작용폭 - 부력방지용 Key 길이 포함)
기초의 저판 두께 : 1.400 m
흙과흙의마찰력 고려길이 : 10.745 m
포장두께 t = 0.08 m 포장 폭 : B= 11.280
기초저판의 부력방지용 Key 길이 : 0.5 m
- 2) 단위중량
 $\gamma_t = 1.9$ $\phi = 30$
 $\gamma_{sub} = 0.9$
 $\gamma_{con} = 2.5$
 $\gamma_{ascon} = 2.3$
- 3) 하중계산
PAB사중 : $2.5 \times 11.400 \times 2 \text{ ea} = 57.000$
연직토압 : $1.9 \times 59.000 + 0.9 \times 56.341 = 162.807$
기초중량 : $1.9 \times 2.000 + 0.9 \times 8.745$ (기초저판 Key 상단) = 11.671
기초중량 : $2.5 \times 47.850 + 1.750$ (기초저판 Key) = 121.375
흙의마찰력 : $K_a = \tan^2(45 - \phi/2) = 0.333$
 $P_f = 1/2 \times K_a \times \gamma_{sub} \times H^2 \times \tan \delta \times 2 \text{ ea}$
 $= 0.5 \times 0.333 \times 0.9 \times 10.745^2 \times \tan 30 \times 2 \text{ ea} = 19.965$
벽면 마찰력 : $= 0.5 \times 0.333 \times 0.9 \times 1.400^2 \times \tan(\phi/2/3) \times 2 \text{ ea} = 0.214$
Ascon : $11.280 \times 0.08 \times 2.3 \times 2 \text{ ea} = 4.151$
부가하중 : $= 0.000$
 $\Sigma W = 377.183$
- 4) 부력
부력 : $U = 1 \times 10.145 \times 30.500 = 309.423$
- 5) 안정성 검토
안전율 : $FS = W / U = 377.183 / 309.423 = 1.219 > 1.2$ O.K!

4.6 가설시 전도에 대한 안정성 검토



$$\Theta = \tan^{-1} (1.1792) = 0.6756^\circ$$

$$\text{수직분력} = \text{Weight} \times \cos(\Theta)$$

$$\text{수평분력} = \text{Weight} \times \sin(\Theta)$$

$$M_o = 11.4 \times 1.5 \times 2.5 \times \cos(0.6756) = 42.75 \text{ ton}$$

$$M_r = 11.4 \times 1.5 \times 2.5 \times \sin(0.6756) = 0.50 \text{ ton}$$

$$S.F = 42.75 / 0.50 = 85.5 \quad \therefore \text{가설시 전도에 대해 안정함.}$$

* 시공완료 후에는 마감벽과 현장 타설 벽체 및 PAB가 일체로 연결되어 토압을 지지하므로 전도가 발생하지 않음.

5. SAP2000 OUTPUT

	COMB1			COMB2		
	P	V	M	P	V	M
1	-117.86	11.78	0.00	-117.85	31.38	0.00
2	-116.79	20.85	10.69	-116.79	34.85	21.64
3	-115.73	29.25	27.11	-115.73	38.06	45.50
4	-114.67	36.94	48.76	-114.67	41.00	71.33
5	-115.77	36.20	63.21	-115.83	37.39	86.89
6	-110.79	30.84	75.19	-110.56	29.28	98.78
7	-103.11	45.90	89.23	-102.55	48.38	111.64
8	-97.19	39.50	70.46	-92.00	43.38	91.39
9	-94.36	38.75	51.20	-86.69	43.54	69.45
10	-89.45	25.78	13.99	-75.56	32.18	23.21
11	-88.16	17.42	6.94	-68.46	23.45	7.57
12	-89.67	11.88	18.40	-64.63	16.13	27.41
13	-93.32	8.41	24.07	-63.49	9.84	38.69
14	-98.74	4.68	26.30	-64.60	3.06	42.76
15	-93.32	8.42	24.07	-63.49	9.85	38.68
16	-89.67	11.89	18.38	-64.63	16.14	27.39
17	-88.16	17.43	6.91	-68.46	23.46	7.53
18	-89.45	25.79	14.03	-75.56	32.19	23.27
19	-94.16	38.75	51.29	-86.44	43.55	69.55
20	-97.56	40.31	71.18	-92.44	44.14	92.12
21	-104.32	44.95	89.35	-103.61	47.47	111.78
22	-109.89	33.42	76.83	-109.71	31.87	100.43
23	-115.02	36.74	63.43	-115.67	37.93	87.12
24	-114.68	36.94	48.75	-114.68	41.00	71.32
25	-115.74	29.24	27.11	-115.75	38.06	45.50
26	-116.81	20.85	10.69	-116.81	34.85	21.64
27	-117.88	11.78	0.00	-117.88	31.38	0.00
28	-117.88	11.85	0.00	-117.88	31.28	0.00
29	-116.82	20.92	10.74	-116.82	34.75	21.57
30	-115.76	29.31	27.20	-115.76	37.96	45.36
31	-114.69	37.01	48.89	-114.70	40.90	71.12
32	-115.63	36.81	63.60	-115.67	37.83	86.87
33	-109.91	33.49	77.03	-109.71	31.77	100.13
34	-104.34	44.92	89.58	-103.60	47.54	111.44
35	-97.62	35.95	71.44	-92.37	40.12	91.77
36	-94.22	15.30	14.40	-86.37	23.49	22.84
37	-89.52	6.46	6.51	-75.48	15.09	8.01
38	-88.23	1.10	17.97	-68.37	8.47	27.92
39	-89.74	2.45	23.65	-64.53	2.51	39.25
40	-93.39	4.66	25.90	-63.39	3.04	43.34
41	-98.81	8.39	23.69	-64.50	9.83	39.29
42	-93.39	11.66	18.05	-63.38	16.14	28.00
43	-89.73	17.39	6.62	-64.52	23.46	8.13
44	-88.22	25.74	14.27	-68.36	32.21	22.70
45	-89.51	38.70	51.45	-75.46	43.58	69.03
46	-94.42	38.70	51.45	-86.60	43.58	69.03
47	-97.24	39.45	70.69	-91.91	43.43	91.01
48	-103.11	45.85	89.47	-102.52	48.44	111.32

49	-110.79	30.91	75.39	-110.53	29.18	98.49
50	-115.77	36.28	63.38	-115.81	37.29	86.64
51	-114.66	37.01	48.90	-114.66	40.90	71.12
52	-115.72	29.32	27.20	-115.72	37.96	45.36
53	-116.78	20.92	10.74	-116.78	34.75	21.57
54	-117.84	11.85	0.00	-117.84	31.28	0.00
101	-117.86	11.78	8.84	-117.85	31.36	8.84
102	-121.65	9.54	6.96	-121.65	23.23	28.79
301	-117.84	11.85	8.84	-117.84	31.28	8.84
302	-124.08	24.85	21.97	-124.08	17.25	46.57
401	0.00	26.53	0.00	0.00	43.72	0.00
402	-23.54	56.52	36.43	17.50	39.51	38.49
403	-22.54	58.11	16.36	18.47	35.97	20.07
404	-21.89	27.83	6.46	18.86	10.51	24.17
405	-21.66	6.70	10.60	18.89	11.08	16.66
406	-21.63	6.02	8.00	18.79	8.02	8.64
407	-21.66	4.94	4.46	18.71	5.02	3.33
408	-21.70	3.62	1.86	18.65	3.18	0.68
409	-21.73	2.70	0.44	18.62	2.22	0.35
410	-21.75	1.98	0.16	18.60	1.79	0.54
411	-21.77	2.04	0.14	18.58	2.30	0.28
412	-21.81	2.86	0.61	18.54	3.01	0.60
413	-21.88	4.26	2.60	18.48	4.27	2.60
414	-21.94	6.27	6.36	18.42	6.28	6.37
415	-21.89	8.10	11.75	18.47	8.20	11.84
416	-21.59	7.38	16.25	18.77	7.36	16.26
417	-20.66	37.75	11.50	19.70	37.68	11.54
418	-19.14	91.41	20.11	21.22	91.42	20.01
419	-40.42	89.82	51.85	9.59	89.98	51.97
420	-38.69	91.29	20.01	11.33	91.57	20.17
421	-37.76	37.64	11.50	12.26	37.81	11.49
422	-37.47	7.36	16.23	12.55	7.41	16.27
423	-37.39	8.25	11.84	12.63	8.12	11.80
424	-37.47	6.28	6.32	12.55	6.28	6.40
425	-37.54	4.20	2.55	12.49	4.31	2.63
426	-37.57	2.83	0.62	12.45	3.03	0.59
427	-37.60	1.89	0.10	12.43	2.38	0.31
428	-37.63	2.13	0.00	12.42	1.87	0.63
429	-37.66	2.87	0.76	12.39	2.15	0.51
430	-37.69	3.89	2.42	12.33	3.07	0.43
431	-37.70	4.98	5.05	12.23	5.08	3.14
432	-37.62	5.41	8.05	12.10	8.46	8.84
433	-37.30	12.10	8.54	12.09	12.46	18.07
434	-36.52	37.30	0.39	12.43	13.28	28.04
435	-35.55	69.12	31.57	13.33	31.76	27.75
436	0.00	67.53	55.49	0.00	43.40	42.09
437	0.00	20.65	0.00	0.00	47.61	0.00

	COMB3			COMB4		
	P	V	M	P	V	M
1	-109.48	4.70	0.00	-108.53	15.60	0.00
2	-108.42	15.72	6.71	-107.47	23.28	12.73
3	-107.35	25.86	20.36	-106.41	30.28	30.28
4	-106.29	35.11	40.31	-105.35	36.59	52.15
5	-107.24	35.68	54.35	-106.28	35.40	66.45
6	-104.77	31.60	66.58	-103.53	29.66	78.21
7	-99.27	42.38	81.03	-97.81	43.91	91.50
8	-95.60	36.53	63.72	-90.77	38.95	73.26
9	-93.16	36.34	45.94	-86.66	39.23	53.79
10	-88.43	24.61	11.09	-77.64	28.49	13.28
11	-86.62	16.90	8.89	-71.69	20.45	12.85
12	-87.25	11.53	20.01	-68.39	13.75	29.04
13	-89.85	7.83	25.37	-67.37	7.96	37.44
14	-94.09	5.26	26.90	-68.33	4.98	39.21
15	-90.11	9.44	23.43	-67.94	11.45	33.23
16	-87.70	13.11	16.14	-69.37	17.20	20.62
17	-87.26	18.44	3.09	-73.08	23.80	0.22
18	-89.23	26.08	18.83	-79.40	31.70	30.13
19	-93.91	37.72	55.65	-88.49	42.25	74.88
20	-96.95	38.62	74.78	-93.34	42.53	96.57
21	-102.09	42.70	92.08	-102.37	45.75	115.46
22	-105.21	34.60	79.03	-106.01	33.27	103.52
23	-108.08	37.68	65.05	-109.09	39.17	89.53
24	-107.12	37.56	49.97	-108.06	41.96	73.21
25	-108.18	29.87	27.92	-109.12	39.02	46.75
26	-109.24	21.47	11.10	-110.19	35.81	22.27
27	-111.38	12.40	0.00	-112.32	32.34	0.00
28	-111.38	13.64	0.00	-112.32	33.46	0.00
29	-110.32	22.72	11.91	-111.26	36.93	23.00
30	-109.25	31.11	29.55	-110.20	40.14	48.21
31	-108.19	38.80	52.41	-109.14	43.08	75.40
32	-104.24	39.09	68.05	-105.24	40.45	92.22
33	-101.74	36.26	82.76	-102.52	34.81	106.88
34	-103.33	42.74	96.41	-103.58	45.87	119.38
35	-98.57	34.37	79.12	-94.86	38.52	100.45
36	-95.52	15.91	22.79	-90.00	22.81	33.51
37	-90.83	8.07	0.28	-80.88	15.31	2.50
38	-88.82	3.22	13.58	-74.52	9.60	18.75
39	-89.19	0.22	21.87	-70.73	4.42	32.39
40	-91.50	2.68	26.52	-69.22	0.51	39.56
41	-95.46	6.74	26.30	-69.66	6.87	39.09
42	-90.90	10.30	22.44	-68.31	12.55	32.16
43	-88.15	16.95	12.42	-69.17	20.53	17.03
44	-87.53	25.99	8.75	-72.47	29.93	10.36
45	-89.49	37.61	45.41	-78.59	40.57	52.76
46	-94.35	37.61	45.41	-87.75	40.57	52.76
47	-96.82	37.69	63.85	-91.89	40.18	72.94
48	-100.92	43.50	81.69	-99.45	45.11	91.75
49	-106.42	31.64	67.22	-105.16	29.57	78.49

50	-108.88	35.88	54.98	-107.92	35.47	66.77
51	-107.93	35.39	40.85	-106.98	36.74	52.44
52	-108.99	26.14	20.72	-108.04	30.43	30.47
53	-110.05	15.99	6.89	-109.10	23.42	12.83
54	-111.11	4.98	0.00	-110.17	15.75	0.00
101	-109.48	4.70	8.21	-108.53	15.60	8.14
102	-113.27	21.32	19.21	-112.33	2.74	1.03
301	-111.11	4.98	8.33	-110.17	15.75	8.26
302	-117.35	39.91	45.80	-116.41	16.03	7.05
401	0.00	49.93	0.00	0.00	56.08	0.00
402	-37.99	57.40	85.29	-14.97	63.55	56.26
403	-37.00	50.06	67.26	-14.88	46.87	30.35
404	-37.63	42.96	26.18	-14.61	39.72	1.11
405	-37.46	35.76	8.63	-14.44	32.52	30.83
406	-37.21	28.53	37.00	-14.19	25.29	56.36
407	-37.02	21.28	59.00	-14.00	18.04	75.50
408	-36.78	13.99	74.55	-13.76	10.76	88.21
409	-36.57	6.67	83.69	-13.55	3.43	94.48
410	-36.35	0.72	86.30	-13.33	3.93	94.26
411	-36.12	8.09	82.45	-13.10	11.31	87.54
412	-35.91	15.51	72.01	-12.90	18.72	74.27
413	-35.67	22.95	55.06	-12.65	26.16	54.46
414	-35.37	30.49	31.50	-12.34	33.65	28.05
415	-35.34	38.00	1.21	-12.33	41.16	5.03
416	-35.03	45.41	35.51	-12.01	48.65	44.65
417	-34.75	53.01	78.96	-11.73	56.22	90.97
418	-33.89	84.95	129.20	-10.87	88.24	144.05
419	-58.36	87.97	159.48	-29.98	91.26	175.49
420	-57.54	84.24	126.84	-29.32	83.33	144.75
421	-57.25	53.42	76.25	-29.02	57.84	90.23
422	-56.92	45.85	32.46	-28.68	50.21	42.53
423	-56.92	38.13	4.64	-28.71	42.48	1.59
424	-56.60	30.17	34.65	-28.38	34.62	32.41
425	-56.34	22.45	57.87	-28.11	26.87	59.56
426	-56.12	14.63	74.25	-27.90	19.05	79.84
427	-55.87	6.78	83.67	-27.65	11.19	93.19
428	-55.64	1.16	86.18	-27.42	3.31	99.60
429	-55.41	9.07	81.66	-27.18	4.63	99.01
430	-55.16	17.02	70.18	-26.93	12.57	91.43
431	-54.94	24.99	51.63	-26.71	20.54	76.81
432	-54.67	32.99	26.07	-26.45	28.54	55.16
433	-54.47	41.02	6.61	-26.24	36.57	26.40
434	-54.18	49.09	46.40	-25.95	44.64	9.49
435	-53.93	57.18	93.34	-25.71	52.73	52.49
436	0.00	60.40	113.92	0.00	62.48	71.52
437	0.00	38.89	0.00	0.00	53.97	0.00

	COMB5			COMB6		
	P	V	M	P	V	M
1	-130.59	17.35	0.00	-130.59	36.95	0.00
2	-129.53	26.42	14.33	-129.53	40.42	25.27
3	-128.47	34.81	34.39	-128.47	43.63	52.77
4	-127.41	42.51	59.67	-127.40	46.57	82.24
5	-128.76	41.17	76.24	-128.81	42.35	99.92
6	-123.53	34.66	89.83	-123.30	33.10	113.42
7	-115.20	51.50	105.60	-114.63	53.98	127.91
8	-108.16	44.84	84.30	-102.97	48.73	105.23
9	-104.68	44.45	62.24	-97.00	49.24	80.49
10	-98.14	30.63	18.39	-84.25	37.03	27.61
11	-95.53	21.30	7.69	-75.82	27.33	8.32
12	-96.06	14.66	22.86	-71.02	18.92	31.87
13	-99.11	10.00	30.79	-69.28	11.43	45.41
14	-104.30	4.94	33.82	-70.16	3.33	50.27
15	-99.11	10.01	30.78	-69.28	11.44	45.40
16	-96.06	14.67	22.84	-71.02	18.93	31.84
17	-95.53	21.31	7.66	-75.83	27.34	8.28
18	-98.14	30.63	18.44	-84.25	37.04	27.67
19	-104.43	44.45	62.34	-96.72	49.25	80.60
20	-108.58	45.74	85.12	-103.46	49.57	106.06
21	-116.53	50.44	105.63	-115.82	52.95	128.05
22	-122.53	37.54	91.66	-122.35	35.99	115.26
23	-128.58	41.77	78.49	-128.63	42.96	100.17
24	-127.42	42.50	59.66	-127.42	46.57	82.23
25	-128.48	34.81	34.38	-128.48	43.63	52.77
26	-129.55	26.42	14.32	-129.55	40.42	25.27
27	-130.62	17.34	0.00	-130.62	36.95	0.00
28	-130.62	17.39	0.00	-130.62	36.82	0.00
29	-129.56	26.46	14.35	-129.56	40.29	25.19
30	-128.49	34.85	34.44	-128.50	43.50	52.60
31	-127.43	42.55	59.75	-127.43	46.44	81.98
32	-128.59	41.81	76.59	-128.64	42.83	99.86
33	-122.55	37.59	91.78	-122.34	35.86	114.89
34	-116.55	50.42	105.77	-115.81	53.04	127.63
35	-108.63	40.92	85.28	-103.37	45.09	105.61
36	-104.47	19.16	18.68	-96.62	27.35	27.12
37	-98.19	9.46	7.39	-84.14	18.09	8.89
38	-95.57	3.13	22.57	-75.71	10.50	32.52
39	-96.11	1.52	30.52	-70.90	3.44	46.12
40	-99.16	4.92	33.57	-69.16	3.30	51.01
41	-104.35	9.99	30.56	-70.03	11.42	46.16
42	-99.15	14.65	22.65	-69.15	18.93	32.60
43	-96.10	21.28	7.51	-70.89	27.36	9.02
44	-95.56	30.60	18.54	-75.70	37.07	26.97
45	-98.17	44.41	62.38	-84.13	49.29	79.96
46	-104.70	44.41	62.38	-96.89	49.29	79.96
47	-108.18	44.81	84.45	-102.86	48.80	104.77
48	-115.19	51.46	105.65	-114.60	54.05	127.50
49	-123.53	34.70	89.96	-123.27	32.97	113.06

50	-128.75	41.21	76.34	-128.79	42.23	99.61
51	-127.39	42.55	59.75	-127.39	46.44	81.98
52	-128.46	34.86	34.44	-128.45	43.50	52.60
53	-129.52	26.46	14.35	-129.52	40.29	25.19
54	-130.58	17.39	0.00	-130.58	36.82	0.00
101	-130.59	17.35	9.79	-130.59	36.95	9.79
102	-134.38	3.98	0.27	-134.38	28.80	35.47
301	-130.58	17.39	9.79	-130.58	36.82	9.79
302	-136.82	19.31	10.41	-136.82	22.79	58.12
401	0.00	32.53	0.00	0.00	49.72	0.00
402	-18.01	57.91	31.23	23.03	45.51	44.05
403	-16.92	59.50	10.67	24.09	37.36	25.76
404	-16.25	26.19	10.69	24.49	12.71	28.41
405	-16.04	6.50	12.89	24.51	12.63	18.95
406	-16.04	6.84	8.92	24.38	8.83	9.56
407	-16.08	5.26	4.66	24.28	5.33	3.53
408	-16.13	3.69	1.78	24.22	3.25	0.60
409	-16.16	2.67	0.30	24.19	2.20	0.50
410	-16.18	1.92	0.29	24.17	1.82	0.67
411	-16.21	2.10	0.21	24.15	2.36	0.36
412	-16.25	2.98	0.64	24.11	3.13	0.63
413	-16.32	4.49	2.84	24.04	4.51	2.84
414	-16.40	6.71	6.99	23.97	6.72	7.00
415	-16.34	8.75	12.95	24.02	8.85	13.05
416	-16.01	7.93	17.90	24.35	7.91	17.92
417	-14.97	41.43	12.67	25.38	41.36	12.70
418	-13.30	100.71	22.19	27.06	100.72	22.09
419	-35.17	99.11	57.19	14.85	99.32	57.37
420	-33.26	100.63	22.13	16.76	100.91	22.30
421	-32.23	41.35	12.66	17.79	41.53	12.65
422	-31.91	7.92	17.88	18.11	7.98	17.92
423	-31.83	8.87	13.03	18.19	8.74	12.99
424	-31.91	6.72	6.96	18.11	6.73	7.04
425	-31.99	4.44	2.80	18.04	4.58	2.87
426	-32.03	2.95	0.65	18.00	3.19	0.60
427	-32.06	1.97	0.18	17.98	2.53	0.45
428	-32.08	2.04	0.15	17.96	1.97	0.91
429	-32.11	2.81	0.56	17.93	2.05	0.87
430	-32.16	3.92	2.24	17.85	3.17	0.16
431	-32.19	5.30	5.15	17.73	5.79	3.50
432	-32.14	6.35	8.99	17.60	9.81	10.38
433	-31.86	8.90	11.25	17.54	13.83	20.82
434	-31.08	33.96	5.16	17.87	16.31	33.47
435	-30.02	68.64	23.07	18.86	31.20	36.16
436	0.00	67.05	46.83	0.00	50.66	48.81
437	0.00	27.85	0.00	0.00	54.87	0.00

	COMB7			COMB8		
	P	V	M	P	V	M
1	-80.49	10.96	0.00	-80.49	10.96	0.00
2	-79.67	16.29	8.92	-79.67	16.29	8.92
3	-78.86	21.23	21.21	-78.86	21.23	21.21
4	-78.04	25.76	36.57	-78.04	25.76	36.57
5	-78.74	24.83	46.58	-78.74	24.83	46.58
6	-75.33	20.77	54.73	-75.33	20.77	54.73
7	-70.06	31.58	64.11	-70.06	31.58	64.11
8	-65.35	27.43	51.13	-65.35	27.43	51.13
9	-63.07	27.07	37.64	-63.07	27.07	37.64
10	-58.82	18.52	10.97	-58.82	18.52	10.97
11	-57.08	12.80	4.79	-57.08	12.80	4.79
12	-57.30	8.76	13.89	-57.30	8.76	13.89
13	-59.06	5.96	18.63	-59.06	5.96	18.63
14	-62.11	2.94	20.43	-62.11	2.94	20.43
15	-59.06	5.96	18.62	-59.06	5.96	18.62
16	-57.30	8.76	13.88	-57.30	8.76	13.88
17	-57.08	12.80	4.77	-57.08	12.80	4.77
18	-58.82	18.53	10.99	-58.82	18.53	10.99
19	-62.92	27.07	37.70	-62.92	27.07	37.70
20	-65.62	27.97	51.62	-65.62	27.97	51.62
21	-70.86	30.94	64.20	-70.86	30.94	64.20
22	-74.73	22.53	55.84	-74.73	22.53	55.84
23	-78.63	25.20	46.73	-78.63	25.20	46.73
24	-78.05	25.76	36.57	-78.05	25.76	36.57
25	-78.86	21.23	21.21	-78.86	21.23	21.21
26	-79.68	16.29	8.92	-79.68	16.29	8.92
27	-80.51	10.95	0.00	-80.51	10.95	0.00
28	-80.51	10.98	0.00	-80.51	10.98	0.00
29	-79.69	16.31	8.93	-79.69	16.31	8.93
30	-78.87	21.25	21.24	-78.87	21.25	21.24
31	-78.06	25.78	36.61	-78.06	25.78	36.61
32	-78.64	25.22	46.79	-78.64	25.22	46.79
33	-74.74	22.55	55.90	-74.74	22.55	55.90
34	-70.87	30.93	64.26	-70.87	30.93	64.26
35	-65.64	25.06	51.71	-65.64	25.06	51.71
36	-62.94	11.65	11.13	-62.94	11.65	11.13
37	-58.85	5.72	4.63	-58.85	5.72	4.63
38	-57.11	1.89	13.74	-57.11	1.89	13.74
39	-57.33	0.90	18.49	-57.33	0.90	18.49
40	-59.09	2.93	20.31	-59.09	2.93	20.31
41	-62.13	5.95	18.52	-62.13	5.95	18.52
42	-59.08	8.75	13.79	-59.08	8.75	13.79
43	-57.32	12.78	4.71	-57.32	12.78	4.71
44	-57.10	18.51	11.03	-57.10	18.51	11.03
45	-58.84	27.05	37.71	-58.84	27.05	37.71
46	-63.08	27.05	37.71	-63.08	27.05	37.71
47	-65.37	27.41	51.20	-65.37	27.41	51.20
48	-70.06	31.56	64.19	-70.06	31.56	64.19
49	-75.33	20.79	54.79	-75.33	20.79	54.79

	COMB9			COMB10		
	P	V	M	P	V	M
1	-80.49	20.29	0.00	-80.49	20.29	0.00
2	-79.67	22.96	14.13	-79.67	22.96	14.13
3	-78.86	25.43	29.97	-78.86	25.43	29.97
4	-78.04	27.69	47.32	-78.04	27.69	47.32
5	-78.76	25.39	57.86	-78.76	25.39	57.86
6	-75.22	20.03	65.96	-75.22	20.03	65.96
7	-69.79	32.76	74.79	-69.79	32.76	74.79
8	-62.88	29.28	61.09	-62.88	29.28	61.09
9	-59.42	29.35	46.33	-59.42	29.35	46.33
10	-52.21	21.57	15.36	-52.21	21.57	15.36
11	-47.70	15.67	5.09	-47.70	15.67	5.09
12	-45.38	10.79	18.18	-45.38	10.79	18.18
13	-44.86	6.64	25.59	-44.86	6.64	25.59
14	-45.85	2.17	28.27	-45.85	2.17	28.27
15	-44.86	6.64	25.58	-44.86	6.64	25.58
16	-45.38	10.79	18.17	-45.38	10.79	18.17
17	-47.70	15.67	5.07	-47.70	15.67	5.07
18	-52.21	21.58	15.39	-52.21	21.58	15.39
19	-59.25	29.35	46.40	-59.25	29.35	46.40
20	-63.18	29.79	61.60	-63.18	29.79	61.60
21	-70.52	32.14	74.88	-70.52	32.14	74.88
22	-74.65	21.79	67.08	-74.65	21.79	67.08
23	-78.65	25.76	58.01	-78.65	25.76	58.01
24	-78.05	27.69	47.32	-78.05	27.69	47.32
25	-78.86	25.43	29.96	-78.86	25.43	29.96
26	-79.68	22.96	14.13	-79.68	22.96	14.13
27	-80.51	20.29	0.00	-80.51	20.29	0.00
28	-80.51	20.23	0.00	-80.51	20.23	0.00
29	-79.69	22.90	14.09	-79.69	22.90	14.09
30	-78.87	25.37	29.89	-78.87	25.37	29.89
31	-78.06	27.63	47.20	-78.06	27.63	47.20
32	-78.66	25.70	57.87	-78.66	25.70	57.87
33	-74.65	21.73	66.91	-74.65	21.73	66.91
34	-70.52	32.18	74.67	-70.52	32.18	74.67
35	-63.13	27.05	61.39	-63.13	27.05	61.39
36	-59.21	15.55	15.15	-59.21	15.55	15.15
37	-52.16	9.83	5.34	-52.16	9.83	5.34
38	-47.65	5.39	18.48	-47.65	5.39	18.48
39	-45.32	1.46	25.91	-45.32	1.46	25.91
40	-44.80	2.16	28.61	-44.80	2.16	28.61
41	-45.79	6.63	25.94	-45.79	6.63	25.94
42	-44.80	10.79	18.53	-44.80	10.79	18.53
43	-45.32	15.67	5.43	-45.32	15.67	5.43
44	-47.64	21.59	15.05	-47.64	21.59	15.05
45	-52.15	29.37	46.08	-52.15	29.37	46.08
46	-59.36	29.37	46.08	-59.36	29.37	46.08
47	-62.83	29.31	60.87	-62.83	29.31	60.87
48	-69.77	32.79	74.60	-69.77	32.79	74.60
49	-75.21	19.97	65.79	-75.21	19.97	65.79

50	-78.73	24.85	46.63	-78.73	24.85	46.63
51	-78.03	25.78	36.62	-78.03	25.78	36.62
52	-78.85	21.25	21.24	-78.85	21.25	21.24
53	-79.66	16.31	8.93	-79.66	16.31	8.93
54	-80.48	10.98	0.00	-80.48	10.98	0.00
101	-80.49	10.96	6.04	-80.49	10.96	6.04
102	-83.41	1.59	0.60	-83.41	1.59	0.60
301	-80.48	10.98	6.04	-80.48	10.98	6.04
302	-85.28	10.61	4.71	-85.28	10.61	4.71
401	0.00	20.99	0.00	0.00	20.91	0.00
402	-9.88	35.44	18.34	-9.89	35.64	18.25
403	-0.20	36.66	5.71	-0.21	36.86	5.55
404	-8.79	16.09	7.13	-8.80	16.41	7.58
405	-8.66	4.49	8.22	-8.67	4.22	9.04
406	-8.66	4.60	5.62	-8.65	5.21	6.69
407	-8.69	3.57	2.92	-8.50	6.54	3.45
408	-8.72	2.58	1.13	-8.79	6.15	0.33
409	-8.74	1.95	0.21	-8.67	4.38	0.73
410	-8.76	1.48	0.15	-8.79	8.31	1.46
411	-8.77	1.61	0.09	-8.62	5.82	0.40
412	-8.80	2.15	0.44	-8.78	6.87	1.58
413	-8.84	3.09	1.81	-8.64	5.08	2.30
414	-8.89	4.47	4.39	-8.79	7.61	4.14
415	-8.85	5.74	8.11	-8.88	12.44	7.69
416	-8.65	5.23	11.18	-8.55	8.59	11.73
417	-8.00	26.08	7.92	-8.08	23.67	7.58
418	-6.96	62.89	13.77	-6.98	62.29	11.99
419	-20.04	61.67	35.59	-20.02	61.06	33.59
420	-18.54	62.85	13.74	-18.77	62.24	11.87
421	-18.21	26.04	7.92	-18.02	23.63	7.56
422	-18.01	5.23	11.17	-17.98	8.60	11.71
423	-17.95	5.81	8.15	-17.74	12.40	7.77
424	-18.01	4.48	4.38	-17.92	7.41	4.26
425	-18.05	3.06	1.79	-18.08	5.28	2.12
426	-18.08	2.14	0.45	-17.94	6.80	1.52
427	-18.10	1.54	0.08	-18.06	5.89	0.39
428	-18.11	1.55	0.07	-17.89	8.23	1.37
429	-18.13	2.03	0.35	-18.07	4.46	0.88
430	-18.16	2.72	1.39	-17.96	6.11	0.05
431	-18.18	3.61	3.21	-18.20	6.57	3.74
432	-18.15	4.35	5.69	-18.15	4.96	6.76
433	-17.99	5.23	7.36	-17.98	5.66	8.18
434	-17.52	20.50	4.10	-17.51	20.82	4.54
435	-16.86	41.96	12.65	-16.85	42.16	12.49
436	0.00	40.74	27.13	0.00	40.94	27.04
437	0.00	18.50	0.00	0.00	18.42	0.00

50	-78.75	25.33	57.71	-78.75	25.33	57.71
51	-78.03	27.63	47.20	-78.03	27.63	47.20
52	-78.85	25.37	29.89	-78.85	25.37	29.89
53	-79.66	22.90	14.09	-79.66	22.90	14.09
54	-80.48	20.23	0.00	-80.48	20.23	0.00
101	-80.49	20.29	6.04	-80.49	20.29	6.04
102	-83.41	14.02	17.62	-83.41	14.02	17.62
301	-80.48	20.23	6.04	-80.48	20.23	6.04
302	-85.28	9.44	27.93	-85.28	9.44	27.93
401	0.00	29.18	0.00	0.00	29.09	0.00
402	9.66	25.94	25.49	9.65	25.86	25.41
403	10.33	26.12	11.63	10.32	26.32	11.79
404	10.61	6.60	15.57	10.60	6.32	16.02
405	10.65	7.41	11.10	10.64	7.14	11.93
406	10.58	5.55	5.92	10.60	6.16	6.99
407	10.53	3.61	2.38	10.62	6.57	2.91
408	10.49	2.37	0.56	10.42	6.11	0.89
409	10.47	1.72	0.17	10.55	4.15	0.35
410	10.46	1.37	0.33	10.43	8.53	1.64
411	10.45	1.73	0.16	10.60	5.75	0.47
412	10.42	2.22	0.44	10.44	6.94	1.57
413	10.38	3.10	1.81	10.58	5.07	2.30
414	10.33	4.48	4.40	10.43	7.61	4.15
415	10.37	5.79	8.15	10.34	12.49	7.74

	COMB11			COMB12		
	P	V	M	P	V	M
1	-63.82	13.58	0.00	-63.82	13.58	0.00
2	-63.00	16.76	9.92	-63.00	16.76	9.92
3	-62.18	19.76	21.87	-62.18	19.76	21.87
4	-61.37	22.55	35.70	-61.37	22.55	35.70
5	-61.88	21.40	44.45	-61.88	21.40	44.45
6	-59.93	17.74	51.57	-59.93	17.74	51.57
7	-56.14	24.82	59.46	-56.14	24.82	59.46
8	-52.84	22.05	49.15	-52.84	22.05	49.15
9	-51.01	22.40	38.13	-51.01	22.40	38.13
10	-47.35	16.38	14.98	-47.35	16.38	14.98
11	-45.50	12.30	0.21	-45.50	12.30	0.21
12	-45.21	8.89	10.06	-45.21	8.89	10.06
13	-46.26	6.18	15.95	-46.26	6.18	15.95
14	-48.48	3.19	18.83	-48.48	3.19	18.83
15	-45.96	4.38	18.12	-45.97	4.38	18.12
16	-44.70	7.12	14.39	-44.70	7.12	14.39
17	-44.79	10.57	6.71	-44.79	10.57	6.71
18	-46.45	14.93	6.32	-46.45	14.93	6.32
19	-49.83	20.85	27.34	-49.83	20.85	27.34
20	-51.93	21.02	37.89	-51.93	21.02	37.89
21	-55.03	22.89	47.23	-55.03	22.89	47.23
22	-57.52	18.53	40.20	-57.52	18.53	40.20
23	-59.91	20.00	32.79	-59.91	20.00	32.79
24	-59.57	19.77	24.84	-59.57	19.77	24.84
25	-60.39	15.24	13.39	-60.39	15.24	13.39
26	-61.21	10.31	5.01	-61.21	10.31	5.01
27	-62.08	4.97	0.00	-62.08	4.97	0.00
28	-62.08	4.92	0.00	-62.08	4.92	0.00
29	-61.26	10.25	4.97	-61.26	10.25	4.97
30	-60.44	15.19	13.32	-60.44	15.19	13.32
31	-59.63	19.72	24.74	-59.63	19.72	24.74
32	-56.65	20.08	32.69	-56.65	20.08	32.69
33	-54.45	18.84	40.24	-54.45	18.84	40.24
34	-55.05	22.94	47.36	-55.05	22.94	47.36
35	-51.91	18.78	38.00	-51.91	18.78	38.00
36	-49.80	9.56	6.38	-49.80	9.56	6.38
37	-46.42	5.08	6.71	-46.42	5.08	6.71
38	-44.75	1.79	14.45	-44.75	1.79	14.45
39	-44.66	0.93	18.22	-44.66	0.93	18.22
40	-45.92	3.16	18.98	-45.92	3.16	18.98
41	-48.34	6.15	16.13	-48.34	6.15	16.13
42	-46.20	8.87	10.27	-46.20	8.87	10.27
43	-45.15	12.29	0.44	-45.15	12.29	0.44
44	-45.44	16.57	14.75	-45.44	16.57	14.75
45	-47.29	22.40	37.93	-47.29	22.40	37.93
46	-50.95	22.40	37.93	-50.95	22.40	37.93
47	-52.78	22.06	48.97	-52.78	22.06	48.97
48	-56.10	24.83	59.30	-56.10	24.83	59.30
49	-59.89	17.69	51.43	-59.89	17.69	51.43

2) 시공중 P.A.B 안정성 검토

50	-61.85	21.35	44.33	-61.85	21.35	44.33
51	-61.34	22.50	35.59	-61.34	22.50	35.59
52	-62.15	19.70	21.80	-62.15	19.70	21.80
53	-62.97	16.71	9.88	-62.97	16.71	9.88
54	-63.79	13.53	0.00	-63.79	13.53	0.00
101	-63.82	13.58	4.79	-63.82	13.58	4.79
102	-66.73	6.27	8.94	-66.73	6.27	8.94
301	-63.79	13.53	4.78	-63.79	13.53	4.78
302	-68.59	1.05	12.11	-68.59	1.05	12.11
401	0.00	21.19	0.00	0.00	21.10	0.00
402	1.43	23.23	18.10	1.43	23.43	18.02
403	1.99	24.45	9.93	1.97	24.00	4.09
404	2.25	8.30	9.90	2.24	8.62	10.34
405	2.31	5.34	8.06	2.30	5.06	8.88
406	2.27	4.47	4.71	2.29	5.07	5.78
407	2.24	3.19	2.13	2.33	6.16	2.66
408	2.21	2.28	0.67	2.14	6.53	0.78
409	2.20	1.76	0.03	2.27	4.19	0.55
410	2.19	1.44	0.16	2.15	8.50	1.47
411	2.18	1.65	0.06	2.32	5.92	0.37
412	2.15	2.06	0.39	2.17	6.77	1.52
413	2.12	2.76	1.46	2.32	5.71	1.96
414	2.09	3.64	3.49	2.18	6.97	3.23
415	2.11	4.85	6.41	2.08	11.55	5.99
416	2.27	4.42	8.80	2.37	7.78	9.34
417	2.78	20.69	6.26	2.70	18.29	5.91
418	3.59	49.40	10.67	3.57	48.79	8.89
419	-4.69	48.25	27.89	-4.67	47.64	25.89
420	-3.75	49.48	10.77	-3.67	49.87	8.99
421	-3.25	20.76	6.22	-3.06	18.34	5.86
422	-3.09	4.45	8.79	-3.06	7.82	9.33
423	-3.05	4.85	6.41	-2.83	11.43	6.04
424	-3.09	3.84	3.49	-3.00	6.77	3.38
425	-3.13	2.76	1.46	-3.15	5.91	1.79
426	-3.15	2.06	0.39	-3.00	6.72	1.47
427	-3.16	1.65	0.06	-3.13	5.97	0.38
428	-3.17	1.44	0.15	-2.95	8.49	1.45
429	-3.18	1.77	0.04	-3.12	4.20	0.57
430	-3.21	2.30	0.71	-3.01	6.49	0.73
431	-3.25	3.23	2.20	-3.27	6.20	2.73
432	-3.28	4.52	4.82	-3.27	5.12	5.89
433	-3.22	5.35	8.18	-3.21	5.08	9.01
434	-2.94	8.79	9.91	-2.93	9.11	10.35
435	-2.43	25.41	3.51	-2.42	25.61	3.67
436	0.00	24.19	18.36	0.00	24.39	18.29
437	0.00	21.47	0.00	0.00	21.39	0.00

1. 검토 내용

부산-울산 개략식 터널(4공구)의 시공과 관련하여 P.A.B 구조를 설치 후 P.A.B 벽체부까지 성토가 완료되었을 때의 구조적 안정성에 대해 검토하고자 함.

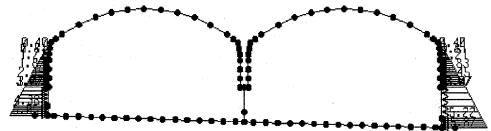
2. 검토 방법

2.1 모델링

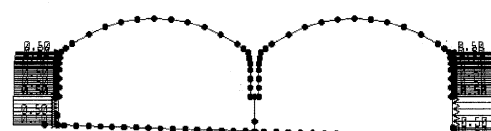
- 개략식 터널의 상시 검토와 동일

2.2 하중조건

- 1) 사하중 : 구조물 사하중은 SAP2000에서 자동 고려.
- 2) 토압 : P.A.B 벽체부까지 성토가 완료되었다고 가정하여 검토함.



- 3) 활하중 : 벽체 성토부 차랑 활하중으로 $P_v=1.0t/m^2$ 를 가정하고 활하중의 수평토압으로 $0.5t/m^2$ 를 가정.



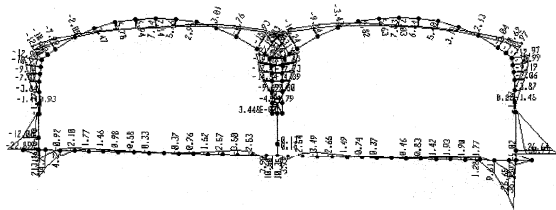
2.3 하중조합

- 도로교설계기준(p32) : 가설시하중 참조

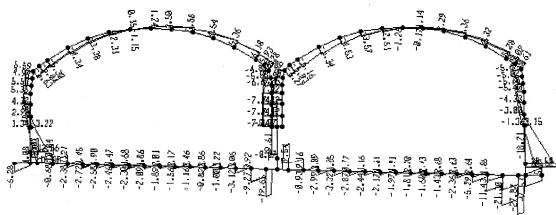
	사하중	도압	활하중의 도압	비고
Comb 1.	1.3	1.7	1.3	강도 설계법
Comb 2.	1.3	0.65	1.3	
Comb 3.	1.0	1.0	1.0	하중 효과 설계법
Comb 4.	1.0	0.5	1.0	

3. 검토 결과

3.1 극한강 검토결과



< Moment Envelop >



< Shear Envelop >

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- 극한강 검토결과에 따르면,

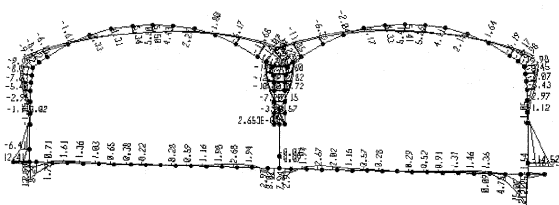
1) 현치부(절점 7) : $M_u = -21.86t\text{-m/m}$, $V_u = 6.28t/m$

2) 슬래브(절점 14) : $M_u = 7.14t\text{-m/m}$ 로서 완성시 P.A.B 단면력 검토시 적용된 하중에 비해 작아 시공중에 발생되는 하중은 구조적으로 문제없는 것으로 계산되었음.

3) 벽체부에 발생되는 하중은 벽체외측에 $M_u = -30.94t\text{-m/m}$, $V_u = 22.52t/m$ 로서 마찬가지로 완성시 현장타설 벽체부 단면력 검토시 적용된 하중에 비해 작아 구조적으로 문제없는 것으로 계산되었음.

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3.2 하중효과 검토 결과



< Moment Envelop >

1) 현치부(절점 7) : $M = -16.20t\text{-m/m}$

2) 슬래브(절점 14) : $M = 5.50t\text{-m/m}$ 로서 완성시 성토 완료후 검토된 하중에 비해 작아 시공성 검토 결과는 문제없는 것으로 판단됨.

3) 온도하중 및 건조수축의 영향 검토

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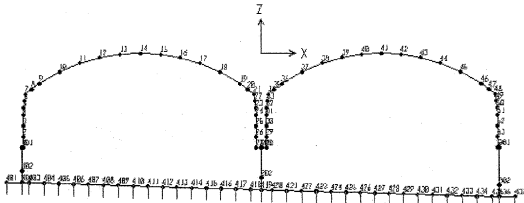
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1. 검토 내용

부산-울산 개축식 터널(4공구)은 Precast Arch 크라운부에서의 토피고가 3m이고 Arch 면을 따라서 5.271m로 토피고가 증가하는 지중구조물이다. 따라서 대기에 노출된 구조물과 달리 온도하중의 영향이 작을 것으로 예상되나 본 검토에서는 온도하중의 영향을 고려하여 구조적 안전성을 확인하고자 함.

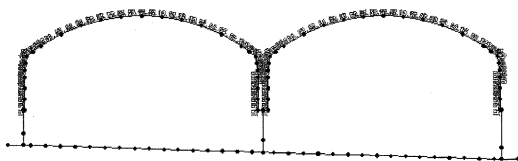
2. 검토 방법

2.1 모델링



2.2 하중조건

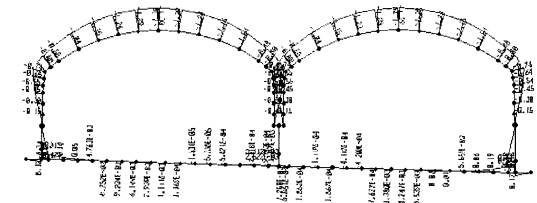
- 1) Comb 1. : 온도하중(+15℃) 작용시
- 2) Comb 2. : 온도하중(-15℃) 및 건조수축(-15℃의 온도하중으로 환산) 작용시



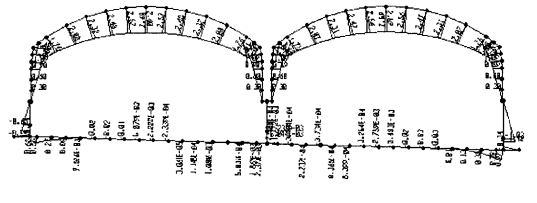
- 온도하중(+15℃)과 건조수축(-15℃의 온도하중으로 환산)을 모두 고려하면 결과적으로 온도가 " 0 " 이므로 온도하중(-15℃)과 건조수축(-15℃)만 고려함.

2.3 하중조합

- 극한모멘트 + 1.3 온도하중, 건조수축
- 3 검토 결과



<Comb1 모멘트도>



<Comb2 모멘트도>

- 고산터널 구조계산서에서 해석한 극한모멘트값에 온도 및 건조수축에 의해 발생한 모멘트값을 더해서 공칭모멘트와 비교 검토

결정번호	Mu	COMB1	COMB2	Mu+comb1	Mu+comb2	공칭모멘트	결과
1	0	0	0	0	0	100.183	O.K
2	-25.27	-0.15	0.30	-25.42	-24.97	100.183	O.K
3	-52.77	-0.30	0.60	-53.07	-52.17	100.183	O.K
4	-82.24	-0.45	0.90	-82.69	-81.34	100.183	O.K
5	-99.92	-0.55	1.09	-100.47	-98.83	111.893	O.K
6	-113.42	-0.65	1.29	-114.07	-112.13	148.994	O.K
7	-127.91	-0.74	1.48	-128.65	-126.43	216.158	O.K
8	-105.23	-0.80	1.61	-106.03	-103.62	150.374	O.K
9	-80.49	-0.88	1.76	-81.37	-78.73	114.947	O.K
10	-27.61	-1.04	2.08	-28.65	-25.53	103.245	O.K
11	12.85	-1.16	2.32	11.69	15.17	77.248	O.K
12	31.67	-1.24	2.48	30.63	34.35	77.248	O.K
13	45.41	-1.29	2.57	44.12	47.96	77.248	O.K
14	50.27	-1.3	2.60	48.97	52.87	77.248	O.K
15	45.4	-1.29	2.57	44.11	47.97	77.248	O.K
16	31.64	-1.24	2.48	30.60	34.32	77.248	O.K
17	8.28	-1.16	2.32	7.12	10.60	77.248	O.K
18	-30.13	-1.04	2.08	-31.17	-28.05	103.245	O.K
19	-80.60	-0.88	1.76	-81.48	-78.84	114.947	O.K
20	-106.06	-0.80	1.61	-106.86	-104.45	150.374	O.K
21	-128.05	-0.74	1.48	-128.79	-126.57	216.158	O.K
22	-115.26	-0.65	1.29	-115.91	-113.97	148.994	O.K
23	-100.17	-0.55	1.09	-100.72	-99.08	111.893	O.K
24	-82.23	-0.45	0.90	-82.68	-81.33	100.183	O.K
25	-52.77	-0.30	0.60	-53.07	-52.17	100.183	O.K
26	-25.27	-0.15	0.30	-25.42	-24.97	100.183	O.K
27	0	0	0	0	0	100.183	O.K

4) 기초슬래브에 작용하는 노면활하중의 영향 검토

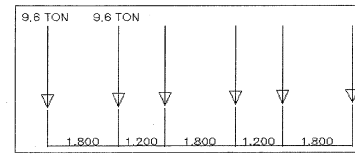
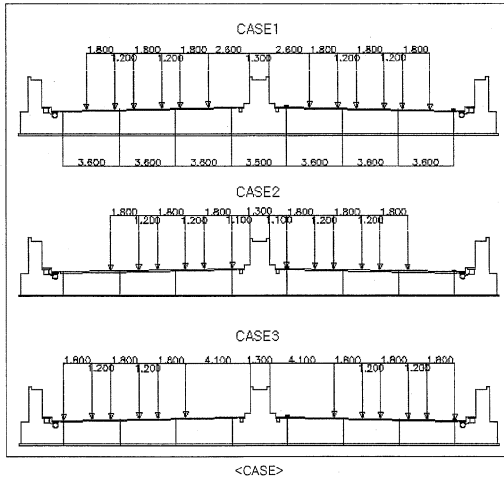
1. 검토내용

기초슬래브 상면에 노면 활하중이 작용하는 경우에 대해 검토하여 P.A.R 및 바닥슬래브에 하중의 증감을 확인하여 구조적으로 미치는 영향에 대해 확인하도록 함.

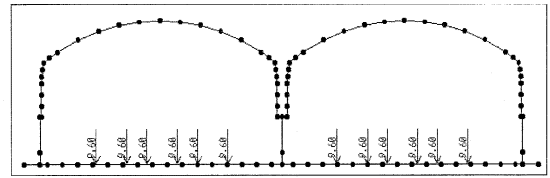
2. 검토 방법

바닥 슬래브에 작용하는 활하중의 종류는 하중의 재위치를 고려하여 다음과 같이 구분하여 적용하도록 함.

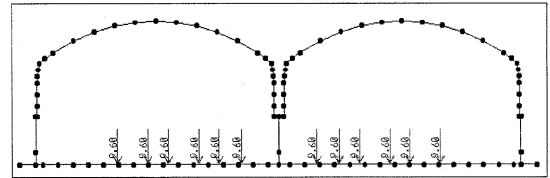
- CASE1 : 차량이 슬래브 중앙에 배치된 경우
CASE2 : 차량이 슬래브 우측으로 배치된 경우
CASE3 : 차량이 슬래브 좌측으로 배치된 경우



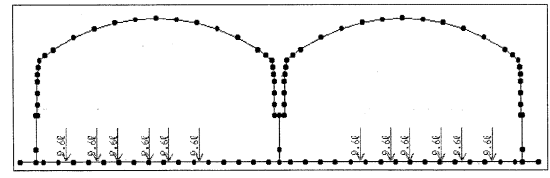
<차량 폭 및 간격>



<CASE1 SAP2000모델링>



<CASE2 SAP2000모델링>

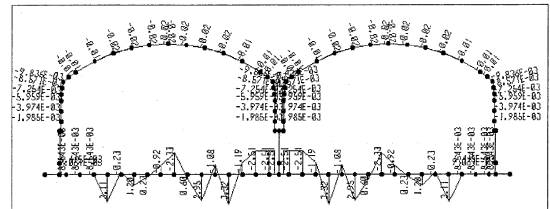


<CASE3 SAP2000모델링>

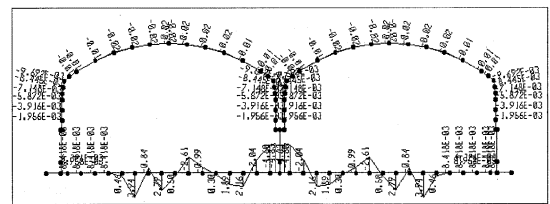
3. 해석결과

3.1 모멘트 검토결과(극한강도)

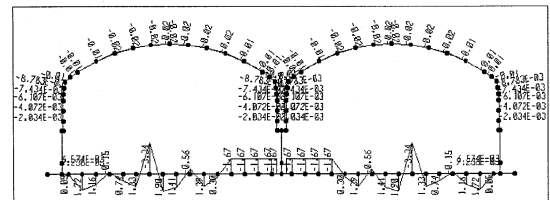
절점	상시MAX	CASE1	CASE2	CASE3	상시MAX +CASE1	상시MAX +CASE2	상시MAX +CASE3	비고
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	-25.21	0.00	0.00	0.00	-25.21	-25.21	-25.21	25.21
3	-52.63	0.00	0.00	0.00	-52.63	-52.63	-52.63	52.63
4	-82.03	-0.01	-0.01	-0.01	-82.04	-82.04	-82.04	82.04
5	-99.67	-0.01	-0.01	-0.01	-99.68	-99.68	-99.68	99.68
6	-113.13	-0.01	-0.01	-0.01	-113.14	-113.14	-113.14	113.14
7	-127.57	-0.01	-0.01	-0.01	-127.58	-127.58	-127.58	127.58
8	-104.86	-0.01	-0.01	-0.01	-104.87	-104.87	-104.87	104.87
9	-80.08	-0.01	-0.01	-0.01	-80.09	-80.09	-80.09	80.09
10	-27.13	-0.01	-0.01	-0.01	-27.14	-27.14	-27.14	27.14
11	12.91	-0.02	-0.02	-0.02	12.89	12.89	12.89	12.91
12	32.44	-0.02	-0.02	-0.02	32.42	32.42	32.42	32.44
13	45.00	-0.02	-0.02	-0.02	45.98	45.98	45.98	45.00
14	50.87	-0.02	-0.02	-0.02	50.85	50.85	50.85	50.87
15	45.99	-0.02	-0.02	-0.02	45.97	45.97	45.97	45.99
16	32.41	-0.02	-0.02	-0.02	32.39	32.39	32.39	32.41
17	8.81	-0.02	-0.02	-0.02	8.79	8.79	8.79	8.81
18	-30.07	-0.01	-0.01	-0.01	-30.06	-30.08	-30.08	30.08
19	-80.20	-0.01	-0.01	-0.01	-80.21	-80.21	-80.21	80.21
20	-105.69	-0.01	-0.01	-0.01	-105.70	-105.70	-105.70	105.70
21	-127.71	-0.01	-0.01	-0.01	-127.72	-127.72	-127.72	127.72
22	-114.96	-0.01	-0.01	-0.01	-114.97	-114.97	-114.97	114.97
23	-99.92	-0.01	-0.01	-0.01	-99.93	-99.93	-99.93	99.93
24	-82.03	-0.01	-0.01	-0.01	-82.04	-82.04	-82.04	82.04
25	-52.63	0.00	0.00	0.00	-52.63	-52.63	-52.63	52.63
26	-25.21	0.00	0.00	0.00	-25.21	-25.21	-25.21	25.21
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
101	9.79	0.00	0.00	0.00	9.79	9.79	9.79	9.79
102	54.71	0.01	0.01	0.01	54.72	54.72	54.72	54.72
401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
402	52.13	-0.01	0.00	0.00	52.12	52.13	52.13	52.13
403	88.54	-0.01	0.00	0.05	88.53	88.54	88.59	88.59
404	42.20	-0.01	0.00	1.72	42.19	42.20	43.92	43.92
405	-29.79	-0.01	0.00	1.16	-29.80	-29.79	-28.63	29.80
406	-58.06	3.11	0.00	-0.15	-54.95	-58.06	-58.21	58.21
407	-79.29	-0.23	0.46	0.74	-79.52	-78.83	-78.55	79.52
408	-93.49	1.20	3.94	1.33	-92.29	-89.55	-92.16	93.49
409	-100.67	0.23	-0.84	-3.34	-100.44	-101.51	-104.01	104.01
410	-100.79	-0.92	2.79	1.90	-101.71	-98.00	-98.89	101.71
411	-93.89	-2.33	0.50	1.41	-96.22	-93.39	-92.46	96.22
412	-79.93	0.60	-2.61	-0.56	-79.33	-82.54	-80.49	82.54
413	-58.95	2.95	-0.99	1.39	-56.00	-59.94	-57.56	59.94
414	-34.29	-1.08	0.30	0.30	-35.37	-33.99	-33.99	35.37
415	-13.08	3.30	1.89	-1.67	-9.78	-11.19	-14.75	14.75
416	46.24	-1.19	2.16	-1.67	45.05	48.40	44.57	48.40
417	95.37	-2.51	-2.04	-1.67	92.86	93.33	93.70	95.37
418	151.59	-2.51	-4.60	-1.67	149.08	146.99	149.92	151.59



<CASE1>



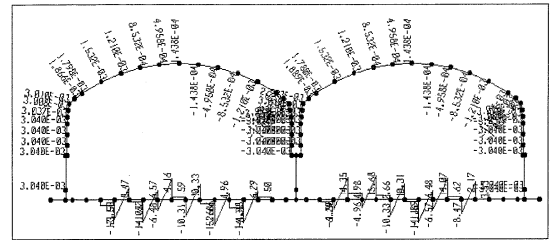
<CASE2>



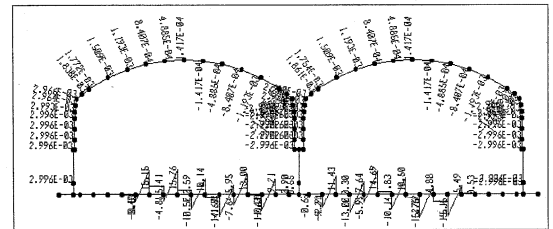
<CASE3>

3.2 전단력 검토결과(극한강도)

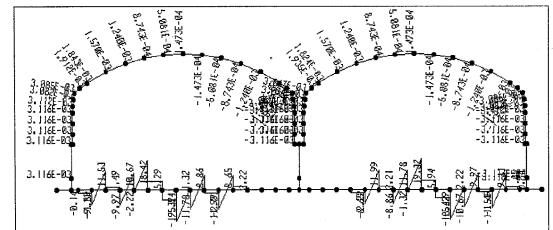
절점	상시 MAX	CASE1	CASE2	CASE3	상시MAX +CASE1	상시MAX +CASE2	상시MAX +CASE3	비고
1	36.84	0.00	0.00	0.00	36.84	36.84	36.84	36.84
2	40.31	0.00	0.00	0.00	40.31	40.31	40.31	40.31
3	43.52	0.00	0.00	0.00	43.52	43.52	43.52	43.52
4	46.46	0.00	0.00	0.00	46.46	46.46	46.46	46.46
5	42.25	0.00	0.00	0.00	42.25	42.25	42.25	42.25
6	34.69	0.00	0.00	0.00	34.69	34.69	34.69	34.69
7	54.04	0.00	0.00	0.00	54.04	54.04	54.04	54.04
8	48.79	0.00	0.00	0.00	48.79	48.79	48.79	48.79
9	49.29	0.00	0.00	0.00	49.29	49.29	49.29	49.29
10	37.07	0.00	0.00	0.00	37.07	37.07	37.07	37.07
11	27.36	0.00	0.00	0.00	27.36	27.36	27.36	27.36
12	18.93	0.00	0.00	0.00	18.93	18.93	18.93	18.93
13	11.43	0.00	0.00	0.00	11.43	11.43	11.43	11.43
14	5.26	0.00	0.00	0.00	5.26	5.26	5.26	5.26
15	11.45	0.00	0.00	0.00	11.45	11.45	11.45	11.45
16	18.94	0.00	0.00	0.00	18.94	18.94	18.94	18.94
17	27.37	0.00	0.00	0.00	27.37	27.37	27.37	27.37
18	37.08	0.00	0.00	0.00	37.08	37.08	37.08	37.08
19	49.30	0.00	0.00	0.00	49.30	49.30	49.30	49.30
20	49.63	0.00	0.00	0.00	49.63	49.63	49.63	49.63
21	53.02	0.00	0.00	0.00	53.02	53.02	53.02	53.02
22	37.57	0.00	0.00	0.00	37.57	37.57	37.57	37.57
23	42.85	0.00	0.00	0.00	42.85	42.85	42.85	42.85
24	46.46	0.00	0.00	0.00	46.46	46.46	46.46	46.46
25	49.52	0.00	0.00	0.00	49.52	49.52	49.52	49.52
26	40.31	0.00	0.00	0.00	40.31	40.31	40.31	40.31
27	36.84	0.00	0.00	0.00	36.84	36.84	36.84	36.84
101	36.84	0.00	0.00	0.00	36.84	36.84	36.84	36.84
102	36.81	0.00	0.00	0.00	36.81	36.81	36.81	36.81
401	-54.25	0.00	0.00	0.00	-54.25	-54.25	-54.25	54.25
402	-60.53	0.00	0.00	0.00	-60.53	-60.53	-60.53	60.53
403	56.46	0.00	0.00	-1.89	56.46	56.46	54.57	56.46
404	48.50	0.00	0.00	-9.11	48.50	48.50	39.39	48.50
405	40.52	-3.53	0.00	11.53	36.99	40.52	52.05	52.05
406	32.56	-12.17	-0.53	-9.97	20.39	32.03	22.59	32.56
407	24.59	8.47	-5.49	10.67	33.06	19.10	35.26	35.26
408	16.63	-14.07	15.15	18.35	2.56	31.78	34.98	34.98
409	8.65	6.57	5.41	5.29	15.22	14.06	13.94	15.22
410	-3.84	14.16	15.76	-19.32	10.32	11.92	-23.16	23.16
411	-11.80	-10.31	-10.50	-11.78	-22.11	-22.30	-23.58	23.58
412	-19.78	10.33	10.14	8.86	-9.45	-9.64	-10.92	19.78
413	-27.74	-15.68	-14.69	-11.99	-43.42	-42.43	-39.73	43.42
414	-35.71	4.96	-7.64	8.65	-30.75	-43.35	-27.06	43.35
415	-43.68	-14.35	13.00	2.22	-58.03	-30.68	-41.46	58.03
416	-51.65	6.29	-11.43	0.00	-45.36	-63.08	-51.65	63.08
417	-59.61	1.50	9.21	0.00	-58.11	-50.40	-59.61	59.61
418	-101.37	0.00	2.90	0.00	-101.37	-98.47	-101.37	101.37



<CASE1>



<CASE2>



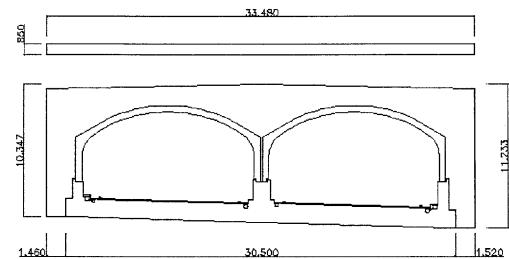
<CASE3>

5) 마 감 벽

1. 검토 내용

- P.A.B를 적용하여 복개 아치 시공 후 복개 아치 라멘의 전, 후면에 마감벽을 시공하도록함.
- 마감벽은 독립기초 벽체와 P.A.B에 커플러로 연결한다.

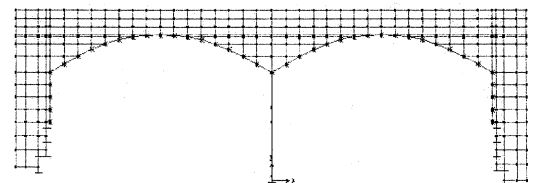
2. 마감벽 단면



3. 검토 방법

- 마감벽을 Sap2000을 이용하여 Shell(Thick)으로 모델링하여 검토함.

1) 모델링



① P.A.B 연결부

P.A.B와 마감벽이 커플러에 의해 연결되므로 P.A.B의 거동이 마감벽에 영향을 미치는 것을 구속조건에 고려하여야한다. 마감벽 설계에 필요한 결과는 Z축 방향의 처짐과 X,Z축의 회전이므로 U2,R2,R3를 고정시켜서 입력함.

② 기초 연결부

P.A.B와 마감벽이 커플러에 의해 연결되고 기초가 고정이므로 고정단

2) 구조물 및 토질 설계 제원

① 콘크리트 & 철근 제원

- $f_{ck} = 270 \text{ kg/cm}^2$
- $f_y = 4000 \text{ kg/cm}^2$

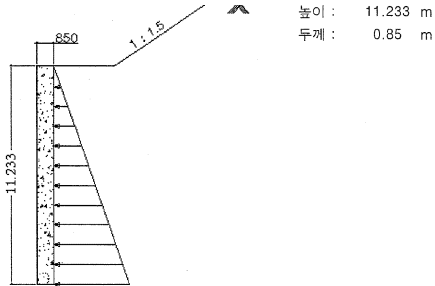
② 토질 정수

- 깃재음, 토파 흙 $\gamma_s = 1.9 \text{ t/m}^3$
- 흙 내부 마찰각 $\phi = 30^\circ$
- 성토구배각도 $\beta = \tan^{-1}(1/1.5) = 33.69^\circ$
- 정지토압 : $K_0 = (1 - \sin\phi)/(1 + \sin\phi) = (1 - \sin 30^\circ)/(1 + \sin 30^\circ) = 0.777$

3) 절점 구속조건

- 현장타설 마감벽과 P.A.B의 현장타설 벽체부는 커플러를 이용하여 상호간 체결하도록 함.
- P.A.B 상부슬래브와 마감벽의 이음부는 P.A.B로부터 커플러를 이용하여 마감벽과 이음함

4) 직음하중산정



① 사하중 : SAP2000 입력 데이터 참조

② 토압 $Ph = \gamma \times 1.9 \times 11.233 = 0.000$

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5) 하중조합

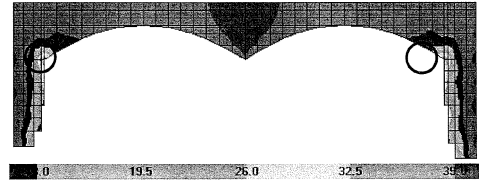
CASE1 = 사하중 + 수평토압

CASE2 = 1.3 사하중 + 1.7 수평토압 (도로교 설계 기준 적용)

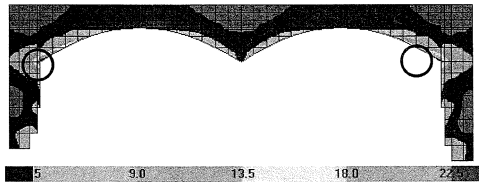
4. 검토결과

- 단면 설계시에는 CASE2, 처짐검토시에는 CASE1을 활용함.

1) Mu11(수평방향 모멘트 검토)

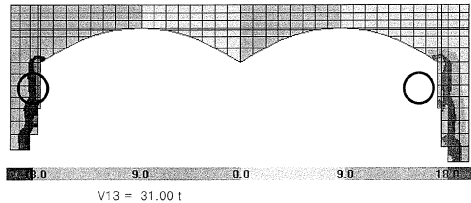


2) Mu22(연직방향 모멘트 검토)

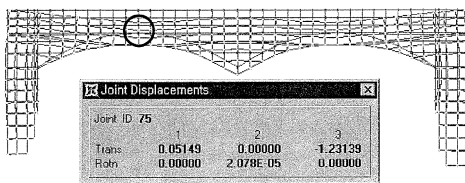


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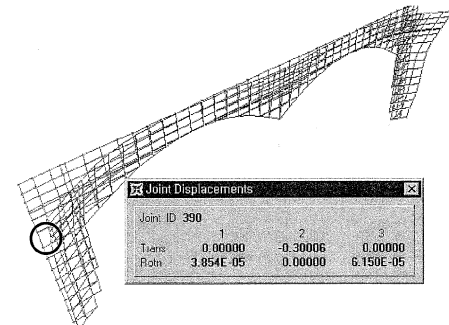
3) V13(수평방향 전단력)



3) 처짐량 검토



연직 처짐량 : P.A.R Arch 슬래브 상단에서의 연직 방향 처짐량은 1.230mm



마감벽의 수평 변위 : 마감벽 배면에서 토압으로 인해 발생하는 변위량은 구조물 전면으로 0.300mm가 발생하는 것으로 검토되었음.

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4) 철근량 계산

① 수평방향 검토 (Mu11)

▷ 검토 조건

$$f_{ck} = 270.0 \text{ kgf/cm}^2 \quad f_y = 4000.0 \text{ kgf/cm}^2$$

$$\beta_1 = 0.850 \quad \phi_b = 0.85 \quad \phi_s = 0.80$$

$$p_b = (0.85 \times \beta_1 \times f_{ck} / f_y) \times [6000 / (6000 + f_y)] = 0.02926$$

$$p_{max} = 0.75 \times p_b = 0.02195$$

$$p_{min} = \max(0.80 \sqrt{f_{ck}} / f_y, 14 / f_y) = 0.00350$$

$$\text{계수 모멘트 } Mu = 38.000 \text{ tf-m}$$

$$\text{단면의 두께 } H = 85.000 \text{ cm} \quad \text{단면 폭 } B = 100.000 \text{ cm}$$

$$\text{유효 길이 } D = 75.000 \text{ cm} \quad \text{피복 두께 } D_c = 10.000 \text{ cm}$$

▷ 휨모멘트 검토

$$\text{소요등가응력길이 } a = 2.644 \text{ cm로 가정}$$

$$As = Mu / (\phi_b \cdot f_y \cdot (D - a/2)) = 15.169 \text{ cm}^2$$

$$a = (As \cdot f_y) / (0.85 \cdot f_{ck} \cdot B) = 2.644 \text{ cm} \quad \therefore \text{가정과 비슷함 O.K}$$

$$P_{req} = [Mu / (\phi_b \cdot f_y \cdot (D - a/2))] / (B \cdot D) = 0.00202 \Rightarrow 4/3 P_{req} = 0.00270$$

$$\therefore \text{필요철근량 } req. As = P_{req} \times (B \cdot D) = 15.169 \text{ cm}^2$$

$$\text{Used } As = H22 @ 15.00 \text{ cm} \quad (D_c = 10.00 \text{ cm})$$

$$= 25.807 \text{ cm}^2 \quad \therefore P = As / (B \cdot D) = 0.00344$$

$$4/3 P_{req} \leq P \leq P_{min} \quad \therefore \text{O.K}$$

$$a = (As \cdot f_y) / (0.85 \cdot f_{ck} \cdot B) = 4.498 \text{ cm}$$

$$\phi M_n = \phi_b \cdot f_y \cdot As \cdot (D - a/2) = 6383371.000 \text{ kgf-cm}$$

$$= 63.834 \text{ tf-m} \geq Mu = 38.000 \text{ tf-m} \quad \therefore \text{O.K}$$

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② 수직방향 검토 (Mu22)

▷ 검토 조건

$$\begin{aligned} f_{ck} &= 270.0 \text{ kgf/cm}^2 & f_y &= 4000.0 \text{ kgf/cm}^2 \\ \beta_1 &= 0.850 & \phi_b &= 0.85 & \phi_s &= 0.80 \\ p_b &= (0.85 \times \beta_1 \times f_{ck} / f_y) \times [6000 / (6000 + f_y)] = 0.02926 \\ p_{max} &= 0.75 \times p_b = 0.02195 \\ p_{min} &= \max(0.80 \sqrt{f_{ck}} / f_y, 14 / f_y) = 0.00350 \end{aligned}$$

$$\begin{aligned} \text{계수 모멘트 } M_u &= 24.000 \text{ tf}\cdot\text{m} \\ \text{단면의 두께 } H &= 85.000 \text{ cm} & \text{단면 폭 } B &= 100.000 \text{ cm} \\ \text{유효 깊이 } D &= 75.000 \text{ cm} & \text{피복 두께 } D_c &= 10.000 \text{ cm} \end{aligned}$$

▷ 휨모멘트 검토

$$\begin{aligned} \text{소요장가응력길이 } a &= 1.659 \text{ cm로 가정} \\ A_s &= M_u / \{\phi_b \cdot f_y \cdot (D - a/2)\} = 9.517 \text{ cm}^2 \\ a &= (A_s \cdot f_y) / (0.85 \cdot f_{ck} \cdot B) = 1.659 \text{ cm} \quad \therefore \text{가정과 비슷함 O.K.} \end{aligned}$$

$$\begin{aligned} \text{Preq} &= [M_u / \{\phi_b \cdot f_y \cdot (D - a/2)\}] / (B \cdot D) = 0.00127 \Rightarrow 4/3 \text{ Preq} = 0.00169 \\ \therefore \text{필요철근량 req. } A_s &= \text{Preq} \times (B \cdot D) = 9.517 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Used } A_s &= \text{H19 @ 15.00 cm} \quad (D_c = 10.00 \text{ cm}) \\ &= 19.100 \text{ cm}^2 \quad \therefore P = A_s / (B \cdot D) = 0.00255 \end{aligned}$$

$$4/3 \text{ Preq} \leq P \leq P_{min} \quad \therefore \text{O.K.}$$

$$\begin{aligned} a &= (A_s \cdot f_y) / (0.85 \cdot f_{ck} \cdot B) = 3.329 \text{ cm} \\ \phi M_n &= \phi_b \cdot f_y \cdot A_s \cdot (D - a/2) = 4762408.000 \text{ kgf}\cdot\text{cm} \\ &= 47.624 \text{ tf}\cdot\text{m} \geq M_u = 24.000 \text{ tf}\cdot\text{m} \quad \therefore \text{O.K.} \end{aligned}$$

③ 수평방향 전단 검토 (V13)

▷ 검토 조건

$$\begin{aligned} f_{ck} &= 270.0 \text{ kgf/cm}^2 & f_y &= 4000.0 \text{ kgf/cm}^2 \\ \beta_1 &= 0.850 & \phi_b &= 0.85 & \phi_s &= 0.80 \\ p_b &= (0.85 \times \beta_1 \times f_{ck} / f_y) \times [6000 / (6000 + f_y)] = 0.02926 \\ p_{max} &= 0.75 \times p_b = 0.02195 \\ p_{min} &= \max(0.80 \sqrt{f_{ck}} / f_y, 14 / f_y) = 0.00350 \end{aligned}$$

$$\begin{aligned} \text{계수 전단력 } V_u &= 31.000 \text{ tonf} \\ \text{단면의 두께 } H &= 85.000 \text{ cm} & \text{단면 폭 } B &= 100.000 \text{ cm} \\ \text{유효 깊이 } D &= 75.000 \text{ cm} & \text{피복 두께 } D_c &= 10.000 \text{ cm} \end{aligned}$$

▷ 전단력 검토

$$\begin{aligned} \text{콘크리트 설계전단강도 } \phi_v \cdot V_c &= \phi_v \cdot 0.53 \cdot \sqrt{f_{ck}} \cdot B \cdot D / 1000 = 52.25 \text{ ton} \\ 0.5 \cdot \phi_v \cdot V_c < V_u &\leq \phi_v \cdot V_c \quad \dots \text{ 최소 전단보강철근 필요} \\ \text{소요 } A_v / s &= \text{최소 } A_v / s = (3.5 \cdot B) / f_y = 0.09 \text{ cm}^2 / \text{cm} \end{aligned}$$

$$\text{사용전단철근 : 철근(Ds)=H16 \quad 다리수(Ns)=2 \quad 간격(s)=45.0 cm}$$

$$\text{사용철근량 } A_v - \text{철근면적} \cdot N_s = 3.97 \text{ cm}^2 > \text{소요철근량 } A_v = 3.94 \text{ cm}^2 \dots \text{ 만족}$$

$$\text{철근 설계전단강도 } \phi_v \cdot V_s = \phi_v \cdot A_v \cdot f_y \cdot D / (s \cdot 1000) = 21.18 \text{ ton}$$

$$\begin{aligned} \text{설계전단강도} \quad \phi_v \cdot V_n &= \phi_v \cdot V_c + \phi_v \cdot V_s = 73.44 \text{ ton} \\ &> \text{설계전단력} \quad V_u = 31.00 \text{ ton} \quad \dots \text{ 만족} \end{aligned}$$

P.C Arch Box Segment의 시공중 안정성(인양 및 설치) 검토

가. 검토 목적

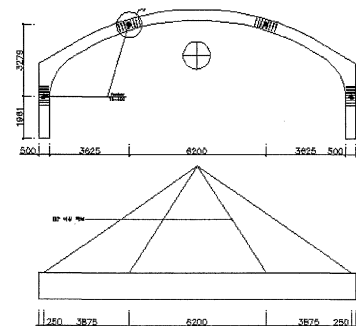
제작장에서 P.A.B를 비딩 거푸집에서 인양하여 아적장으로 옮기는 경우 케이블 연결부에서의 콘크리트 인장력 및 P.A.B 본체에서의 인장력 발생량을 검토하여 인양시 구조적으로 안정한지 확인하고자 한다.

제작된 P.A.B를 현장에서 조립 설치하기 위한 연결부의 위치가 적정하고 또한 P.A.B 본체에 미치는 영향을 확인함.

나. 검토 내용 및 결과

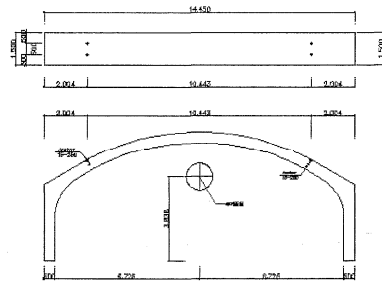
Cable의 길이 : 각 약 11m로 가정.

위치 : 그림 1, 2 참조



< 그림-1 탈형시 Anchor 위치도 >

6) LIFTING 안정검토



< 그림-2 설치시 Anchor 위치도 >

1) P.A.B 구조물 본체 인양시

① 구조물 본체 응력

탈형시 강도 : $f_{ck} = 200 \text{ kg/cm}^2$ (가정)

허용휨인장응력 : $f_{ta} = 1.06 \sqrt{f_{ck}} = 15.0 \text{ kg/cm}^2$

(콘크리트 구조 설계 기준 15.3 (3) ① p243쪽)

P.A.B 구조물 본체에 걸쳐 전 구간이 허용휨인장응력이하 이므로 P.A.B 본체는 인양 중 구조적으로 안정함.

Anchor는 물레에 철근을 보강하여 설치함. (그림 3, 4 참조)

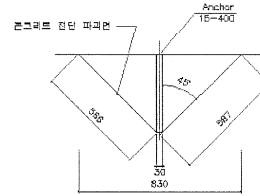
② 구조물 본체 처짐

탈형시 상단부 변위는 내측으로 0.0676mm, 하단부 변위는 내측으로 0.00225mm이며 유류 및 탈형시 구조물은 안전함. (그림 - 5, 6 참조)

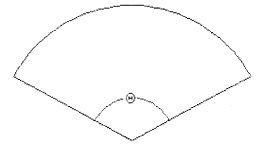
③ 구조물 인양시 인양고리에 대한 전단파괴 검토

PAB 1SEG 중량 : 42.75 ton

한개의 인양고리에 걸리는 하중 : $42.75/4 = 10.69 \text{ ton}$ (인양시 하중이 한쪽으론 걸리는 경우)



< 콘크리트 전단 파괴형상 >



< 전단 파괴면 전개도 >

콘크리트 허용전단강도 = $0.25 \sqrt{f_{ck} b_d}$ (도로교 설계기준 2000 p.28)

b_d : 콘크리트 전단 파괴면의 넓이

전단 파괴면 전개도에서

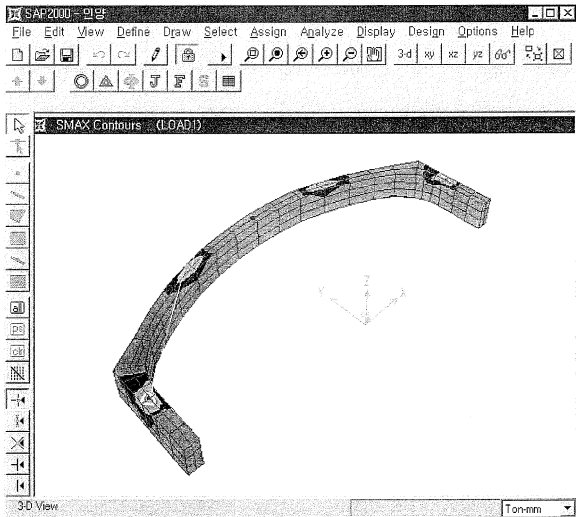
$$2 \times \frac{1}{2} \times 587 \times \theta / 360 = 2 \times \frac{1}{2} \times 830 / 2$$

$$\theta = 254.5^\circ$$

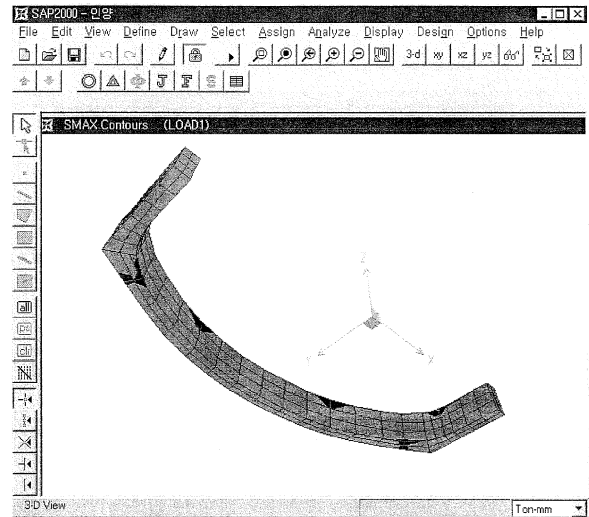
$$b_d = \frac{1}{2} \times (587 - 566) \times 254.5 / 360 = 764285 \text{ mm}^2 = 7642.85 \text{ cm}^2$$

콘크리트 허용 전단강도 = $0.25 \sqrt{f_{ck} b_d} = 0.25 \sqrt{200 \times 7642.85} = 27021.67 \text{ kg} = 27.021 \text{ ton}$

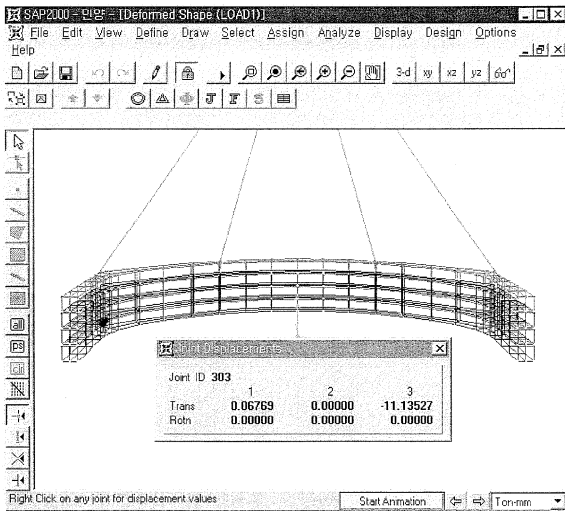
$27.021 > 10.69 \text{ ton}$ 이므로 전단파괴에 대해 안전함.



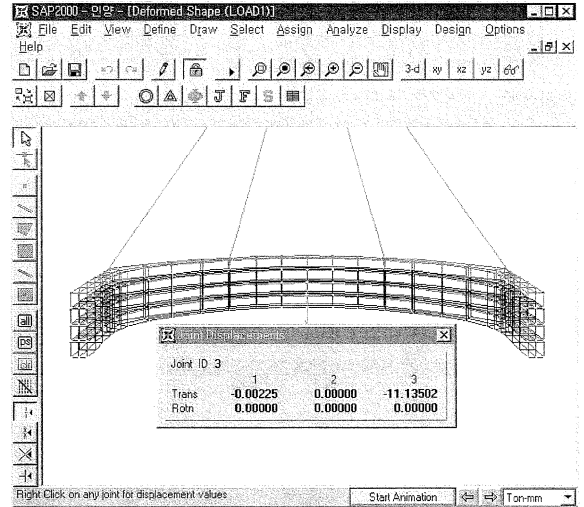
< 그림-3 인양시 P.A.B 상부 응력 분포도 >



< 그림-4 인양시 P.A.B 하부 응력 분포도 >



< 그림-5 인양시 P.A.B 상단에서의 변위 >



< 그림-6 인양시 P.A.B 하단에서의 변위 >

3) P.A.B 구조물 본체 설치시

① 구조물 본체 응력

설치시 강도 : $f_{ck} = 400 \text{ kg/cm}^2$ (가정)

허용휨인장응력 : $f_{ta} = 1.06 \sqrt{f_{ck}} = 21.2 \text{ kg/cm}^2$

(콘크리트 구조 설계 기준 15.3 (3) ① p243쪽)

P.A.R 구조물 본체 및 Lifting Anchor 들레에서의 발생인장 응력이 허용휨인장응력이하로 구조적으로 안정함. (그림 7, 8 참조)

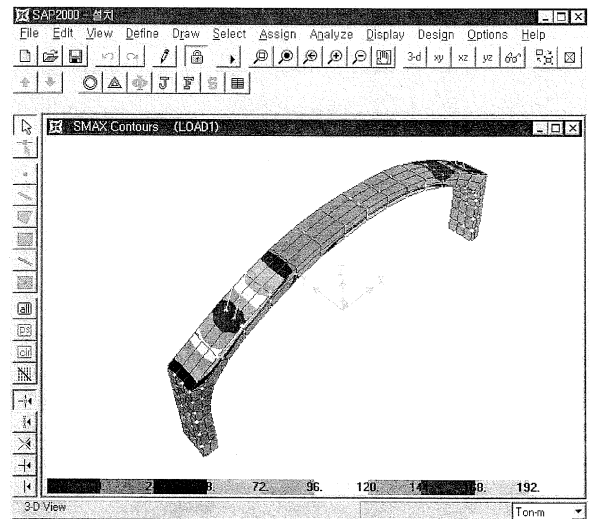
② 구조물 본체 처짐

설치시 P.A.B 벽체 하단부 변위는 내측으로 0.0958mm이며 변위량이 미소함.

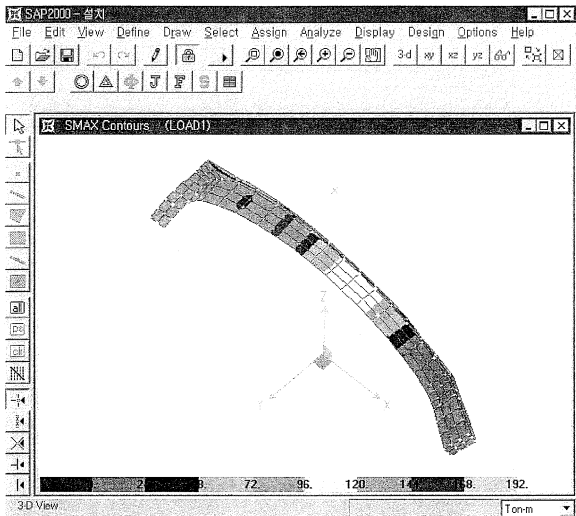
(그림 - 9 참조)

③ 구조물 설치시 인양고리에 대한 전단파괴 검토

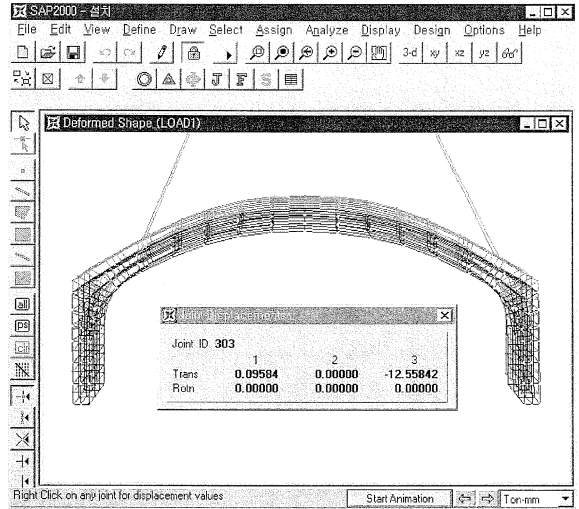
인양시의 같은 형상의 앵커를 사용하므로 인양시와 동일함.



< 그림-7 설치시 P.A.B 상부 응력 분포도 >



< 그림-8 설치시 P.A.B 하루 응력 분포도 >



< 그림-9 설치시 P.A.B 하단에서의 변위 >

7) 허용지지력 계산근거

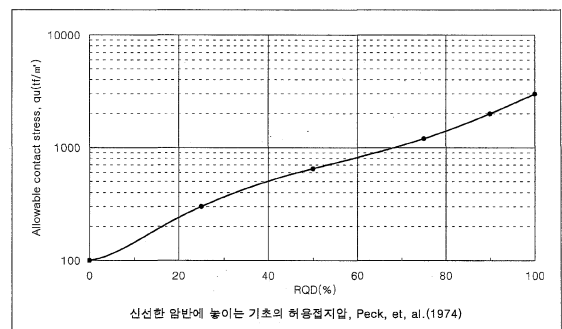
■ 알반에 지지되는 직접기초의 허용지지력

1. 지지층의 알반특성

위 치	공번	TCR/RQD (%)	일축압축강도 (kg/cm ²)	절리간격 (cm)	절리틈새 (mm)	비 고
터널부	CB-7	50 / 0	2,090	< 6	> 5	

2. Peck et. al.의 방법(1974) - 도로교설계기준해설(하부구조편, 2001. 9)

- 불연속면의 틈새가 치밀하게 밀착되었을 경우 적용(<3mm)
- RQD와 허용지지압과의 관계로부터 산정(RQD는 기초바닥면 아래 0.25B 이내의 암질을 적용)
- 단, 허용지지압(qa)이 무결암의 일축압축강도(qu)보다 크면 qa=qu로 간주한다.



• 허용지지력 산정

위 치	공번	TCR/RQD (%)	일축압축강도 (kg/cm ²)	절리틈새 (mm)	적용여부	qa (t/m ²)	비 고
터널부	CB-7	50 / 0	2090	< 5	NG	-	

3. C.G.S(Canadian Geotechnical Society, 1985) 방법 - 도로교설계기준해설(하부구조편, 2001. 9)

- 최대나 절리가 밀접한 알반(불연속면간격≥30cm, 틈새≥5mm인 경우, 수평하중이 없는 경우 적용)
- 단, 퇴적암반의 경우, 층리가 수평하여야 함.

$$q_a = K_{sp} \times q_u$$

$$K_{sp} = (3+C/B)/((10 \times (1+3005/C)))$$

여기서, qa : 허용지지력(kg/cm²)

적용조건 : 0.05 < C/Bf < 2.0
0 < δ/C < 0.02

qu : 코아의 평균일축압축강도(kg/cm²)
C : 불연속면의 간격(mm)
Bf : 기초폭(mm)
δ : 불연속면의 틈새(mm)

㉞ BMR : Geomechanics Rock Mass Rating System - Bieniawski(1989)
NGI : Norwegian Geotechnical Institute Rock Mass Classification System, Barton(1974)
RQD : Rock Quality Designation
Nms : 암석의 종류에 따라 정해지는 값으로, 다음표에 따른다(해설표5.6.5)

• 해설 표 5.6.5 암석의 종류에 따른 일축압축강도의 대표적인 범위

암석분류	일반사항	암석명	C ₀ (kg/cm ²)
A	잘 발달된 결정질 벽계를 가진 탄산염암	돌로마이트	336 ~ 3,150
		석회암	245 ~ 2,940
		대리석	385 ~ 2,450
B	점토질암	규질점토암	294 ~ 1,470
		점토암	14 ~ 84
		이회암	532 ~ 1,960
		천매암	245 ~ 2,450
		미시암	98 ~ 1,190
		세일	70 ~ 357
		질판암	1,470 ~ 2,100
C	강한결정과 약한 벽계를 가진 사질 암석	역암	336 ~ 2,240
		사암	679 ~ 1,750
D	세립질의 화성암 결정질 암석	규암	630 ~ 3,850
		안산암	980 ~ 1,820
E	조립질의 화성암과 변성암의 결정질 암	휘록암	217 ~ 5,810
		각섬암	1,190 ~ 2,800
		반려암	1,260 ~ 3,150
		편마암	245 ~ 3,150
		화강암	147 ~ 3,430
		석영섬록암	98 ~ 980
		편암	98 ~ 1,470
		섬장암	1,820 ~ 4,340

• 허용지지력 산정

위 치	공변	ICR/RQU (%)	일축압축강도 (kg/cm ²)	N _{ms}	적용여부	qu (tf/m ²)	qa (tf/m ²)
터널부	CB-7	50 / 0	2,090	0.016	NG	-	-

- ※ ① 일반화하중 및 영구 하중을 포함한 편심하중에 의한 후탕의 최대 접지압력이 위 표의 공칭 경험값을 초과해서는 않된다.
② 바람이나 지진같은 일시적인 하중에 의한 접지압은 공칭 경험값의 1/3을 초과할 수 없다.
③ 연한 암반이나 토층 지반에서 기초는 인접 최저 지표고로부터 최소 0.5m는 근입되어야 한다.
④ 연한 암반이나 사질토 지반에서는 ③에서 규정한 최소 근입깊이(0.5m)로부터 근입깊이가 0.3m 증가할때마다 공칭 경험값의 5%를 할증하여 사용한다.
⑤ 경질 또는 중간경도 경질인 암에서는 기초가 암표면에 놓일 경우 표에 제시된 경험값을 사용하고, 근입깊이가 암표면으로부터 0.3m 증가할때마다 공칭 경험값의 10%를 할증한다.

• 허용지지력 산정

위 치	공변	TCR/RQD (%)	일축압축강도 (kg/cm ²)	qa (tf/m ²)
터널부	CB-7	50 / 0	2,090	85

6. 허용지지력의 결정

위 치	공변	TCR/RQD (%)	일축강도 (kg/cm ²)	기초폭 (Bf, mm)	Peck의 방법 (tf/m ²)	C.G.S 방법 (tf/m ²)	AASHTO 방법 (tf/m ²)	NAVFAC의 경험치 (tf/m ²)	적용 (tf/m ²)
터널부	CB-7	50 / 0	2,090	30,500	-	-	-	85	85

• 허용지지력 산정

위 치	공변	TCR/RQD (%)	일축강도 (kg/cm ²)	절리간격 (C, mm)	절리폭 (δ, mm)	기초폭 (Bf, mm)	C/Bf	δ/C	적용여부	Ksp	qa (tf/m ²)
터널부	CB-7	50 / 0	2090	< 60	> 5	#####	0.002	0.083	NG	-	-

4. AASHTO(1996) 방법 - 도로교설계기준해설(하부구조편, 2001. 9)

• 공학적 분류에 의해 암반의 상태를 정량적으로 평가할 수 있는 경우 적용(최소안전율 3 적용)

$$q_u = N_{ms} \times C_0$$

여기서, N_{ms} : 암석의 종류에 따라 정해지는 값
C₀ : 암석의 일축압축강도(kg/cm²)

• 파쇄나 절리가 발달한 암반에 놓인 기초의 극한지지력 산정을 위한 N_{ms}계수(Hoek, 1983 의 자료 수정)

암반 등급	일반사항	RMR 등급	NGI 등급	RQD (%)	N _{ms}				
					A	B	C	D	E
우수	절리간격 3m이상의 신선암	100	500	95~100	3.8	4.3	5.0	5.2	6.1
매우 양호	절리간격 0.9~3m이며, 절리면이 거칠며 치밀하게 밀착되어 있고 풍화되어 있지 않음	85	100	90~95	1.4	1.6	1.9	2	2.3
양호	절리간격 0.9~3.0m이며, 절리면이 약간 교란되고 풍화된 신선암	65	10	75~90	0.28	0.32	0.38	0.4	0.46
보통	절리간격 0.9~3.0m의 여러 세트의 적당히 풍화된 절리를 가진 암석	44	1	50~75	0.049	0.056	0.066	0.069	0.081
불량	절리간격이 2~50cm의 약간의 충전물이 있으며 풍화된 절리를 가진 암석	23	0.1	25~50	0.015	0.016	0.019	0.02	0.024
매우 불량	50cm보다 작은 간격의 수많은 풍화된 절리를 가진 암석	3	0.01	<25	상응하는 사질토의 극한지지력을 사용				

5. 확대기초의 지지력 경험치(NAVFAC DM7, 1982)에 의한 방법 - 구조물기초 설계기준(1997)

지 지 층	현장경도 상태	허용지지력 (tf/m ²)	
		범 위	추천값
괴상의 결정질 화강암, 변성암 : 화강암, 섬록암, 현무암, 완전히 고결된 역암	경질의 신선한 암	650 ~ 1070	860
열리성 변성암 : 슬레이트, 편암	중간 경질의 신선한 암	320 ~ 430	375
퇴적암 : 시멘트화된 경질의 세일, 실트암, 사암, 동공이 없는 석회암	중간 경질의 신선한 암	160 ~ 270	215
풍화되거나 파쇄된 모암, 이질암(세일) 이외의 모암암, RQD<25	연암	85 ~ 130	85
컴팩션 세일(Compaction shale)이나 신선한 이질암	연암	85 ~ 160	105
임도분표가 양호한 세립토 모래자갈의 혼합물 : 빙하퇴적물, 하드판(Hardpan), 점성토 섞인 자갈(GW-GC, GC, SC)	매우조밀함	85 ~ 130	105
자갈, 자갈-모래 혼합물, 호박돌-자갈 혼합물(GW, GP, SW, SP)	매우조밀함	65 ~ 105	75
	중간정도 조밀	40 ~ 75	50
	느슨함	20 ~ 65	30
임자가 굵거나 중간경도의 모래, 자갈이 약간섞인 모래(SW, SP)	매우조밀함	40 ~ 65	40
	중간정도 조밀	20 ~ 40	30
가는 모래, 실트질이나 점토질 중간정도 임도나 굵은 모래(SW, SM, SC)	느슨함	10 ~ 30	15
	매우조밀함	30 ~ 50	30
	중간정도 조밀	20 ~ 40	25
균질한 점토, 모래질이나 실트질 점토(CL, CH)	느슨함	10 ~ 30	15
	균음	30 ~ 60	40
	중간정도 균음	10 ~ 30	20
실트, 모래질 실트, 점토질 실트, 교호된(varved) 실트-점토-세사층	느슨함	5 ~ 10	5
	매우균음	20 ~ 40	30
	중간정도 균음	10 ~ 30	15
	연함	5 ~ 10	5

8) 전산 INPUT DATA

File: \\박유현\SAP2000 DATA\PA8\가설.82K 9/18/02
10:36:02AM

NAME=VAR8 TYPE=ROFFR
SEC=77,T3 EIVAR=1,1 L=1.392
NAME=VAR7 TYPE=ROFFR
SEC=77,T8 EIVAR=1,1 L=1.313

FRAME
1 J=1,2 SEC=71 NBSG=1 ANG=180 IREL=R3
2 J=2,3 SEC=71 NBSG=1 ANG=180
3 J=3,4 SEC=71 NBSG=1 ANG=180
4 J=4,5 SEC=VAR1 NBSG=1 ANG=0
5 J=5,6 SEC=VAR2 NBSG=1 ANG=0
6 J=6,7 SEC=VAR3 NBSG=1 ANG=0
7 J=7,8 SEC=VAR4 NBSG=1 ANG=0
8 J=8,9 SEC=VAR5 NBSG=1 ANG=0
9 J=9,10 SEC=VAR6 NBSG=1 ANG=0
10 J=10,11 SEC=VAR7 NBSG=1 ANG=0
11 J=11,12 SEC=78 NBSG=1 ANG=0
12 J=12,13 SEC=78 NBSG=1 ANG=0
13 J=13,14 SEC=78 NBSG=1 ANG=0
14 J=14,15 SEC=78 NBSG=1 ANG=0
15 J=15,16 SEC=78 NBSG=1 ANG=0
16 J=16,17 SEC=78 NBSG=1 ANG=0
17 J=17,18 SEC=VAR7 NBSG=1 ANG=0
18 J=18,19 SEC=VAR6 NBSG=1 ANG=0
19 J=19,20 SEC=VAR5 NBSG=1 ANG=0
20 J=20,21 SEC=VAR4 NBSG=1 ANG=0
21 J=21,22 SEC=VAR3 NBSG=1 ANG=0
22 J=22,23 SEC=VAR2 NBSG=1 ANG=0
23 J=23,24 SEC=VAR1 NBSG=1 ANG=0
24 J=24,25 SEC=71 NBSG=1 ANG=0
25 J=25,26 SEC=71 NBSG=1 ANG=0
26 J=26,27 SEC=71 NBSG=1 ANG=0 JREL=R3
86 J=201,27 SEC=RIGID NBSG=1 ANG=0
89 J=1,101 SEC=RIGID NBSG=1 ANG=0
101 J=101,101 SEC=WALL NBSG=1 ANG=180
102 J=402,102 SEC=WALL NBSG=1 ANG=180

JOFF=4875 RIGID=0
201 J=202,201 SEC=WALL NBSG=1 ANG=0
202 J=413,202 SEC=WALL NBSG=1 ANG=0
JOFF=375 RIGID=0
301 J=301,302 SEC=WALL NBSG=1 ANG=0
302 J=302,416 SEC=WALL NBSG=1 ANG=0
JOFF=4875 RIGID=0
401 J=401,402 SEC=FOOT NBSG=1 ANG=0
403 J=402,402 SEC=FOOT NBSG=1 ANG=0
JOFF=075 RIGID=0
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435 J=436,437 SEC=FOOT NBSG=1 ANG=0

LOAD
NAME=SW SH=1 CYS=0
OUTPUT
: NO Output Requested

File: \\박유현\SAP2000 DATA\PA8\가설.82K 9/18/02
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END
: The following data is used for graphics, design
and pushover analysis.
: If changes are made to the analysis data above,
this should be checked for consistency.

SAP2000 V7.40 SUPPLEMENTAL DATA
GRID GLOBAL X '* -15.925
GRID GLOBAL Y '* 0
GRID GLOBAL Z '* -1.116
GRID GLOBAL X '* 0
GRID GLOBAL Y '* 0
GRID GLOBAL Z '* 15.925
MATERIAL CONC FYSBAR 42184.18 FYSHEAR 2812.79
FC 2812.579 FCSHEAR 2812.579
MATERIAL RIGID FYSBAR 42184.18 FYSHEAR
2812.79 FC 2812.579 FCSHEAR 2812.579
CONCRETESECTION 71 COLUMN COVER .055 REBAR
RR=3
CONCRETESECTION 72 COLUMN COVER .0574 REBAR
RR=3
CONCRETESECTION 73 COLUMN COVER .0672 REBAR
RR=3
CONCRETESECTION 74 COLUMN COVER .0871 REBAR
RR=3
CONCRETESECTION 75 COLUMN COVER .0863 REBAR
RR=3
CONCRETESECTION 76 COLUMN COVER .0644 REBAR
RR=3
CONCRETESECTION 77 COLUMN COVER .0529 REBAR
RR=3
CONCRETESECTION 78 COLUMN COVER .05 REBAR
RR=3
CONCRETESECTION FOOT COLUMN COVER .14 REBAR
RR=3
CONCRETESECTION WALL COLUMN COVER .057 REBAR
RR=3
CONCRETESECTION RIGID COLUMN COVER 1 REBAR
RR=3
CONCRETESECTION WALL COLUMN COVER 1 REBAR
RR=3
STATIC/LOAD ON TYPE LOAD
END SUPPLEMENTAL DATA

File: \\박유현\SAP2000 DATA\PA8\가설.82K 9/18/02
10:36:02AM

File D:\SAP2000\DATA\만경개측식리버\가설.82K
saved 9-18-02 10:36:02 in Ton-m

SYSTEM
DOP=UX,UZ,EY LENGTH=8 FORCE=Ton LINES=59
JOINT
1 X=14.25 Y=0 Z=-5.679
2 X=14.25 Y=0 Z=-5.679
3 X=14.25 Y=0 Z=-4.372
4 X=14.25 Y=0 Z=-3.719
5 X=14.23 Y=0 Z=-3.293
6 X=14.166 Y=0 Z=-2.86
7 X=14.107 Y=0 Z=-2.444
8 X=13.748 Y=0 Z=-2.165
9 X=13.294 Y=0 Z=-1.832
10 X=12.092 Y=0 Z=-1.331
11 X=10.887 Y=0 Z=-.608
12 X=-.683 Y=0 Z=-.256
13 X=-8.479 Y=0 Z=-.057
14 X=-7.275 Y=0 Z=0
15 X=-6.071 Y=0 Z=-.057
16 X=-4.867 Y=0 Z=-.256
17 X=-3.663 Y=0 Z=-.608
18 X=-2.458 Y=0 Z=-1.331
19 X=-1.256 Y=0 Z=-1.832
20 X=-.795 Y=0 Z=-2.165
21 X=-.443 Y=0 Z=-2.444
22 X=-.369 Y=0 Z=-2.86
23 X=-.318 Y=0 Z=-3.293
24 X=-.3 Y=0 Z=-3.719
25 X=-.3 Y=0 Z=-4.372
26 X=-.3 Y=0 Z=-5.026
27 X=-.3 Y=0 Z=-5.679
101 X=14.325 Y=0 Z=-5.679
102 X=14.325 Y=0 Z=-7.052
201 X=0 Y=0 Z=-5.679
202 X=0 Y=0 Z=-7.476
301 X=14.325 Y=0 Z=-5.679
302 X=14.325 Y=0 Z=-7.938
401 X=15.25 Y=0 Z=-7.764
402 X=14.325 Y=0 Z=-7.764
403 X=13.3 Y=0 Z=-7.777
404 X=13.017 Y=0 Z=-7.804
405 X=12.133 Y=0 Z=-7.83
406 X=11.28 Y=0 Z=-7.857
407 X=10.367 Y=0 Z=-7.883
408 X=9.408 Y=0 Z=-7.91
409 X=8.5 Y=0 Z=-7.936
410 X=7.717 Y=0 Z=-7.963
411 X=6.834 Y=0 Z=-7.989
412 X=5.95 Y=0 Z=-8.016
413 X=5.067 Y=0 Z=-8.042
414 X=4.184 Y=0 Z=-8.069
415 X=3.3 Y=0 Z=-8.098
416 X=2.417 Y=0 Z=-8.122
417 X=1.534 Y=0 Z=-8.148
418 X=.65 Y=0 Z=-8.175
419 X=0 Y=0 Z=-8.194
420 X=.65 Y=0 Z=-8.214
421 X=.334 Y=0 Z=-8.241
422 X=2.417 Y=0 Z=-8.267
423 X=.3 Y=0 Z=-8.291
424 X=4.184 Y=0 Z=-8.32
425 X=5.067 Y=0 Z=-8.347
426 X=5.95 Y=0 Z=-8.373
427 X=6.834 Y=0 Z=-8.4
428 X=7.717 Y=0 Z=-8.426
429 X=8.5 Y=0 Z=-8.453
430 X=9.484 Y=0 Z=-8.479
431 X=10.367 Y=0 Z=-8.506
432 X=11.25 Y=0 Z=-8.532
433 X=12.133 Y=0 Z=-8.559
434 X=13.017 Y=0 Z=-8.585
435 X=13.9 Y=0 Z=-8.612
436 X=14.745 Y=0 Z=-8.625
437 X=15.25 Y=0 Z=-8.634
PATTERN
NAME=TEMP
NAME=PRES
SPRING
ADD=401 UZ=201064.2
ADD=402 UZ=234445
ADD=403 UZ=284315.6
ADD=404 UZ=384087
ADD=405 UZ=384087

File: \\박유현\SAP2000 DATA\PA8\가설.82K 9/18/02
10:36:02AM

ADD=406 UZ=383869.6
ADD=407 UZ=383869.6
ADD=408 UZ=384087
ADD=409 UZ=384087
ADD=410 UZ=383869.6
ADD=411 UZ=384087
ADD=412 UZ=384087
ADD=413 UZ=383869.6
ADD=414 UZ=384087
ADD=415 UZ=384087
ADD=416 UZ=383869.6
ADD=417 UZ=384087
ADD=418 UZ=334440.5
ADD=419 UZ=10000 UZ=282576.7
ADD=420 UZ=333440.5
ADD=421 UZ=384087
ADD=422 UZ=383869.6
ADD=423 UZ=384087
ADD=424 UZ=384087
ADD=425 UZ=383869.6
ADD=426 UZ=384087
ADD=427 UZ=384087
ADD=428 UZ=383869.6
ADD=429 UZ=384087
ADD=430 UZ=384087
ADD=431 UZ=383869.6
ADD=432 UZ=383869.6
ADD=433 UZ=384087
ADD=434 UZ=384087
ADD=435 UZ=284315.6
ADD=436 UZ=234445
ADD=437 UZ=231064.2

MATERIAL
NAME=CONC IDRS=C M=2448 W=2.5
T=0 E=2800000 U=2 A=00001
NAME=STEEL IDRS=C
T=0 E=28*10 U=3 A=0000117 FY=25310.51
NAME=RIGID IDRS=C
T=0 E=244750 U=3 A=00001
NAME=CONCL IDRS=C M=2448 W=2.5
T=0 E=244750 U=2 A=00001
FRAME SECTION
NAME=71 MAT=CONC SH=R T=5.1 A=5
J=2.861003E-02 I=1.041667E-02,4.897667E-02
AS=416667,416667
NAME=72 MAT=CONC SH=R T=542.1 A=542
J=3.508126E-02 I=1.326834E-02,5.16667E-02
AS=416667,416667
NAME=73 MAT=CONC SH=R T=675.1 A=675
J=5.967038E-02 I=2.562891E-02,0.05625
AS=5625,5625
NAME=74 MAT=CONC SH=R T=916.1 A=916
J=117023 I=6.404794E-02,7.633334E-02
AS=763333,763333
NAME=75 MAT=CONC SH=R T=66.1 A=66
J=6.07058E-02 I=2.620267E-02,5.66667E-02
AS=566667,566667
NAME=76 MAT=CONC SH=R T=553.1 A=553
J=3.688433E-02 I=1.040227,4.608333E-02
AS=460833,460833
NAME=77 MAT=CONC SH=R T=511.1 A=511
J=3.040398E-02 I=1.011354,4.258333E-02
AS=460833,460833
NAME=78 MAT=CONC SH=R T=5.1 A=5
J=2.861003E-02 I=1.041667E-02,4.897667E-02
AS=416667,416667
NAME=POOT MAT=CONC SE=R T=1.4 L=1.4
J=261222 I=1.288465,116667
AS=116667,116667
NAME=WALL MAT=CONC SH=R T=85.1 A=85
J=9.58526E-02 I=1.077058E-02,7.083333E-02
AS=708334,708334
NAME=RIGID MAT=RIGID SH=R T=10.10 A=1010
J=4809.133 I=8.313527,8313527
AS=8313527,8313527
NAME=WALL MAT=CONC SH=R T=1.1 A=1.1
J=.239604 I=.182893,182893
AS=182893,182893
PATTERN
NAME=TEMP
NAME=PRES
SPRING
ADD=401 UZ=201064.2
ADD=402 UZ=234445
ADD=403 UZ=284315.6
ADD=404 UZ=384087
ADD=405 UZ=384087
ADD=406 UZ=383869.6
ADD=407 UZ=384087
ADD=408 UZ=384087
ADD=409 UZ=383869.6
ADD=410 UZ=384087
ADD=411 UZ=384087
ADD=412 UZ=384087
ADD=413 UZ=383869.6
ADD=414 UZ=384087
ADD=415 UZ=384087
ADD=416 UZ=383869.6
ADD=417 UZ=384087
ADD=418 UZ=333440.5
ADD=419 UZ=10000 UZ=282576.7
ADD=420 UZ=333440.5
ADD=421 UZ=384087
ADD=422 UZ=383869.6
ADD=423 UZ=384087
ADD=424 UZ=384087
ADD=425 UZ=383869.6
ADD=426 UZ=384087
ADD=427 UZ=384087
ADD=428 UZ=383869.6
ADD=429 UZ=384087
ADD=430 UZ=384087
ADD=431 UZ=383869.6
ADD=432 UZ=383869.6
ADD=433 UZ=384087
ADD=434 UZ=384087
ADD=435 UZ=284315.6
ADD=436 UZ=234445
ADD=437 UZ=231064.2

File: \\박유현\SAP2000 DATA\FAB\MAT1.S2k 10/9/02
9.59.523M

AD9+44	RD=0.1	U2=5.958, -6.428
AD9+45	RD=0.1	U2=6.615, -6.928
AD9+46	RD=0.1	U2=6.774, -7.428
AD9+47	RD=0.1	U2=5.189, -7.928
AD9+48	RD=0.1	U2=7.58, -7.986
TYPE-DISTRIBUTED SPAN		
AD9+1	RD=0.1	U2=5.018, 4.724
AD9+2	RD=0.1	U2=6.724, 4.43
AD9+3	RD=0.1	U2=4.43, 4.136
AD9+4	RD=0.1	U2=4.136, 3.84
AD9+5	RD=0.1	U2=3.84, 3.54
AD9+6	RD=0.1	U2=3.79, 3.246
AD9+7	RD=0.1	U2=3.387, 2.95
AD9+8	RD=0.1	U2=3.437, 2.657
AD9+9	RD=0.1	U2=3.287, 2.361
AD9+10	RD=0.1	U2=3.287, 2.064
AD9+11	RD=0.1	U2=3.76, 2.578
AD9+12	RD=0.1	U2=3.76, 2.281
AD9+13	RD=0.1	U2=4.286, 4.003
AD9+14	RD=0.1	U2=4.286, 3.706
AD9+15	RD=0.1	U2=4.286, 3.409
AD9+16	RD=0.1	U2=5.278, 2.726
AD9+17	RD=0.1	U2=5.278, 2.429
AD9+18	RD=0.1	U2=5.736, 2.971
AD9+19	RD=0.1	U2=5.736, 2.674
AD9+20	RD=0.1	U2=5.287, 4.037
AD9+21	RD=0.1	U2=5.287, 3.74
AD9+22	RD=0.1	U2=5.409, 3.805
AD9+23	RD=0.1	U2=5.409, 3.508
AD9+24	RD=0.1	U2=6.421, 7.221
AD9+25	RD=0.1	U2=6.421, 6.924
AD9+26	RD=0.1	U2=6.421, 6.627
AD9+27	RD=0.1	U2=6.483, 6.862
AD9+28	RD=0.1	U2=6.483, 6.565
AD9+29	RD=0.1	U2=7.241, 6.261
AD9+30	RD=0.1	U2=7.241, 5.964
AD9+31	RD=0.1	U2=6.805, 8.005
AD9+32	RD=0.1	U2=6.805, 7.708
AD9+33	RD=0.1	U2=6.805, 7.411
AD9+34	RD=0.1	U2=6.352, 3.437
AD9+35	RD=0.1	U2=6.352, 3.14
AD9+36	RD=0.1	U2=6.287, 2.973
AD9+37	RD=0.1	U2=6.287, 2.676
AD9+38	RD=0.1	U2=6.287, 2.379
AD9+39	RD=0.1	U2=6.287, 2.082
AD9+40	RD=0.1	U2=6.287, 1.785
AD9+41	RD=0.1	U2=6.287, 1.488
AD9+42	RD=0.1	U2=6.287, 1.191
AD9+43	RD=0.1	U2=6.287, 0.894
AD9+44	RD=0.1	U2=6.287, 0.597
AD9+45	RD=0.1	U2=6.287, 0.3
AD9+46	RD=0.1	U2=6.287, 0.003
AD9+47	RD=0.1	U2=6.287, -0.294
AD9+48	RD=0.1	U2=6.287, -0.597
AD9+49	RD=0.1	U2=6.287, -0.894
AD9+50	RD=0.1	U2=6.287, -1.191

[illegible]

Page :

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File: \\박우현\SA2P2000 DATA\PA8\PA8\WAT3.S2K 10/9/02
9:59:56AM

File: \\박우현\SA2P2000DATA\한정계측용리브\WAT3.S2K
saved 10-9-02 9:59:57 in Ton=

SYSTEM
DOF=0, UZ, EY, LBNH=8M PORCE=TON LINE=59

JOINT

1 X=14.25 Y=0 Z=-5.679
2 X=14.25 Y=0 Z=-5.026
3 X=14.25 Y=0 Z=-3.719
4 X=14.25 Y=0 Z=-3.719
5 X=14.25 Y=0 Z=-3.719
6 X=14.166 Y=0 Z=-3.886
7 X=14.107 Y=0 Z=-3.446
8 X=13.748 Y=0 Z=-3.165
9 X=13.294 Y=0 Z=-1.832
10 X=12.092 Y=0 Z=-1.131
11 X=10.44 Y=0 Z=-.698
12 X=9.683 Y=0 Z=-.256
13 X=8.479 Y=0 Z=-.057
14 X=7.275 Y=0 Z=0
15 X=6.071 Y=0 Z=-.057
16 X=4.867 Y=0 Z=-.057
17 X=3.663 Y=0 Z=-.698
18 X=2.458 Y=0 Z=-1.131
19 X=1.256 Y=0 Z=-1.832
20 X=0 Y=0 Z=-2.165
21 X=-.443 Y=0 Z=-3.165
22 X=-.369 Y=0 Z=-2.85
23 X=-.316 Y=0 Z=-3.293
24 X=-.3 Y=0 Z=-3.719
25 X=-.3 Y=0 Z=-4.372
26 X=-.3 Y=0 Z=-5.026
27 X=-.3 Y=0 Z=-5.679
28 X=-3 Y=0 Z=-5.679
29 X=-3 Y=0 Z=-5.026
30 X=-3 Y=0 Z=-4.372
31 X=-3 Y=0 Z=-3.719
32 X=-318 Y=0 Z=-3.293
33 X=-369 Y=0 Z=-2.85
34 X=-443 Y=0 Z=-3.165
35 X=-755 Y=0 Z=-2.165
36 X=-1256 Y=0 Z=-1.832
37 X=-2458 Y=0 Z=-1.131
38 X=-3663 Y=0 Z=-.698
39 X=-4867 Y=0 Z=-.057
40 X=-6071 Y=0 Z=-.057
41 X=7.275 Y=0 Z=0
42 X=8.479 Y=0 Z=-.057
43 X=9.683 Y=0 Z=-.256
44 X=10.44 Y=0 Z=-.698
45 X=12.092 Y=0 Z=-1.131
46 X=13.294 Y=0 Z=-1.832
47 X=13.748 Y=0 Z=-3.165
48 X=14.107 Y=0 Z=-3.446
49 X=14.166 Y=0 Z=-3.886
50 X=14.25 Y=0 Z=-5.026
51 X=14.25 Y=0 Z=-5.679
52 X=14.25 Y=0 Z=-5.679
53 X=14.25 Y=0 Z=-5.679
54 X=14.25 Y=0 Z=-5.679
55 X=14.25 Y=0 Z=-5.679
56 X=14.25 Y=0 Z=-5.679
57 X=14.25 Y=0 Z=-5.679
58 X=14.25 Y=0 Z=-5.679
59 X=14.25 Y=0 Z=-5.679
60 X=14.25 Y=0 Z=-5.679
61 X=14.25 Y=0 Z=-5.679
62 X=14.25 Y=0 Z=-5.679
63 X=14.25 Y=0 Z=-5.679
64 X=14.25 Y=0 Z=-5.679
65 X=14.25 Y=0 Z=-5.679
66 X=14.25 Y=0 Z=-5.679
67 X=14.25 Y=0 Z=-5.679
68 X=14.25 Y=0 Z=-5.679
69 X=14.25 Y=0 Z=-5.679
70 X=14.25 Y=0 Z=-5.679
71 X=14.25 Y=0 Z=-5.679
72 X=14.25 Y=0 Z=-5.679
73 X=14.25 Y=0 Z=-5.679
74 X=14.25 Y=0 Z=-5.679
75 X=14.25 Y=0 Z=-5.679
76 X=14.25 Y=0 Z=-5.679
77 X=14.25 Y=0 Z=-5.679
78 X=14.25 Y=0 Z=-5.679
79 X=14.25 Y=0 Z=-5.679
80 X=14.25 Y=0 Z=-5.679
81 X=14.25 Y=0 Z=-5.679
82 X=14.25 Y=0 Z=-5.679
83 X=14.25 Y=0 Z=-5.679
84 X=14.25 Y=0 Z=-5.679
85 X=14.25 Y=0 Z=-5.679
86 X=14.25 Y=0 Z=-5.679
87 X=14.25 Y=0 Z=-5.679
88 X=14.25 Y=0 Z=-5.679
89 X=14.25 Y=0 Z=-5.679
90 X=14.25 Y=0 Z=-5.679
91 X=14.25 Y=0 Z=-5.679
92 X=14.25 Y=0 Z=-5.679
93 X=14.25 Y=0 Z=-5.679
94 X=14.25 Y=0 Z=-5.679
95 X=14.25 Y=0 Z=-5.679
96 X=14.25 Y=0 Z=-5.679
97 X=14.25 Y=0 Z=-5.679
98 X=14.25 Y=0 Z=-5.679
99 X=14.25 Y=0 Z=-5.679
100 X=14.25 Y=0 Z=-5.679

Page: 1

File: \\박우현\SA2P2000 DATA\PA8\PA8\WAT3.S2K 10/9/02
9:59:56AM

File: \\박우현\SA2P2000DATA\한정계측용리브\WAT3.S2K
saved 10-9-02 9:59:57 in Ton=

SYSTEM
DOF=0, UZ, EY, LBNH=8M PORCE=TON LINE=59

JOINT

322 X=2.417 Y=0 Z=-8.287
323 X=3.1 Y=0 Z=-8.281
324 X=4.184 Y=0 Z=-8.32
325 X=5.067 Y=0 Z=-8.32
326 X=5.95 Y=0 Z=-8.373
327 X=6.834 Y=0 Z=-8.4
328 X=7.717 Y=0 Z=-8.426
329 X=8.6 Y=0 Z=-8.453
330 X=9.486 Y=0 Z=-8.479
331 X=10.367 Y=0 Z=-8.506
332 X=11.25 Y=0 Z=-8.532
333 X=12.133 Y=0 Z=-8.559
334 X=13.017 Y=0 Z=-8.585
335 X=13.9 Y=0 Z=-8.612
336 X=14.783 Y=0 Z=-8.639
337 X=15.65 Y=0 Z=-8.665
338 X=16.533 Y=0 Z=-8.692
339 X=17.417 Y=0 Z=-8.719
340 X=18.3 Y=0 Z=-8.746
341 X=19.183 Y=0 Z=-8.773
342 X=20.067 Y=0 Z=-8.8
343 X=20.95 Y=0 Z=-8.827
344 X=21.833 Y=0 Z=-8.854
345 X=22.717 Y=0 Z=-8.881
346 X=23.6 Y=0 Z=-8.908
347 X=24.483 Y=0 Z=-8.935
348 X=25.367 Y=0 Z=-8.962
349 X=26.25 Y=0 Z=-8.989
350 X=27.133 Y=0 Z=-9.016
351 X=28.017 Y=0 Z=-9.043
352 X=28.9 Y=0 Z=-9.07
353 X=29.783 Y=0 Z=-9.097
354 X=30.667 Y=0 Z=-9.124
355 X=31.55 Y=0 Z=-9.151
356 X=32.433 Y=0 Z=-9.178
357 X=33.317 Y=0 Z=-9.205
358 X=34.2 Y=0 Z=-9.232
359 X=35.083 Y=0 Z=-9.259
360 X=35.967 Y=0 Z=-9.286
361 X=36.85 Y=0 Z=-9.313
362 X=37.733 Y=0 Z=-9.34
363 X=38.617 Y=0 Z=-9.367
364 X=39.5 Y=0 Z=-9.394
365 X=40.383 Y=0 Z=-9.421
366 X=41.267 Y=0 Z=-9.448
367 X=42.15 Y=0 Z=-9.475
368 X=43.033 Y=0 Z=-9.502
369 X=43.917 Y=0 Z=-9.529
370 X=44.8 Y=0 Z=-9.556
371 X=45.683 Y=0 Z=-9.583
372 X=46.567 Y=0 Z=-9.61
373 X=47.45 Y=0 Z=-9.637
374 X=48.333 Y=0 Z=-9.664
375 X=49.217 Y=0 Z=-9.691
376 X=50.1 Y=0 Z=-9.718
377 X=50.983 Y=0 Z=-9.745
378 X=51.867 Y=0 Z=-9.772
379 X=52.75 Y=0 Z=-9.799
380 X=53.633 Y=0 Z=-9.826
381 X=54.517 Y=0 Z=-9.853
382 X=55.4 Y=0 Z=-9.88
383 X=56.283 Y=0 Z=-9.907
384 X=57.167 Y=0 Z=-9.934
385 X=58.05 Y=0 Z=-9.961
386 X=58.933 Y=0 Z=-9.988
387 X=59.817 Y=0 Z=-10.015
388 X=60.7 Y=0 Z=-10.042
389 X=61.583 Y=0 Z=-10.069
390 X=62.467 Y=0 Z=-10.096
391 X=63.35 Y=0 Z=-10.123
392 X=64.233 Y=0 Z=-10.15
393 X=65.117 Y=0 Z=-10.177
394 X=66 Y=0 Z=-10.204
395 X=66.883 Y=0 Z=-10.231
396 X=67.767 Y=0 Z=-10.258
397 X=68.65 Y=0 Z=-10.285
398 X=69.533 Y=0 Z=-10.312
399 X=70.417 Y=0 Z=-10.339
400 X=71.3 Y=0 Z=-10.366
401 X=72.183 Y=0 Z=-10.393
402 X=73.067 Y=0 Z=-10.42
403 X=73.95 Y=0 Z=-10.447
404 X=74.833 Y=0 Z=-10.474
405 X=75.717 Y=0 Z=-10.501
406 X=76.6 Y=0 Z=-10.528
407 X=77.483 Y=0 Z=-10.555
408 X=78.367 Y=0 Z=-10.582
409 X=79.25 Y=0 Z=-10.609
410 X=80.133 Y=0 Z=-10.636
411 X=81.017 Y=0 Z=-10.663
412 X=81.9 Y=0 Z=-10.69
413 X=82.783 Y=0 Z=-10.717
414 X=83.667 Y=0 Z=-10.744
415 X=84.55 Y=0 Z=-10.771
416 X=85.433 Y=0 Z=-10.798
417 X=86.317 Y=0 Z=-10.825
418 X=87.2 Y=0 Z=-10.852
419 X=88.083 Y=0 Z=-10.879
420 X=88.967 Y=0 Z=-10.906
421 X=89.85 Y=0 Z=-10.933
422 X=90.733 Y=0 Z=-10.96
423 X=91.617 Y=0 Z=-10.987
424 X=92.5 Y=0 Z=-11.014
425 X=93.383 Y=0 Z=-11.041
426 X=94.267 Y=0 Z=-11.068
427 X=95.15 Y=0 Z=-11.095
428 X=96.033 Y=0 Z=-11.122
429 X=96.917 Y=0 Z=-11.149
430 X=97.8 Y=0 Z=-11.176
431 X=98.683 Y=0 Z=-11.203
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433 X=100.45 Y=0 Z=-11.257
434 X=101.333 Y=0 Z=-11.284
435 X=102.217 Y=0 Z=-11.311
436 X=103.1 Y=0 Z=-11.338
437 X=103.983 Y=0 Z=-11.365
438 X=104.867 Y=0 Z=-11.392
439 X=105.75 Y=0 Z=-11.419
440 X=106.633 Y=0 Z=-11.446
441 X=107.517 Y=0 Z=-11.473
442 X=108.4 Y=0 Z=-11.5
443 X=109.283 Y=0 Z=-11.527
444 X=110.167 Y=0 Z=-11.554
445 X=111.05 Y=0 Z=-11.581
446 X=111.933 Y=0 Z=-11.608
447 X=112.817 Y=0 Z=-11.635
448 X=113.7 Y=0 Z=-11.662
449 X=114.583 Y=0 Z=-11.689
450 X=115.467 Y=0 Z=-11.716
451 X=116.35 Y=0 Z=-11.743
452 X=117.233 Y=0 Z=-11.77
453 X=118.117 Y=0 Z=-11.797
454 X=119 Y=0 Z=-11.824
455 X=119.883 Y=0 Z=-11.851
456 X=120.767 Y=0 Z=-11.878
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458 X=122.533 Y=0 Z=-11.932
459 X=123.417 Y=0 Z=-11.959
460 X=124.3 Y=0 Z=-11.986
461 X=125.183 Y=0 Z=-12.013
462 X=126.067 Y=0 Z=-12.04
463 X=126.95 Y=0 Z=-12.067
464 X=127.833 Y=0 Z=-12.094
465 X=128.717 Y=0 Z=-12.121
466 X=129.6 Y=0 Z=-12.148
467 X=130.483 Y=0 Z=-12.175
468 X=131.367 Y=0 Z=-12.202
469 X=132.25 Y=0 Z=-12.229
470 X=133.133 Y=0 Z=-12.256
471 X=134.017 Y=0 Z=-12.283
472 X=134.9 Y=0 Z=-12.31
473 X=135.783 Y=0 Z=-12.337
474 X=136.667 Y=0 Z=-12.364
475 X=137.55 Y=0 Z=-12.391
476 X=138.433 Y=0 Z=-12.418
477 X=139.317 Y=0 Z=-12.445
478 X=140.2 Y=0 Z=-12.472
479 X=141.083 Y=0 Z=-12.499
480 X=141.967 Y=0 Z=-12.526
481 X=142.85 Y=0 Z=-12.553
482 X=143.733 Y=0 Z=-12.58
483 X=144.617 Y=0 Z=-12.607
484 X=145.5 Y=0 Z=-12.634
485 X=146.383 Y=0 Z=-12.661
486 X=147.267 Y=0 Z=-12.688
487 X=148.15 Y=0 Z=-12.715
488 X=149.033 Y=0 Z=-12.742
489 X=149.917 Y=0 Z=-12.769
490 X=150.8 Y=0 Z=-12.796
491 X=151.683 Y=0 Z=-12.823
492 X=152.567 Y=0 Z=-12.85
493 X=153.45 Y=0 Z=-12.877
494 X=154.333 Y=0 Z=-12.904
495 X=155.217 Y=0 Z=-12.931
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507 X=165.817 Y=0 Z=-13.255
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512 X=170.233 Y=0 Z=-13.39
513 X=171.117 Y=0 Z=-13.417
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515 X=172.883 Y=0 Z=-13.471
516 X=173.767 Y=0 Z=-13.498
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518 X=175.533 Y=0 Z=-13.552
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520 X=177.3 Y=0 Z=-13.606
521 X=178.183 Y=0 Z=-13.633
522 X=179.067 Y=0 Z=-13.66
523 X=179.95 Y=0 Z=-13.687
524 X=180.833 Y=0 Z=-13.714
525 X=181.717 Y=0 Z=-13.741
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528 X=184.367 Y=0 Z=-13.822
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532 X=187.9 Y=0 Z=-13.93
533 X=188.783 Y=0 Z=-13.957
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536 X=191.433 Y=0 Z=-14.038
537 X=192.317 Y=0 Z=-14.065
538 X=193.2 Y=0 Z=-14.092
539 X=194.083 Y=0 Z=-14.119
540 X=194.967 Y=0 Z=-14.146
541 X=195.85 Y=0 Z=-14.173
542 X=196.733 Y=0 Z=-14.2
543 X=197.617 Y=0 Z=-14.227
544 X=198.5 Y=0 Z=-14.254
545 X=199.383 Y=0 Z=-14.281
546 X=200.267 Y=0 Z=-14.308
547 X=201.15 Y=0 Z=-14.335
548 X=202.033 Y=0 Z=-14.362
549 X=202.917 Y=0 Z=-14.389
550 X=203.8 Y=0 Z=-14.416
551 X=204.683 Y=0 Z=-14.443
552 X=205.567 Y=0 Z=-14.47
553 X=206.45 Y=0 Z=-14.497
554 X=207.333 Y=0 Z=-14.524
555 X=208.217 Y=0 Z=-14.551
556 X=209.1 Y=0 Z=-14.578
557 X=209.983 Y=0 Z=-14.605
558 X=210.867 Y=0 Z=-14.632
559 X=211.75 Y=0 Z=-14.659
560 X=212.633 Y=0 Z=-14.686
561 X=213.517 Y=0 Z=-14.713
562 X=214.4 Y=0 Z=-14.74
563 X=215.283 Y=0 Z=-14.767
564 X=216.167 Y=0 Z=-14.794
565 X=217.05 Y=0 Z=-14.821
566 X=217.933 Y=0 Z=-14.848
567 X=218.817 Y=0 Z=-14.875
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569 X=220.583 Y=0 Z=-14.929
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571 X=222.35 Y=0 Z=-14.983
572 X=223.233 Y=0 Z=-15.01
573 X=224.117 Y=0 Z=-15.037
574 X=225 Y=0 Z=-15.064
575 X=225.883 Y=0 Z=-15.091
576 X=226.767 Y=0 Z=-15.118
577 X=227.65 Y=0 Z=-15.145
578 X=228.533 Y=0 Z=-15.172
579 X=229.417 Y=0 Z=-15.199
580 X=230.3 Y=0 Z=-15.226
581 X=231.183 Y=0 Z=-15.253
582 X=232.067 Y=0 Z=-15.28
583 X=232.95 Y=0 Z=-15.307
584 X=233.833 Y=0 Z=-15.334
585 X=234.717 Y=0 Z=-15.361
586 X=235.6 Y=0 Z=-15.388
587 X=236.483 Y=0 Z=-15.415
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589 X=238.25 Y=0 Z=-15.469
590 X=239.133 Y=0 Z=-15.496
591 X=240.017 Y=0 Z=-15.523
592 X=240.9 Y=0 Z=-15.55
593 X=241.783 Y=0 Z=-15.577
594 X=242.667 Y=0 Z=-15.604
595 X=243.55 Y=0 Z=-15.631
596 X=244.433 Y=0 Z=-15.658
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598 X=246.2 Y=0 Z=-15.712
599 X=247.083 Y=0 Z=-15.739
600 X=247.967 Y=0 Z=-15.766
601 X=248.85 Y=0 Z=-15.793
602 X=249.733 Y=0 Z=-15.82
603 X=250.617 Y=0 Z=-15.847
604 X=251.5 Y=0 Z=-15.874
605 X=252.383 Y=0 Z=-15.901
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609 X=255.917 Y=0 Z=-16.009
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611 X=257.683 Y=0 Z=-16.063
612 X=258.567 Y=0 Z=-16.09
613 X=259.45 Y=0 Z=-16.117
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615 X=261.217 Y=0 Z=-16.171
616 X=262.1 Y=0 Z=-16.198
617 X=262.983 Y=0 Z=-16.225
618 X=263.867 Y=0 Z=-16.252
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620 X=265.633 Y=0 Z=-16.306
621 X=266.517 Y=0 Z=-16.333
622 X=267.4 Y=0 Z=-16.36
623 X=268.283 Y=0 Z=-16.387
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625 X=270.05 Y=0 Z=-16.441
626 X=270.933 Y=0 Z=-16.468
627 X=271.817 Y=0 Z=-16.495
628 X=272.7 Y=0 Z=-16.522
629 X=273.583 Y=0 Z=-16.549
630 X=274.467 Y=0 Z=-16.576
631 X=275.35 Y=0 Z=-16.603
632 X=276.233 Y=0 Z=-16.63
633 X=277.117 Y=0 Z=-16.657
634 X=278 Y=0 Z=-16.684
635 X=278.883 Y=0 Z=-16.711
636 X=279.767 Y=0 Z=-16.738
637 X=280.65 Y=0 Z=-16.765
638 X=281.533 Y=0 Z=-16.792
639 X=282.417 Y=0 Z=-16.819
640 X=283.3 Y=0 Z=-16.846
641 X=284.183 Y=0 Z=-16.873
642 X=285.067 Y=0 Z=-16.9
643 X=285.95 Y=0 Z=-16.927
644 X=286.833 Y=0 Z=-16.954
645 X=287.717 Y=0 Z=-16.981
646 X=288.6 Y=0 Z=-17.008
647 X=289.483 Y=0 Z=-17.035
648 X=290.367 Y=0 Z=-17.062
649 X=291.25 Y=0 Z=-17.089
650 X=292.133 Y=0 Z=-17.116
651 X=293.017 Y=0 Z=-17.143
652 X=293.9 Y=0 Z=-17.17
653 X=294.783 Y=0 Z=-17.197
654 X=295.667 Y=0 Z=-17.224
655 X=296.55 Y=0 Z=-17.251
656 X=297.433 Y=0 Z=-17.278
657 X=298.317 Y=0 Z=-17.305
658 X=299.2 Y=0 Z=-17.332
659 X=300.083 Y=0 Z=-17.359
660 X=300.967 Y=0 Z=-17.386
661 X=301.85 Y=0 Z=-17.413
662 X=302.733 Y=0 Z=-17.44
663 X=303.617 Y=0 Z=-17.467
664 X=304.5 Y=0 Z=-17.494
665 X=305.383 Y=0 Z=-17.521
666 X=306.267 Y=0 Z=-17.548
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668 X=308.033 Y=0 Z=-17.602
669 X=308.917 Y=0 Z=-17.629
670 X=309.8 Y=0 Z=-17.656
671 X=310.683 Y=0 Z=-17.683
672 X=311.567 Y=0 Z=-17.71
673 X=312.45 Y=0 Z=-17.737
674 X=313.333 Y=0 Z=-17.764
675 X=314.217 Y=0 Z=-17.791
676 X=315.1 Y=0 Z=-17.818
677 X=315.983 Y=0 Z=-17.845
678 X=316.867 Y=0 Z=-17.872
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681 X=319.517 Y=0 Z=-17.953
682 X=320.4 Y=0 Z=-17.98
683 X=321.283 Y=0 Z=-18.007
684 X=322.167 Y=0 Z=-18.034
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686 X=323.933 Y=0 Z=-18.088
687 X=324.817 Y=0 Z=-18.115
688 X=325.7 Y=0 Z=-18.142
689 X=326.583 Y=0 Z=-18.169
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691 X=328.35 Y=0 Z=-18.223
692 X=329.233 Y=0 Z=-18.25
693 X=330.117 Y=0 Z=-18.277
694 X=331 Y=0 Z=-18.304
695 X=331.883 Y=0 Z=-18.331
696 X=332.767 Y=0 Z=-18.358
697 X=333.65 Y=0 Z=-18.385
698 X=334.533 Y=0 Z=-18.412
699 X=335.417 Y=0 Z=-18.439
700 X=336.3 Y=0 Z=-18.466
701 X=337.183 Y=0 Z=-18.493
702 X=338.067 Y=0 Z=-18.52
703 X=338.95 Y=0 Z=-18.547
704 X=339.833 Y=0 Z=-18.574
705 X=340.717 Y=0 Z=-18.601
706 X=341.6 Y=0 Z=-18.628
707 X=342.483 Y=0 Z=-18.655
708 X=343.367 Y=0 Z=-18.682
709 X=344.25 Y=0 Z=-18.709
710 X=345.133 Y=0 Z=-18.736
711 X=346.017 Y=0 Z=-18.763
712 X=346.9 Y=0 Z=-18.79
713 X=347.783 Y=0 Z=-18.817
714 X=348.667 Y=0 Z=-18.844
715 X=349.55 Y=0 Z=-18.871
716 X=350.433 Y=0 Z=-18.898
717 X=351.317 Y=0 Z=-18.925
718 X=352.2 Y=0 Z=-18.952
719 X=353.083 Y=0 Z=-18.979
720 X=353.967 Y=0 Z=-19.006
721 X=354.85 Y=0 Z=-19.033
722 X=355.733 Y=0 Z=-19.06
723 X=356.617 Y=0 Z=-19.087
724 X=357.5 Y=0 Z=-19.114
725 X=358.383 Y=0 Z=-19.141
726 X=359.267 Y=0 Z=-19.168
727 X=360.15 Y=0 Z=-19.195
728 X=361.033 Y=0 Z=-19.222
729 X=361.917 Y=0 Z=-19.249
730

File: \\박유원\SAP2000 DATA\PAB\MAT4.S2k 10/9/02
10:03:10AM

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RR-3-3
STATICLOAD SW TYPE DEAD
STATICLOAD PV TYPE DEAD
STATICLOAD PN TYPE DEAD
STATICLOAD PWN TYPE DEAD
STATICLOAD PWN TYPE DEAD
STATICLOAD PN TYPE DEAD
STATICLOAD PL TYPE DEAD
STATICLOAD PVL TYPE DEAD
END SUPPLEMENTAL DATA

```

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File: \\서우원\SAF2000 DATA\PAE\MAT6.02k 10/9/0
10:17:26AM

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J=2.861003E-02 I=1.041667E-02,4.897667E-02
AS=.4166667,.4166667
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10/17/268M
201 -J202.201.321 REC-HALL1 NERSB-1 ANG-0
202 -J202.413.924 REC-HALL1 NERSB-1 ANG-0
100FF-375 RIGID=0
203 -J301.301.321 REC-HALL1 NERSB-1 ANG-0
204 -J301.402.324 REC-HALL1 NERSB-1 ANG-0
100FF-475 RIGID=0
205 -J401.401.424 REC-HALL1 NERSB-1 ANG-0
206 -J401.402.424 REC-HALL1 NERSB-1 ANG-0
100FF-075 RIGID=0
402 -J403.403.424 REC-HALL1 NERSB-1 ANG-0
403 -J404.405.424 REC-HALL1 NERSB-1 ANG-0
404 -J405.406.424 REC-HALL1 NERSB-1 ANG-0
405 -J406.407.424 REC-HALL1 NERSB-1 ANG-0
406 -J407.408.424 REC-HALL1 NERSB-1 ANG-0
407 -J408.409.424 REC-HALL1 NERSB-1 ANG-0
408 -J409.410.424 REC-HALL1 NERSB-1 ANG-0
409 -J410.411.424 REC-HALL1 NERSB-1 ANG-0
410 -J411.412.424 REC-HALL1 NERSB-1 ANG-0
411 -J412.413.424 REC-HALL1 NERSB-1 ANG-0
412 -J413.414.424 REC-HALL1 NERSB-1 ANG-0
413 -J414.415.424 REC-HALL1 NERSB-1 ANG-0
414 -J415.416.424 REC-HALL1 NERSB-1 ANG-0
415 -J416.417.424 REC-HALL1 NERSB-1 ANG-0
416 -J417.418.424 REC-HALL1 NERSB-1 ANG-0
417 -J418.419.424 REC-HALL1 NERSB-1 ANG-0
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418 -J419.420.424 REC-HALL1 NERSB-1 ANG-0
100FF-3 RIGID=0
419 -J420.421.424 REC-HALL1 NERSB-1 ANG-0
420 -J421.422.424 REC-HALL1 NERSB-1 ANG-0
421 -J422.423.424 REC-HALL1 NERSB-1 ANG-0
422 -J423.424.424 REC-HALL1 NERSB-1 ANG-0
423 -J424.425.424 REC-HALL1 NERSB-1 ANG-0
424 -J425.426.424 REC-HALL1 NERSB-1 ANG-0
425 -J426.427.424 REC-HALL1 NERSB-1 ANG-0
426 -J427.428.424 REC-HALL1 NERSB-1 ANG-0
427 -J428.429.424 REC-HALL1 NERSB-1 ANG-0
428 -J429.430.424 REC-HALL1 NERSB-1 ANG-0
429 -J430.431.424 REC-HALL1 NERSB-1 ANG-0
430 -J431.432.424 REC-HALL1 NERSB-1 ANG-0
431 -J432.433.424 REC-HALL1 NERSB-1 ANG-0
432 -J433.434.424 REC-HALL1 NERSB-1 ANG-0
433 -J434.435.424 REC-HALL1 NERSB-1 ANG-0
434 -J435.436.424 REC-HALL1 NERSB-1 ANG-0
100FF-075 RIGID=0
435 -J436.437.424 REC-HALL1 NERSB-1 ANG-0

LOND
NMRB=5M
NMRB=10
TYPE=DISTRIBUTED SPAN
ACD-5 RE=D-0.1 US=-12.459, -11.602
ACD-6 RE=D-0.1 US=-12.602, -9.766
ACD-7 RE=D-0.1 US=-12.602, -9.766
ACD-8 RE=D-0.1 US=-12.602, -9.766
ACD-9 RE=D-0.1 US=-9.666, -8.279
ACD-10 RE=D-0.1 US=-9.666, -8.279
ACD-11 RE=D-0.1 US=-7.143, -6.452
ACD-12 RE=D-0.1 US=-7.143, -6.452
ACD-13 RE=D-0.1 US=-6.452, -6.452
ACD-14 RE=D-0.1 US=-5.939, -6.452
ACD-15 RE=D-0.1 US=-6.452, -6.452
ACD-16 RE=D-0.1 US=-6.446, -7.143
ACD-17 RE=D-0.1 US=-7.143, -8.719
ACD-18 RE=D-0.1 US=-8.719, -9.766
ACD-19 RE=D-0.1 US=-9.766, -10.226
ACD-20 RE=D-0.1 US=-10.226, -11.602
ACD-21 RE=D-0.1 US=-10.778, -11.602
ACD-22 RE=D-0.1 US=-11.602, -12.459
ACD-23 RE=D-0.1 US=-12.459, -13.606
ACD-32 RE=D-0.1 US=-11.602, -10.778
ACD-33 RE=D-0.1 US=-10.778, -9.766
ACD-34 RE=D-0.1 US=-10.226, -9.666
ACD-35 RE=D-0.1 US=-9.666, -8.379
ACD-36 RE=D-0.1 US=-8.379, -6.452
ACD-37 RE=D-0.1 US=-7.143, -6.452
ACD-38 RE=D-0.1 US=-6.446, -6.452
ACD-39 RE=D-0.1 US=-6.452, -6.452
ACD-40 RE=D-0.1 US=-6.452, -6.452
ACD-41 RE=D-0.1 US=-6.452, -6.452
ACD-42 RE=D-0.1 US=-6.446, -7.143
ACD-43 RE=D-0.1 US=-7.143, -8.719
ACD-44 RE=D-0.1 US=-8.719, -9.766
ACD-45 RE=D-0.1 US=-9.766, -10.226
ACD-46 RE=D-0.1 US=-10.226, -11.602
ACD-47 RE=D-0.1 US=-10.778, -11.602
ACD-48 RE=D-0.1 US=-11.602, -12.459
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TYPE=DISTRIBUTED SPAN
ACD-10 RE=D-0.1 US=-10.463, 9.787

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ADD-2 RD=0.1 UX=7.862,7.241
ADD-3 RD=0.1 UX=7.241,6.621
ADD-4 RD=0.1 UX=6.621,6.216
ADD-5 RD=0.1 UX=6.216,5.805
ADD-6 RD=0.1 UX=5.805,5.409
ADD-7 RD=0.1 UX=5.409,5.144
ADD-8 RD=0.1 UX=5.144,4.828
ADD-9 RD=0.1 UX=4.828,4.428
ADD-10 RD=0.1 UX=4.428,3.985
ADD-11 RD=0.1 UX=3.985,3.531
ADD-12 RD=0.1 UX=3.531,3.142
ADD-13 RD=0.1 UX=3.142,2.621
ADD-14 RD=0.1 UX=2.621,2.189
ADD-15 RD=0.1 UX=2.189,1.862
ADD-16 RD=0.1 UX=1.862,1.506
ADD-17 RD=0.1 UX=1.506,1.186
ADD-18 RD=0.1 UX=1.186,0.886
ADD-19 RD=0.1 UX=0.886,0.615
ADD-20 RD=0.1 UX=0.615,0.331
ADD-21 RD=0.1 UX=0.331,0.085
ADD-22 RD=0.1 UX=0.085,-0.186
ADD-23 RD=0.1 UX=-0.186,-0.506
ADD-24 RD=0.1 UX=-0.506,-0.886
ADD-25 RD=0.1 UX=-0.886,-1.186
ADD-26 RD=0.1 UX=-1.186,-1.506
ADD-27 RD=0.1 UX=-1.506,-1.862
ADD-28 RD=0.1 UX=-1.862,-2.189
ADD-29 RD=0.1 UX=-2.189,-2.621
ADD-30 RD=0.1 UX=-2.621,-3.142
ADD-31 RD=0.1 UX=-3.142,-3.531
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ADD-33 RD=0.1 UX=-3.985,-4.428
ADD-34 RD=0.1 UX=-4.428,-4.828
ADD-35 RD=0.1 UX=-4.828,-5.144
ADD-36 RD=0.1 UX=-5.144,-5.409
ADD-37 RD=0.1 UX=-5.409,-5.805
ADD-38 RD=0.1 UX=-5.805,-6.216
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ADD-40 RD=0.1 UX=-6.621,-7.241
ADD-41 RD=0.1 UX=-7.241,-7.862
ADD-42 RD=0.1 UX=-7.862,-8.483
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ADD-44 RD=0.1 UX=-9.029,-9.589
ADD-45 RD=0.1 UX=-9.589,-10.172

TYPE=DISTRIBUTED SPAN
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ADD-354 RD=0.1 UX=112.554,112.883
ADD-355 RD=0.1 UX=112.883,113.212
ADD-356 RD=0.1 UX=113.212,113.541
ADD-357 RD=0.1 UX=113.541,113.870
ADD-358 RD=0.1 UX=113.870,114.200
ADD-359 RD=0.1 UX=114.200,114.529
ADD-360 RD=0.1 UX=114.529,114.858
ADD-361 RD=0.1 UX=114.858,115.187
ADD-362 RD=0.1 UX=115.187,115.516
ADD-363 RD=0.1 UX=115.516,115.845
ADD-364 RD=0.1 UX=115.845,116.174
ADD-365 RD=0.1 UX=116.174,116.503
ADD-366 RD=0.1 UX=116.503,116.832
ADD-367 RD=0.1 UX=116.832,117.161
ADD-368 RD=0.1 UX=117.161,117.490
ADD-369 RD=0.1 UX=117.490,117.

45 X=12.082 Y=0 Z=-1.131
 46 X=13.284 Y=0 Z=-1.832
 47 X=13.748 Y=0 Z=-2.165
 48 X=14.107 Y=0 Z=-2.444
 49 X=14.166 Y=0 Z=-2.85
 50 X=14.23 Y=0 Z=-3.233
 51 X=14.25 Y=0 Z=-3.719
 52 X=14.25 Y=0 Z=-4.372
 53 X=14.25 Y=0 Z=-5.025
 54 X=14.25 Y=0 Z=-5.679
 101 X=14.325 Y=0 Z=-5.679
 102 X=14.325 Y=0 Z=-7.052
 201 X=0 Y=0 Z=-5.679
 202 X=0 Y=0 Z=-7.475
 301 X=14.325 Y=0 Z=-5.679
 302 X=14.325 Y=0 Z=-7.938
 401 X=-15.25 Y=0 Z=-7.764
 402 X=-14.325 Y=0 Z=-7.764
 403 X=-13.9 Y=0 Z=-7.777
 404 X=-13.017 Y=0 Z=-7.804
 405 X=-12.133 Y=0 Z=-7.83
 406 X=-11.25 Y=0 Z=-7.857
 407 X=-10.367 Y=0 Z=-7.883
 408 X=-9.484 Y=0 Z=-7.91
 409 X=-8.6 Y=0 Z=-7.936
 410 X=-7.717 Y=0 Z=-7.963
 411 X=-6.834 Y=0 Z=-7.989
 412 X=-5.95 Y=0 Z=-8.016
 413 X=-5.067 Y=0 Z=-8.042
 414 X=-4.184 Y=0 Z=-8.069
 415 X=-3.3 Y=0 Z=-8.098
 416 X=-2.417 Y=0 Z=-8.122
 417 X=-1.534 Y=0 Z=-8.148
 418 X=-.65 Y=0 Z=-8.175
 419 X=0 Y=0 Z=-8.194
 420 X=.65 Y=0 Z=-8.214
 421 X=1.534 Y=0 Z=-8.241
 422 X=2.417 Y=0 Z=-8.267
 423 X=3.3 Y=0 Z=-8.291
 424 X=4.184 Y=0 Z=-8.32
 425 X=5.067 Y=0 Z=-8.347
 426 X=5.95 Y=0 Z=-8.373
 427 X=6.834 Y=0 Z=-8.4
 428 X=7.717 Y=0 Z=-8.426
 429 X=8.6 Y=0 Z=-8.453
 430 X=9.484 Y=0 Z=-8.479
 431 X=10.367 Y=0 Z=-8.506
 432 X=11.25 Y=0 Z=-8.532
 433 X=12.133 Y=0 Z=-8.559
 434 X=13.017 Y=0 Z=-8.585

435 X=13.9 Y=0 Z=-8.612
 436 X=14.325 Y=0 Z=-8.625
 437 X=15.25 Y=0 Z=-8.625

PATTERN
 NAME=TEMP
 NAME=PRES

SPRING
 ADD=401 U3=201054.2
 ADD=402 U3=293445
 ADD=403 U3=284315.6
 ADD=404 U3=384087
 ADD=405 U3=384087
 ADD=406 U3=383869.6
 ADD=407 U3=383869.6
 ADD=408 U3=384087
 ADD=409 U3=384087
 ADD=410 U3=383869.6
 ADD=411 U3=384087
 ADD=412 U3=384087
 ADD=413 U3=383869.6
 ADD=414 U3=384087
 ADD=415 U3=384087
 ADD=416 U3=383869.6
 ADD=417 U3=384087
 ADD=418 U3=333440.5
 ADD=419 U3=100000 U5=292576.7
 ADD=420 U3=333440.5
 ADD=421 U3=384087
 ADD=422 U3=383869.6
 ADD=423 U3=384087
 ADD=424 U3=384087
 ADD=425 U3=383869.6
 ADD=426 U3=384087
 ADD=427 U3=384087
 ADD=428 U3=383869.6
 ADD=429 U3=384087
 ADD=430 U3=384087
 ADD=431 U3=383869.6
 ADD=432 U3=383869.6
 ADD=433 U3=384087
 ADD=434 U3=384087
 ADD=435 U3=284315.6
 ADD=436 U3=293445
 ADD=437 U3=201054.2

MATERIAL
 NAME=CONC IDES=C M=.2448 W=2.5
 T=0 E=2800000 U=.2 A=.00001

NAME=STEEL IDES=S
 T=0 E=2E+10 U=.3 A=.0000117 FY=25310.51
 NAME=RIGID IDES=C
 T=0 E=2454750 U=.3 A=.00001
 NAME=CONC1 IDES=C M=.2448 W=2.5
 T=0 E=2454750 U=.2 A=.00001
 FRAME SECTION
 NAME=T1 MAT=CONC SH-R T=.5,1 A=.5 J=2.861003E-02 I=1.041667E-02,4.897667E-02
 AS=.4166667,.4166667
 NAME=T2 MAT=CONC SH-R T=.542,1 A=.542 J=3.508126E-02 I=1.325834E-02,4.516667E-02
 AS=.4516667,.4516667
 NAME=T3 MAT=CONC SH-R T=.675,1 A=.675 J=5.967503E-02 I=2.582891E-02,.05625 AS=.5625,.5625
 NAME=T4 MAT=CONC SH-R T=.916,1 A=.916 J=.1170223 I=.6.404794E-02,7.633333E-02
 AS=.7633333,.7633333
 NAME=T5 MAT=CONC SH-R T=.86,1 A=.69 J=6.070982E-02 I=2.620267E-02,5.666667E-02
 AS=.5666667,.5666667
 NAME=T6 MAT=CONC SH-R T=.553,1 A=.553 J=3.688483E-02 I=.0140327,4.608333E-02
 AS=.4608333,.4608333
 NAME=T7 MAT=CONC SH-R T=.511,1 A=.511 J=3.024029E-02 I=.0111194,4.258334E-02
 AS=.4258333,.4258333
 NAME=T8 MAT=CONC SH-R T=.5,1 A=.5 J=2.861003E-02 I=1.041667E-02,4.897667E-02
 AS=.4166667,.4166667
 NAME=FOOT MAT=CONC1 SH-R T=1.4,1 A=1.4 J=.2612221 I=.2286666,.1166667 AS=1.166667,1.166667
 NAME=WALL MAT=CONC1 SH-R T=.85,1 A=.85 J=9.985562E-02 I=.4.117709E-02,7.083333E-02
 AS=.7083334,.7083334
 NAME=RIGID MAT=RIGID SH-R T=10,10 A=100 J=1408.333 I=833.5623,833.5623 AS=83.56233,83.56233
 NAME=WALL1 MAT=CONC1 SH-R T=1.3,1 A=1.3 J=.2294606 I=.1830833,.1083333 AS=1.083333,1.083333
 NAME=VAR1 TYPE=NONPR
 SEC=T1,T2 EIVAR=1,1 L=.426
 NAME=VAR2 TYPE=NONPR
 SEC=T2,T3 EIVAR=1,1 L=.436
 NAME=VAR3 TYPE=NONPR
 SEC=T3,T4 EIVAR=1,1 L=.422
 NAME=VAR4 TYPE=NONPR
 SEC=T4,T5 EIVAR=1,1 L=.455
 NAME=VAR5 TYPE=NONPR
 SEC=T5,T6 EIVAR=1,1 L=.563
 NAME=VAR6 TYPE=NONPR
 SEC=T6,T7 EIVAR=1,1 L=1.382
 NAME=VAR7 TYPE=NONPR
 SEC=T7,T8 EIVAR=1,1 L=1.313

FRAME
 1 J=1,2 SEC=T1 NSEG=1 ANG=180 IREL=R3
 2 J=2,3 SEC=T1 NSEG=1 ANG=180
 3 J=3,4 SEC=T1 NSEG=1 ANG=180
 4 J=4,5 SEC=VAR1 NSEG=1 ANG=0
 5 J=5,6 SEC=VAR2 NSEG=1 ANG=0
 6 J=6,7 SEC=VAR3 NSEG=1 ANG=0

7 J=7,8 SEC=VAR4 NSEG=1 ANG=0
 8 J=8,9 SEC=VAR5 NSEG=1 ANG=0
 9 J=9,10 SEC=VAR6 NSEG=1 ANG=0
 10 J=10,11 SEC=VAR7 NSEG=1 ANG=0
 11 J=11,12 SEC=T8 NSEG=1 ANG=0
 12 J=12,13 SEC=T8 NSEG=1 ANG=0
 13 J=13,14 SEC=T8 NSEG=1 ANG=0
 14 J=14,15 SEC=T8 NSEG=1 ANG=0
 15 J=15,16 SEC=T8 NSEG=1 ANG=0
 16 J=16,17 SEC=T8 NSEG=1 ANG=0
 17 J=17,18 SEC=VAR7 NSEG=1 ANG=0
 18 J=18,19 SEC=VAR6 NSEG=1 ANG=0
 19 J=19,20 SEC=VAR5 NSEG=1 ANG=0
 20 J=20,21 SEC=VAR4 NSEG=1 ANG=0
 21 J=21,22 SEC=VAR3 NSEG=1 ANG=0
 22 J=22,23 SEC=VAR2 NSEG=1 ANG=0
 23 J=23,24 SEC=VAR1 NSEG=1 ANG=0
 24 J=24,25 SEC=T1 NSEG=1 ANG=0
 25 J=25,26 SEC=T1 NSEG=1 ANG=0
 26 J=26,27 SEC=T1 NSEG=1 ANG=0 JREL=R3
 27 J=28,29 SEC=T1 NSEG=1 ANG=180 IREL=R3
 28 J=29,30 SEC=T1 NSEG=1 ANG=180
 29 J=30,31 SEC=T1 NSEG=1 ANG=180
 30 J=31,32 SEC=VAR1 NSEG=1 ANG=0
 31 J=32,33 SEC=VAR2 NSEG=1 ANG=0
 32 J=33,34 SEC=VAR3 NSEG=1 ANG=0
 33 J=34,35 SEC=VAR4 NSEG=1 ANG=0
 34 J=35,36 SEC=VAR5 NSEG=1 ANG=0
 35 J=36,37 SEC=VAR6 NSEG=1 ANG=0
 36 J=37,38 SEC=VAR7 NSEG=1 ANG=0
 37 J=38,39 SEC=T8 NSEG=1 ANG=0
 38 J=39,40 SEC=T8 NSEG=1 ANG=0
 39 J=40,41 SEC=T8 NSEG=1 ANG=0
 40 J=41,42 SEC=T8 NSEG=1 ANG=0
 41 J=42,43 SEC=T8 NSEG=1 ANG=0
 42 J=43,44 SEC=T8 NSEG=1 ANG=0
 43 J=44,45 SEC=VAR7 NSEG=1 ANG=0
 44 J=45,46 SEC=VAR6 NSEG=1 ANG=0
 45 J=46,47 SEC=VAR5 NSEG=1 ANG=0
 46 J=47,48 SEC=VAR4 NSEG=1 ANG=0
 47 J=48,49 SEC=VAR3 NSEG=1 ANG=0
 48 J=49,50 SEC=VAR2 NSEG=1 ANG=0
 49 J=50,51 SEC=VAR1 NSEG=1 ANG=0
 50 J=51,52 SEC=T1 NSEG=1 ANG=0
 52 J=52,53 SEC=T1 NSEG=1 ANG=0
 53 J=53,54 SEC=T1 NSEG=1 ANG=0 JREL=R3
 85 J=28,201 SEC=RIGID NSEG=1 ANG=0
 86 J=201,27 SEC=RIGID NSEG=1 ANG=0
 87 J=301,54 SEC=RIGID NSEG=1 ANG=0
 88 J=1,101 SEC=RIGID NSEG=1 ANG=0

101 J=102,101 SEC=WALL NSEG=1 ANG=180
 102 J=402,102 SEC=WALL NSEG=1 ANG=180 IOFF=.02475 RIGID=0
 201 J=202,201 SEC=WALL1 NSEG=1 ANG=0
 202 J=419,202 SEC=WALL1 NSEG=1 ANG=0 IOFF=.375 RIGID=0
 301 J=301,302 SEC=WALL NSEG=1 ANG=0
 302 J=302,436 SEC=WALL NSEG=1 ANG=0 JOFF=.4875 RIGID=0
 400 J=401,402 SEC=FOOT NSEG=1 ANG=0
 401 J=402,403 SEC=FOOT NSEG=1 ANG=0 IOFF=.075 RIGID=0
 402 J=403,404 SEC=FOOT NSEG=1 ANG=0
 403 J=404,405 SEC=FOOT NSEG=1 ANG=0
 404 J=405,406 SEC=FOOT NSEG=1 ANG=0
 405 J=406,407 SEC=FOOT NSEG=1 ANG=0
 406 J=407,408 SEC=FOOT NSEG=1 ANG=0
 407 J=408,409 SEC=FOOT NSEG=1 ANG=0
 408 J=409,410 SEC=FOOT NSEG=1 ANG=0
 409 J=410,411 SEC=FOOT NSEG=1 ANG=0
 410 J=411,412 SEC=FOOT NSEG=1 ANG=0
 411 J=412,413 SEC=FOOT NSEG=1 ANG=0
 412 J=413,414 SEC=FOOT NSEG=1 ANG=0
 413 J=414,415 SEC=FOOT NSEG=1 ANG=0
 414 J=415,416 SEC=FOOT NSEG=1 ANG=0
 415 J=416,417 SEC=FOOT NSEG=1 ANG=0
 416 J=417,418 SEC=FOOT NSEG=1 ANG=0
 417 J=418,419 SEC=FOOT NSEG=1 ANG=0 JOFF=.3 RIGID=0
 418 J=419,420 SEC=FOOT NSEG=1 ANG=0 IOFF=.3 RIGID=0
 419 J=420,421 SEC=FOOT NSEG=1 ANG=0
 420 J=421,422 SEC=FOOT NSEG=1 ANG=0
 421 J=422,423 SEC=FOOT NSEG=1 ANG=0
 422 J=423,424 SEC=FOOT NSEG=1 ANG=0
 423 J=424,425 SEC=FOOT NSEG=1 ANG=0
 424 J=425,426 SEC=FOOT NSEG=1 ANG=0
 425 J=426,427 SEC=FOOT NSEG=1 ANG=0
 426 J=427,428 SEC=FOOT NSEG=1 ANG=0
 427 J=428,429 SEC=FOOT NSEG=1 ANG=0
 428 J=429,430 SEC=FOOT NSEG=1 ANG=0
 429 J=430,431 SEC=FOOT NSEG=1 ANG=0
 430 J=431,432 SEC=FOOT NSEG=1 ANG=0
 431 J=432,433 SEC=FOOT NSEG=1 ANG=0
 432 J=433,434 SEC=FOOT NSEG=1 ANG=0
 433 J=434,435 SEC=FOOT NSEG=1 ANG=0
 434 J=435,436 SEC=FOOT NSEG=1 ANG=0 JOFF=.075 RIGID=0
 435 J=436,437 SEC=FOOT NSEG=1 ANG=0

LOAD
 NAME=SW SF=1
 NAME=PH
 TYPE=DISTRIBUTED SPAN
 ADD=1 RD=0,1 UX=3.07,2.45
 ADD=2 RD=0,1 UX=2.45,1.83
 ADD=3 RD=0,1 UX=1.83,1.21

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LOAD=PVL SF=1
 NAME=COMB5 TYPE=ENVE
 COMB=COMB1 SF=1
 COMB=COMB2 SF=1
 NAME=COMB6 TYPE=ENVE
 COMB=COMB3 SF=1
 COMB=COMB4 SF=1

OUTPUT
 : No Output Requested

END

: The following data is used for graphics, design and pushover analysis.
 : If changes are made to the analysis data above, then the following data
 : should be checked for consistency.

SAP2000 V7.10 SUPPLEMENTAL DATA
 GRID GLOBAL X "1" -15.25
 GRID GLOBAL Y "2" 0
 GRID GLOBAL Z "3" -8.625
 GRID GLOBAL X "4" 0
 GRID GLOBAL Z "5" 0
 GRID GLOBAL X "6" 15.25
 MATERIAL STEEL FY 25310.51
 MATERIAL CONC FYREBAR 40000 FYSHEAR 28122.79 FC 4000 FCSHEAR 2812.279
 MATERIAL RIGID FYREBAR 40000 FYSHEAR 28122.79 FC 4000 FCSHEAR 2812.279
 MATERIAL CONC1 FYREBAR 40000 FYSHEAR 28122.79 FC 4000 FCSHEAR 2812.279
 CONCRETESECTION T1 COLUMN COVER .05 REBAR RR-3-3
 CONCRETESECTION T2 COLUMN COVER .0542 REBAR RR-3-3
 CONCRETESECTION T3 COLUMN COVER .0675 REBAR RR-3-3
 CONCRETESECTION T4 COLUMN COVER .0916 REBAR RR-3-3
 CONCRETESECTION T5 COLUMN COVER .068 REBAR RR-3-3
 CONCRETESECTION T6 COLUMN COVER .0553 REBAR RR-3-3
 CONCRETESECTION T7 COLUMN COVER .0511 REBAR RR-3-3
 CONCRETESECTION T8 COLUMN COVER .05 REBAR RR-3-3
 CONCRETESECTION FOOT COLUMN COVER .14 REBAR RR-3-3
 CONCRETESECTION WALL COLUMN COVER .085 REBAR RR-3-3
 CONCRETESECTION RIGID COLUMN COVER 1 REBAR RR-3-3
 CONCRETESECTION WALL1 COLUMN COVER .13 REBAR RR-3-3
 STAT1CLOAD SW TYPE DEAD
 STAT1CLOAD PH TYPE DEAD
 STAT1CLOAD PVL TYPE DEAD
 END SUPPLEMENTAL DATA

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ADD=4 RD=0,1 UX=1.21,.81
 ADD=5 RD=0,1 UX=.81,.4
 ADD=6 RD=0,1 UX=.4,0
 ADD=53 RD=0,1 UX=-2.45,-3.07
 ADD=52 RD=0,1 UX=-1.83,-2.45
 ADD=50 RD=0,1 UX=-1.21,-1.83
 ADD=49 RD=0,1 UX=-.81,-1.21
 ADD=48 RD=0,1 UX=-.4,-.81
 ADD=47 RD=0,1 UX=0,-.4
 ADD=102 RD=0,1 UX=5.05,4.38
 ADD=101 RD=0,1 UX=4.38,3.07
 ADD=302 RD=0,1 UX=-5.22,-5.87
 ADD=301 RD=0,1 UX=-3.07,-5.22

NAME=PVL
 TYPE=DISTRIBUTED SPAN
 ADD=1 RD=0,1 UX=.5,.5
 ADD=2 RD=0,1 UX=.5,.5
 ADD=3 RD=0,1 UX=.5,.5
 ADD=4 RD=0,1 UX=.5,.5
 ADD=5 RD=0,1 UX=.5,.5
 ADD=6 RD=0,1 UX=.5,.5
 ADD=88 RD=0,1 UX=.5,.5
 ADD=101 RD=0,1 UX=.5,.5
 ADD=102 RD=0,1 UX=.5,.5
 ADD=47 RD=0,1 UX=-.5,-.5
 ADD=48 RD=0,1 UX=-.5,-.5
 ADD=49 RD=0,1 UX=-.5,-.5
 ADD=50 RD=0,1 UX=-.5,-.6
 ADD=52 RD=0,1 UX=-.5,-.5
 ADD=53 RD=0,1 UX=-.5,-.5
 ADD=87 RD=0,1 UX=-.5,-.5
 ADD=301 RD=0,1 UX=-.5,-.5
 ADD=302 RD=0,1 UX=-.5,-.5

COMBO

NAME=COMB1
 LOAD=SW SF=1.3
 LOAD=PH SF=1.7
 LOAD=PVL SF=1.3
 NAME=COMB2
 LOAD=SW SF=1.3
 LOAD=PH SF=.65
 LOAD=PVL SF=1.3
 NAME=COMB3
 LOAD=SW SF=1
 LOAD=PH SF=1
 LOAD=PVL SF=1
 NAME=COMB4
 LOAD=SW SF=1
 LOAD=PH SF=.5

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4. SAP2000 INPUT DATA 첨부

CASE1	활하중영함검토토1.\$2K
CASE2	활하중영함검토토2.\$2K
CASE3	활하중영함검토토3.\$2K

: File D:\SWAP2000DATA\W개척시티날W활하중영함검토토1.\$2k saved 11-25-02 13:32:32 in Ton-m

SYSTEM

DOF=UX,UZ,RY LENGTH=m FORCE=Ton LINES=69

JOINT

1 X=-14.25 Y=0 Z=-5.679
 2 X=-14.25 Y=0 Z=-5.026
 3 X=-14.25 Y=0 Z=-4.372
 4 X=-14.25 Y=0 Z=-3.719
 5 X=-14.23 Y=0 Z=-3.293
 6 X=-14.186 Y=0 Z=-2.86
 7 X=-14.107 Y=0 Z=-2.444
 8 X=-13.748 Y=0 Z=-2.165
 9 X=-13.294 Y=0 Z=-1.832
 10 X=-12.092 Y=0 Z=-1.131
 11 X=-10.887 Y=0 Z=-.608
 12 X=-9.683 Y=0 Z=-.256
 13 X=-8.479 Y=0 Z=-.057
 14 X=-7.275 Y=0 Z=0
 15 X=-6.071 Y=0 Z=-.057
 16 X=-4.867 Y=0 Z=-.256
 17 X=-3.663 Y=0 Z=-.608
 18 X=-2.458 Y=0 Z=-1.131
 19 X=-1.256 Y=0 Z=-1.832
 20 X=-.795 Y=0 Z=-2.165
 21 X=-.443 Y=0 Z=-2.444
 22 X=-.369 Y=0 Z=-2.86
 23 X=-.318 Y=0 Z=-3.293
 24 X=-.3 Y=0 Z=-3.719
 25 X=-.3 Y=0 Z=-4.372
 26 X=-.3 Y=0 Z=-5.026
 27 X=-.3 Y=0 Z=-5.679
 28 X=.3 Y=0 Z=-5.679
 29 X=.3 Y=0 Z=-5.026
 30 X=.3 Y=0 Z=-4.372
 31 X=.3 Y=0 Z=-3.719
 32 X=.318 Y=0 Z=-3.293
 33 X=.369 Y=0 Z=-2.86
 34 X=.443 Y=0 Z=-2.444
 35 X=.795 Y=0 Z=-2.165
 36 X=1.256 Y=0 Z=-1.832

37 X=2.458 Y=0 Z=-1.131

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38 X=-3.663 Y=0 Z=-.908
39 X=4.667 Y=0 Z=-.256
40 X=6.071 Y=0 Z=-.057
41 X=7.275 Y=0 Z=0
42 X=8.479 Y=0 Z=-.057
43 X=9.683 Y=0 Z=-.256
44 X=10.887 Y=0 Z=-.608
45 X=12.092 Y=0 Z=-1.131
46 X=13.294 Y=0 Z=-1.832
47 X=13.748 Y=0 Z=-2.165
48 X=14.107 Y=0 Z=-2.444
49 X=14.166 Y=0 Z=-2.86
50 X=14.23 Y=0 Z=-3.293
51 X=14.25 Y=0 Z=-3.719
52 X=14.25 Y=0 Z=-4.372
53 X=14.25 Y=0 Z=-5.026
54 X=14.25 Y=0 Z=-5.679
101 X=-14.325 Y=0 Z=-5.679
102 X=-14.325 Y=0 Z=-7.789
201 X=0 Y=0 Z=-5.679
202 X=0 Y=0 Z=-7.789
301 X=14.325 Y=0 Z=-5.679
302 X=14.325 Y=0 Z=-7.789
401 X=-15.25 Y=0 Z=-8.489
402 X=-14.325 Y=0 Z=-8.489
403 X=-13.9 Y=0 Z=-8.489
404 X=-13.017 Y=0 Z=-8.489
405 X=-12.133 Y=0 Z=-8.489
406 X=-11.25 Y=0 Z=-8.489
407 X=-10.367 Y=0 Z=-8.489
408 X=-9.484 Y=0 Z=-8.489
409 X=-8.6 Y=0 Z=-8.489
410 X=-7.717 Y=0 Z=-8.489
411 X=-6.834 Y=0 Z=-8.489
412 X=-5.95 Y=0 Z=-8.489
413 X=-5.067 Y=0 Z=-8.489
414 X=-4.184 Y=0 Z=-8.489
415 X=-3.3 Y=0 Z=-8.489
416 X=-2.417 Y=0 Z=-8.489
417 X=-1.534 Y=0 Z=-8.489
418 X=-.65 Y=0 Z=-8.489
419 X=0 Y=0 Z=-8.489
420 X=.65 Y=0 Z=-8.489
421 X=1.534 Y=0 Z=-8.489
422 X=2.417 Y=0 Z=-8.489
423 X=3.3 Y=0 Z=-8.489
424 X=4.184 Y=0 Z=-8.489
425 X=5.067 Y=0 Z=-8.489
426 X=5.95 Y=0 Z=-8.489
427 X=6.834 Y=0 Z=-8.489
428 X=7.717 Y=0 Z=-8.489
429 X=8.6 Y=0 Z=-8.489
430 X=9.484 Y=0 Z=-8.489
431 X=10.367 Y=0 Z=-8.489
432 X=11.25 Y=0 Z=-8.489
433 X=12.133 Y=0 Z=-8.489

434 X=13.017 Y=0 Z=-8.489
435 X=13.9 Y=0 Z=-8.489
436 X=14.325 Y=0 Z=-8.489
437 X=15.25 Y=0 Z=-8.489

PATTERN
NAME=TEMP
NAME=PRES

SPRING
ADD=405 U3=384087
ADD=406 U3=383869.6
ADD=407 U3=383869.6
ADD=408 U3=384087
ADD=409 U3=384087
ADD=410 U3=383869.6
ADD=411 U3=384087
ADD=412 U3=384087
ADD=413 U3=383869.6
ADD=414 U3=384087
ADD=415 U3=384087
ADD=416 U3=383869.6
ADD=417 U3=384087
ADD=419 U1=10000
ADD=421 U3=384087
ADD=422 U3=383869.6
ADD=423 U3=384087
ADD=424 U3=384087
ADD=425 U3=383869.6
ADD=426 U3=384087
ADD=427 U3=384087
ADD=428 U3=383869.6
ADD=429 U3=384087
ADD=430 U3=384087
ADD=431 U3=383869.6
ADD=432 U3=383869.6
ADD=433 U3=384087

MATERIAL
NAME=CONC IDES=C M=.2448 W=2.5
T=0 E=2800000 U=.2 A=.00001
NAME=STEEL IDES=S
T=0 E=2E+10 U=.3 A=.0000117 FY=25310.51
NAME=RIGID IDES=C
T=0 E=2464750 U=.3 A=.00001
NAME=CONC1 IDES=C M=.2448 W=2.5
T=0 E=2464750 U=.2 A=.00001

FRAME SECTION
NAME=T1 MAT=CONC SH=R T=.5,1 A=.5 J=.2861003E-02 I=.1041667E-02,4.897667E-02
AS=.4166667,.416667
NAME=T2 MAT=CONC SH=R T=.542,1 A=.542 J=.3.508126E-02 I=.1.326834E-02,4.516667E-02
AS=.4516667,.451667
NAME=T3 MAT=CONC SH=R T=.675,1 A=.675 J=.5.967503E-02 I=.2.562891E-02,.05625 AS=.5625,.5625
NAME=T4 MAT=CONC SH=R T=.916,1 A=.916 J=.1170223 I=.6.404794E-02,7.633334E-02
AS=.7633333,.7633333

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NAME=T5 MAT=CONC SH=R T=.68,1 A=.68 J=.6.070982E-02 I=.2.620297E-02,5.666667E-02
AS=.5966667,.596667
NAME=T6 MAT=CONC SH=R T=.553,1 A=.553 J=.3.689493E-02 I=.0140927,4.608333E-02
AS=.4608333,.4608333
NAME=T7 MAT=CONC SH=R T=.511,1 A=.511 J=.3.024029E-02 I=.0111194,4.258334E-02
AS=.4258333,.4258333
NAME=T8 MAT=CONC SH=R T=.5,1 A=.5 J=.2.861003E-02 I=.1.041667E-02,4.897667E-02
AS=.4166667,.416667
NAME=FOOT MAT=CONC1 SH=R T=1,4,1 A=1.4 J=.2612221 I=.2286666,.1166667 AS=1.166667,1.166667
NAME=WALL MAT=CONC1 SH=R T=.85,1 A=.85 J=.9.985562E-02 I=.4.117709E-02,7.083333E-02
AS=.7083334,.7083334
NAME=RIGID MAT=RIGID SH=R T=10,10 A=100 J=1408.333 I=833.5623,833.5623 AS=83.56233,83.56233
NAME=WALL1 MAT=CONC1 SH=R T=1,3,1 A=1.3 J=.2294606 I=.1830633,.1083333
AS=.1.083333,1.083333
NAME=VAR1 TYPE=NONPR
SEC=T1,T2 EIVAR=1,1 L=.426
NAME=VAR2 TYPE=NONPR
SEC=T2,T3 EIVAR=1,1 L=.436
NAME=VAR3 TYPE=NONPR
SEC=T3,T4 EIVAR=1,1 L=.422
NAME=VAR4 TYPE=NONPR
SEC=T4,T5 EIVAR=1,1 L=.455
NAME=VAR5 TYPE=NONPR
SEC=T5,T6 EIVAR=1,1 L=.563
NAME=VAR6 TYPE=NONPR
SEC=T6,T7 EIVAR=1,1 L=1.392
NAME=VAR7 TYPE=NONPR
SEC=T7,T8 EIVAR=1,1 L=1.313

FRAME
1 J=1,2 SEC=T1 NSEG=1 ANG=180 IREL=R3
2 J=2,3 SEC=T1 NSEG=1 ANG=180
3 J=3,4 SEC=T1 NSEG=1 ANG=180
4 J=4,5 SEC=VAR1 NSEG=1 ANG=0
5 J=5,6 SEC=VAR2 NSEG=1 ANG=0
6 J=6,7 SEC=VAR3 NSEG=1 ANG=0
7 J=7,8 SEC=VAR4 NSEG=1 ANG=0
8 J=8,9 SEC=VAR5 NSEG=1 ANG=0
9 J=9,10 SEC=VAR6 NSEG=1 ANG=0
10 J=10,11 SEC=VAR7 NSEG=1 ANG=0
11 J=11,12 SEC=T8 NSEG=1 ANG=0
12 J=12,13 SEC=T8 NSEG=1 ANG=0
13 J=13,14 SEC=T8 NSEG=1 ANG=0
14 J=14,15 SEC=T8 NSEG=1 ANG=0
15 J=15,16 SEC=T8 NSEG=1 ANG=0
16 J=16,17 SEC=T8 NSEG=1 ANG=0
17 J=17,18 SEC=VAR7 NSEG=1 ANG=0
18 J=18,19 SEC=VAR6 NSEG=1 ANG=0
19 J=19,20 SEC=VAR5 NSEG=1 ANG=0
20 J=20,21 SEC=VAR4 NSEG=1 ANG=0
21 J=21,22 SEC=VAR3 NSEG=1 ANG=0
22 J=22,23 SEC=VAR2 NSEG=1 ANG=0
23 J=23,24 SEC=VAR1 NSEG=1 ANG=0
24 J=24,25 SEC=T1 NSEG=1 ANG=0
25 J=25,26 SEC=T1 NSEG=1 ANG=0
26 J=26,27 SEC=T1 NSEG=1 ANG=0 JREL=R3

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27 J=28,29 SEC=T1 NSEG=1 ANG=180 IREL=R3
28 J=29,30 SEC=T1 NSEG=1 ANG=180
29 J=30,31 SEC=T1 NSEG=1 ANG=180
30 J=31,32 SEC=VAR1 NSEG=1 ANG=0
31 J=32,33 SEC=VAR2 NSEG=1 ANG=0
32 J=33,34 SEC=VAR3 NSEG=1 ANG=0
33 J=34,35 SEC=VAR4 NSEG=1 ANG=0
34 J=35,36 SEC=VAR5 NSEG=1 ANG=0
35 J=36,37 SEC=VAR6 NSEG=1 ANG=0
36 J=37,38 SEC=VAR7 NSEG=1 ANG=0
37 J=38,39 SEC=T8 NSEG=1 ANG=0
38 J=39,40 SEC=T8 NSEG=1 ANG=0
39 J=40,41 SEC=T8 NSEG=1 ANG=0
40 J=41,42 SEC=T8 NSEG=1 ANG=0
41 J=42,43 SEC=T8 NSEG=1 ANG=0
42 J=43,44 SEC=T8 NSEG=1 ANG=0
43 J=44,45 SEC=VAR7 NSEG=1 ANG=0
44 J=45,46 SEC=VAR6 NSEG=1 ANG=0
45 J=46,47 SEC=VAR5 NSEG=1 ANG=0
46 J=47,48 SEC=VAR4 NSEG=1 ANG=0
47 J=48,49 SEC=VAR3 NSEG=1 ANG=0
48 J=49,50 SEC=VAR2 NSEG=1 ANG=0
49 J=50,51 SEC=VAR1 NSEG=1 ANG=0
50 J=51,52 SEC=T1 NSEG=1 ANG=0
52 J=52,53 SEC=T1 NSEG=1 ANG=0
53 J=53,54 SEC=T1 NSEG=1 ANG=0 JREL=R3
55 J=29,201 SEC=RIGID NSEG=1 ANG=0
56 J=201,27 SEC=RIGID NSEG=1 ANG=0
57 J=301,54 SEC=RIGID NSEG=1 ANG=0
58 J=1,101 SEC=RIGID NSEG=1 ANG=0
101 J=102,101 SEC=WALL NSEG=1 ANG=180
102 J=402,102 SEC=WALL NSEG=1 ANG=180 IOFF=.4875 RIGID=0
201 J=202,201 SEC=WALL1 NSEG=1 ANG=0
202 J=419,202 SEC=WALL1 NSEG=1 ANG=0 IOFF=.375 RIGID=0
301 J=301,302 SEC=WALL NSEG=1 ANG=0
302 J=302,436 SEC=WALL NSEG=1 ANG=0 IOFF=.4875 RIGID=0
400 J=401,402 SEC=FOOT NSEG=1 ANG=0
401 J=402,403 SEC=FOOT NSEG=1 ANG=0 IOFF=.075 RIGID=0
402 J=403,404 SEC=FOOT NSEG=1 ANG=0
403 J=404,405 SEC=FOOT NSEG=1 ANG=0
404 J=405,406 SEC=FOOT NSEG=1 ANG=0
405 J=406,407 SEC=FOOT NSEG=1 ANG=0
406 J=407,408 SEC=FOOT NSEG=1 ANG=0
407 J=408,409 SEC=FOOT NSEG=1 ANG=0
408 J=409,410 SEC=FOOT NSEG=1 ANG=0
409 J=410,411 SEC=FOOT NSEG=1 ANG=0
410 J=411,412 SEC=FOOT NSEG=1 ANG=0
411 J=412,413 SEC=FOOT NSEG=1 ANG=0
412 J=413,414 SEC=FOOT NSEG=1 ANG=0
413 J=414,415 SEC=FOOT NSEG=1 ANG=0
414 J=415,416 SEC=FOOT NSEG=1 ANG=0
415 J=416,417 SEC=FOOT NSEG=1 ANG=0
416 J=417,418 SEC=FOOT NSEG=1 ANG=0
417 J=418,419 SEC=FOOT NSEG=1 ANG=0 IOFF=.3 RIGID=0
418 J=419,420 SEC=FOOT NSEG=1 ANG=0 IOFF=.3 RIGID=0
419 J=420,421 SEC=FOOT NSEG=1 ANG=0

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420 J=421,422 SEC=FOOT NSEG=1 ANG=0
421 J=422,423 SEC=FOOT NSEG=1 ANG=0
422 J=423,424 SEC=FOOT NSEG=1 ANG=0
423 J=424,425 SEC=FOOT NSEG=1 ANG=0
424 J=425,426 SEC=FOOT NSEG=1 ANG=0
425 J=426,427 SEC=FOOT NSEG=1 ANG=0
426 J=427,428 SEC=FOOT NSEG=1 ANG=0
427 J=428,429 SEC=FOOT NSEG=1 ANG=0
428 J=429,430 SEC=FOOT NSEG=1 ANG=0
429 J=430,431 SEC=FOOT NSEG=1 ANG=0
430 J=431,432 SEC=FOOT NSEG=1 ANG=0
431 J=432,433 SEC=FOOT NSEG=1 ANG=0
432 J=433,434 SEC=FOOT NSEG=1 ANG=0
433 J=434,435 SEC=FOOT NSEG=1 ANG=0
434 J=435,436 SEC=FOOT NSEG=1 ANG=0 JOFF=.075 RIGID=0
435 J=436,437 SEC=FOOT NSEG=1 ANG=0

LOAD

NAME=PVL1
TYPE=CONCENTRATED SPAN
ADD=414 RD=.057 UZ=-9.6
ADD=412 RD=.019 UZ=-9.6
ADD=410 RD=.681 UZ=-9.6
ADD=408 RD=.623 UZ=-9.6
ADD=407 RD=.265 UZ=-9.6
ADD=405 RD=.227 UZ=-9.6
ADD=421 RD=.943 UZ=-9.6
ADD=423 RD=.981 UZ=-9.6
ADD=425 RD=.339 UZ=-9.6
ADD=427 RD=.377 UZ=-9.6
ADD=426 RD=.735 UZ=-9.6
ADD=430 RD=.773 UZ=-9.6

COMBO

NAME=COMB1
LOAD=PVL1 SF=2.15

OUTPUT

: No Output Requested

END

: File D:\WSAP2000DATA\W개력식터널부활하중영향검토2.52k saved 11-25-02 13:22:43 in Ton-m

SYSTEM

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413 J=414,415 SEC=FOOT NSEG=1 ANG=0
414 J=415,416 SEC=FOOT NSEG=1 ANG=0
415 J=416,417 SEC=FOOT NSEG=1 ANG=0
416 J=417,418 SEC=FOOT NSEG=1 ANG=0
417 J=418,419 SEC=FOOT NSEG=1 ANG=0 IOFF=.3 RIGID=0
418 J=419,420 SEC=FOOT NSEG=1 ANG=0 IOFF=.3 RIGID=0
419 J=420,421 SEC=FOOT NSEG=1 ANG=0
420 J=421,422 SEC=FOOT NSEG=1 ANG=0
421 J=422,423 SEC=FOOT NSEG=1 ANG=0
422 J=423,424 SEC=FOOT NSEG=1 ANG=0
423 J=424,425 SEC=FOOT NSEG=1 ANG=0
424 J=425,426 SEC=FOOT NSEG=1 ANG=0
425 J=426,427 SEC=FOOT NSEG=1 ANG=0
426 J=427,428 SEC=FOOT NSEG=1 ANG=0
427 J=428,429 SEC=FOOT NSEG=1 ANG=0
428 J=429,430 SEC=FOOT NSEG=1 ANG=0
429 J=430,431 SEC=FOOT NSEG=1 ANG=0
430 J=431,432 SEC=FOOT NSEG=1 ANG=0
431 J=432,433 SEC=FOOT NSEG=1 ANG=0
432 J=433,434 SEC=FOOT NSEG=1 ANG=0
433 J=434,435 SEC=FOOT NSEG=1 ANG=0
434 J=435,436 SEC=FOOT NSEG=1 ANG=0 IOFF=.075 RIGID=0
435 J=436,437 SEC=FOOT NSEG=1 ANG=0

LOAD
NAME=PVL2
TYPE=CONCENTRATED SPAN
ADD=415 RD=.216 UZ=-9.6
ADD=413 RD=.717 UZ=-9.6
ADD=412 RD=.359 UZ=-9.6
ADD=410 RD=.321 UZ=-9.6
ADD=408 RD=.963 UZ=-9.6

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ADD=406 RD=.925 UZ=-9.6
ADD=420 RD=.784 UZ=-9.6
ADD=422 RD=.263 UZ=-9.6
ADD=423 RD=.641 UZ=-9.6
ADD=425 RD=.679 UZ=-9.6
ADD=427 RD=.037 UZ=-9.6
ADD=429 RD=.075 UZ=-9.6

COMBO
NAME=COMB1
LOAD=PVL2 SF=2.15

OUTPUT
: No Output Requested

END

: File D:\WSAP2000\DATA\W개척신티널부활하중영향검토3.\$2k saved 11-25-02 13:22:56 in Ton-m

SYSTEM
DOF=UX,UZ,RY LENGTH=m FORCE=Ton LINES=59

JOINT

1 X=-14.25 Y=0 Z=-5.679
2 X=-14.25 Y=0 Z=-5.026
3 X=-14.25 Y=0 Z=-4.372
4 X=-14.25 Y=0 Z=-3.719
5 X=-14.23 Y=0 Z=-3.293
6 X=-14.166 Y=0 Z=-2.86
7 X=-14.107 Y=0 Z=-2.444
8 X=-13.748 Y=0 Z=-2.165
9 X=-13.294 Y=0 Z=-1.832
10 X=-12.092 Y=0 Z=-1.131
11 X=-10.887 Y=0 Z=-.608
12 X=-9.883 Y=0 Z=-.256
13 X=-8.479 Y=0 Z=-.057
14 X=-7.275 Y=0 Z=0
15 X=-6.071 Y=0 Z=-.057
16 X=-4.867 Y=0 Z=-.256
17 X=-3.663 Y=0 Z=-.608
18 X=-2.458 Y=0 Z=-1.131
19 X=-1.256 Y=0 Z=-1.832
20 X=-.795 Y=0 Z=-2.165
21 X=-.443 Y=0 Z=-2.444
22 X=-.389 Y=0 Z=-2.86
23 X=-.318 Y=0 Z=-3.293
24 X=-.3 Y=0 Z=-3.719
25 X=-.3 Y=0 Z=-4.372
26 X=-.3 Y=0 Z=-5.026
27 X=-.3 Y=0 Z=-5.679
28 X=.3 Y=0 Z=-5.679
29 X=.3 Y=0 Z=-5.026
30 X=.3 Y=0 Z=-4.372
31 X=.3 Y=0 Z=-3.719

32 X=-.318 Y=0 Z=-3.293
33 X=-.389 Y=0 Z=-2.86
34 X=-.443 Y=0 Z=-2.444
35 X=-.795 Y=0 Z=-2.165
36 X=-1.256 Y=0 Z=-1.832
37 X=-2.458 Y=0 Z=-1.131
38 X=-3.663 Y=0 Z=-.608
39 X=-4.867 Y=0 Z=-.256
40 X=-6.071 Y=0 Z=-.057
41 X=-7.275 Y=0 Z=0
42 X=-8.479 Y=0 Z=-.057
43 X=-9.883 Y=0 Z=-.256
44 X=-10.887 Y=0 Z=-.608
45 X=-12.092 Y=0 Z=-1.131
46 X=-13.294 Y=0 Z=-1.832
47 X=-13.748 Y=0 Z=-2.165
48 X=-14.107 Y=0 Z=-2.444
49 X=-14.166 Y=0 Z=-2.86
50 X=-14.23 Y=0 Z=-3.293
51 X=-14.25 Y=0 Z=-3.719
52 X=-14.25 Y=0 Z=-4.372
53 X=-14.25 Y=0 Z=-5.026
54 X=-14.25 Y=0 Z=-5.679
101 X=-14.325 Y=0 Z=-5.679
102 X=-14.325 Y=0 Z=-7.789
201 X=0 Y=0 Z=-5.679
202 X=0 Y=0 Z=-7.789
301 X=14.325 Y=0 Z=-5.679
302 X=14.325 Y=0 Z=-7.789
401 X=-15.25 Y=0 Z=-8.489
402 X=-14.325 Y=0 Z=-8.489
403 X=-13.9 Y=0 Z=-8.489
404 X=-13.017 Y=0 Z=-8.489
405 X=-12.133 Y=0 Z=-8.489
406 X=-11.25 Y=0 Z=-8.489
407 X=-10.367 Y=0 Z=-8.489
408 X=-9.484 Y=0 Z=-8.489
409 X=-8.6 Y=0 Z=-8.489
410 X=-7.717 Y=0 Z=-8.489
411 X=-6.834 Y=0 Z=-8.489
412 X=-5.95 Y=0 Z=-8.489
413 X=-5.067 Y=0 Z=-8.489
414 X=-4.184 Y=0 Z=-8.489
415 X=-3.3 Y=0 Z=-8.489
416 X=-2.417 Y=0 Z=-8.489
417 X=-1.534 Y=0 Z=-8.489
418 X=-.65 Y=0 Z=-8.489
419 X=0 Y=0 Z=-8.489
420 X=.65 Y=0 Z=-8.489
421 X=1.534 Y=0 Z=-8.489
422 X=2.417 Y=0 Z=-8.489
423 X=3.3 Y=0 Z=-8.489
424 X=4.184 Y=0 Z=-8.489
425 X=5.067 Y=0 Z=-8.489
426 X=5.95 Y=0 Z=-8.489
427 X=6.834 Y=0 Z=-8.489

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428 X=7.717 Y=0 Z=-8.489
429 X=8.6 Y=0 Z=-8.489
430 X=9.484 Y=0 Z=-8.489
431 X=10.367 Y=0 Z=-8.489
432 X=11.25 Y=0 Z=-8.489
433 X=12.133 Y=0 Z=-8.489
434 X=13.017 Y=0 Z=-8.489
435 X=13.9 Y=0 Z=-8.489
436 X=14.325 Y=0 Z=-8.489
437 X=15.25 Y=0 Z=-8.489

PATTERN
NAME=TEMP
NAME=PRES

SPRING
ADD=402 U3=293445
ADD=403 U3=284315.6
ADD=404 U3=384087
ADD=405 U3=384087
ADD=406 U3=383869.6
ADD=407 U3=383869.6
ADD=408 U3=384087
ADD=409 U3=384087
ADD=410 U3=383869.6
ADD=411 U3=384087
ADD=412 U3=384087
ADD=413 U3=383869.6
ADD=414 U3=384087
ADD=415 U3=384087
ADD=419 U1=10000
ADD=423 U3=384087
ADD=424 U3=384087
ADD=425 U3=383869.6
ADD=426 U3=384087
ADD=427 U3=384087
ADD=428 U3=383869.6
ADD=429 U3=384087
ADD=430 U3=384087
ADD=431 U3=383869.6
ADD=432 U3=383869.6
ADD=433 U3=384087
ADD=434 U3=384087
ADD=435 U3=284315.6
ADD=436 U3=293445

MATERIAL
NAME=CONC IDES=C M=.2448 W=2.5
T=0 E=28000000 U=.2 A=.00001
NAME=STEEL IDES=S
T=0 E=2E+10 U=.3 A=.0000117 FY=25310.51
NAME=RIGID IDES=C
T=0 E=2464750 U=.3 A=.00001
NAME=CONC1 IDES=C M=.2448 W=2.5
T=0 E=2464750 U=.2 A=.00001

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19 J=19,20 SEC=VAR5 NSEG=1 ANG=0
20 J=20,21 SEC=VAR4 NSEG=1 ANG=0
21 J=21,22 SEC=VAR3 NSEG=1 ANG=0
22 J=22,23 SEC=VAR2 NSEG=1 ANG=0
23 J=23,24 SEC=VAR1 NSEG=1 ANG=0
24 J=24,25 SEC=T1 NSEG=1 ANG=0
25 J=25,26 SEC=T1 NSEG=1 ANG=0
26 J=26,27 SEC=T1 NSEG=1 ANG=0 JREL=R3
27 J=28,29 SEC=T1 NSEG=1 ANG=180 IREL=R3
28 J=29,30 SEC=T1 NSEG=1 ANG=180
29 J=30,31 SEC=T1 NSEG=1 ANG=180
30 J=31,32 SEC=VAR1 NSEG=1 ANG=0
31 J=32,33 SEC=VAR2 NSEG=1 ANG=0
32 J=33,34 SEC=VAR3 NSEG=1 ANG=0
33 J=34,35 SEC=VAR4 NSEG=1 ANG=0
34 J=35,36 SEC=VAR5 NSEG=1 ANG=0
35 J=36,37 SEC=VAR6 NSEG=1 ANG=0
36 J=37,38 SEC=VAR7 NSEG=1 ANG=0
37 J=38,39 SEC=T8 NSEG=1 ANG=0
38 J=39,40 SEC=T8 NSEG=1 ANG=0
39 J=40,41 SEC=T8 NSEG=1 ANG=0
40 J=41,42 SEC=T8 NSEG=1 ANG=0
41 J=42,43 SEC=T8 NSEG=1 ANG=0
42 J=43,44 SEC=T8 NSEG=1 ANG=0
43 J=44,45 SEC=VAR7 NSEG=1 ANG=0
44 J=45,46 SEC=VAR6 NSEG=1 ANG=0
45 J=46,47 SEC=VAR5 NSEG=1 ANG=0
46 J=47,48 SEC=VAR4 NSEG=1 ANG=0
47 J=48,49 SEC=VAR3 NSEG=1 ANG=0
48 J=49,50 SEC=VAR2 NSEG=1 ANG=0
49 J=50,51 SEC=VAR1 NSEG=1 ANG=0
50 J=51,52 SEC=T1 NSEG=1 ANG=0
52 J=52,53 SEC=T1 NSEG=1 ANG=0
53 J=53,54 SEC=T1 NSEG=1 ANG=0 JREL=R3
85 J=28,201 SEC=RIGID NSEG=1 ANG=0
86 J=201,27 SEC=RIGID NSEG=1 ANG=0
87 J=301,54 SEC=RIGID NSEG=1 ANG=0
88 J=1,101 SEC=RIGID NSEG=1 ANG=0
101 J=102,101 SEC=WALL NSEG=1 ANG=180
102 J=402,102 SEC=WALL NSEG=1 ANG=180 IOFF=.4875 RIGID=0
201 J=202,201 SEC=WALL1 NSEG=1 ANG=0
202 J=419,202 SEC=WALL1 NSEG=1 ANG=0 IOFF=.375 RIGID=0
301 J=301,302 SEC=WALL NSEG=1 ANG=0
302 J=302,436 SEC=WALL NSEG=1 ANG=0 IOFF=.4875 RIGID=0
400 J=401,402 SEC=FOOT NSEG=1 ANG=0
401 J=402,403 SEC=FOOT NSEG=1 ANG=0 IOFF=.075 RIGID=0
402 J=403,404 SEC=FOOT NSEG=1 ANG=0
403 J=404,405 SEC=FOOT NSEG=1 ANG=0
404 J=405,406 SEC=FOOT NSEG=1 ANG=0
405 J=406,407 SEC=FOOT NSEG=1 ANG=0
406 J=407,408 SEC=FOOT NSEG=1 ANG=0
407 J=408,409 SEC=FOOT NSEG=1 ANG=0
408 J=409,410 SEC=FOOT NSEG=1 ANG=0
409 J=410,411 SEC=FOOT NSEG=1 ANG=0
410 J=411,412 SEC=FOOT NSEG=1 ANG=0
411 J=412,413 SEC=FOOT NSEG=1 ANG=0

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FRAME SECTION
NAME=T1 MAT=CONC SH=R T=.5,1 A=.5 J=2.861003E-02 I=.041667E-02,4.897667E-02
AS=.4166667,4166667
NAME=T2 MAT=CONC SH=R T=.542,1 A=.542 J=3.508126E-02 I=.1.326834E-02,4.516667E-02
AS=.4516667,4516667
NAME=T3 MAT=CONC SH=R T=.675,1 A=.675 J=5.967503E-02 I=.2.562891E-02,0.5625 AS=.5625,5625
NAME=T4 MAT=CONC SH=R T=.916,1 A=.916 J=.1170223 I=.6.404794E-02,7.633334E-02
AS=.7633333,7633333
NAME=T5 MAT=CONC SH=R T=.68,1 A=.68 J=.6.070982E-02 I=.2.620267E-02,5.666667E-02
AS=.5666667,5666667
NAME=T6 MAT=CONC SH=R T=.553,1 A=.553 J=3.688483E-02 I=.0140927,4.608333E-02
AS=.4608333,4608333
NAME=T7 MAT=CONC SH=R T=.511,1 A=.511 J=3.024028E-02 I=.0111194,4.235334E-02
AS=.4258333,4258333
NAME=T8 MAT=CONC SH=R T=.5,1 A=.5 J=2.861003E-02 I=.041667E-02,4.897667E-02
AS=.4166667,4166667
NAME=FOOT MAT=CONC1 SH=R T=.1,4,1 A=.1,4 J=.2812221 I=.2286666,1166667 AS=.1.166667,1.166667
NAME=WALL MAT=CONC1 SH=R T=.85,1 A=.85 J=.0.985562E-02 I=.4.117709E-02,7.083333E-02
AS=.7083334,7083334
NAME=RIGID MAT=RIGID SH=R T=.10,10 A=.100 J=.1408.333 I=.833.5623,833.5623 AS=.83.56233,83.56233
NAME=WALL1 MAT=CONC1 SH=R T=.1,3,1 A=.1,3 J=.2294606 I=.1830893,1083333
AS=.1.083333,1.083333
NAME=VAR1 TYPE=NONPR
SEC=T1,T2 EIVAR=1,1 L=.426
NAME=VAR2 TYPE=NONPR
SEC=T2,T3 EIVAR=1,1 L=.436
NAME=VAR3 TYPE=NONPR
SEC=T3,T4 EIVAR=1,1 L=.422
NAME=VAR4 TYPE=NONPR
SEC=T4,T5 EIVAR=1,1 L=.455
NAME=VAR5 TYPE=NONPR
SEC=T5,T6 EIVAR=1,1 L=.563
NAME=VAR6 TYPE=NONPR
SEC=T6,T7 EIVAR=1,1 L=.1.392
NAME=VAR7 TYPE=NONPR
SEC=T7,T8 EIVAR=1,1 L=.1.313

FRAME
1 J=1,2 SEC=T1 NSEG=1 ANG=180 IREL=R3
2 J=2,3 SEC=T1 NSEG=1 ANG=180
3 J=3,4 SEC=T1 NSEG=1 ANG=180
4 J=4,5 SEC=VAR1 NSEG=1 ANG=0
5 J=5,6 SEC=VAR2 NSEG=1 ANG=0
6 J=6,7 SEC=VAR3 NSEG=1 ANG=0
7 J=7,8 SEC=VAR4 NSEG=1 ANG=0
8 J=8,9 SEC=VAR5 NSEG=1 ANG=0
9 J=9,10 SEC=VAR6 NSEG=1 ANG=0
10 J=10,11 SEC=VAR7 NSEG=1 ANG=0
11 J=11,12 SEC=T8 NSEG=1 ANG=0
12 J=12,13 SEC=T8 NSEG=1 ANG=0
13 J=13,14 SEC=T8 NSEG=1 ANG=0
14 J=14,15 SEC=T8 NSEG=1 ANG=0
15 J=15,16 SEC=T8 NSEG=1 ANG=0
16 J=16,17 SEC=T8 NSEG=1 ANG=0
17 J=17,18 SEC=VAR7 NSEG=1 ANG=0
18 J=18,19 SEC=VAR6 NSEG=1 ANG=0

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412 J=413,414 SEC=FOOT NSEG=1 ANG=0
413 J=414,415 SEC=FOOT NSEG=1 ANG=0
414 J=415,416 SEC=FOOT NSEG=1 ANG=0
415 J=416,417 SEC=FOOT NSEG=1 ANG=0
416 J=417,418 SEC=FOOT NSEG=1 ANG=0
417 J=418,419 SEC=FOOT NSEG=1 ANG=0 IOFF=.3 RIGID=0
418 J=419,420 SEC=FOOT NSEG=1 ANG=0 IOFF=.3 RIGID=0
419 J=420,421 SEC=FOOT NSEG=1 ANG=0
420 J=421,422 SEC=FOOT NSEG=1 ANG=0
421 J=422,423 SEC=FOOT NSEG=1 ANG=0
422 J=423,424 SEC=FOOT NSEG=1 ANG=0
423 J=424,425 SEC=FOOT NSEG=1 ANG=0
424 J=425,426 SEC=FOOT NSEG=1 ANG=0
425 J=426,427 SEC=FOOT NSEG=1 ANG=0
426 J=427,428 SEC=FOOT NSEG=1 ANG=0
427 J=428,429 SEC=FOOT NSEG=1 ANG=0
428 J=429,430 SEC=FOOT NSEG=1 ANG=0
429 J=430,431 SEC=FOOT NSEG=1 ANG=0
430 J=431,432 SEC=FOOT NSEG=1 ANG=0
431 J=432,433 SEC=FOOT NSEG=1 ANG=0
432 J=433,434 SEC=FOOT NSEG=1 ANG=0
433 J=434,435 SEC=FOOT NSEG=1 ANG=0
434 J=435,436 SEC=FOOT NSEG=1 ANG=0 IOFF=.075 RIGID=0
435 J=436,437 SEC=FOOT NSEG=1 ANG=0

LOAD
NAME=PVL3
TYPE=CONCENTRATED SPAN
ADD=412 RD=.359 UZ=-9.6
ADD=410 RD=.321 UZ=-9.6
ADD=409 RD=.037 UZ=-9.6
ADD=406 RD=.925 UZ=-9.6
ADD=405 RD=.568 UZ=-9.6
ADD=403 RD=.528 UZ=-9.6
ADD=423 RD=.641 UZ=-9.6
ADD=425 RD=.679 UZ=-9.6
ADD=426 RD=.963 UZ=-9.6
ADD=429 RD=.075 UZ=-9.6
ADD=430 RD=.434 UZ=-9.6
ADD=432 RD=.472 UZ=-9.6

COMBO
NAME=COMB1
LOAD=PVL3 SF=2.15

OUTPUT
; No Output Requested

END

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File: \\박우현\BAP2000 DATA\마감백\WIN01.52k 9/2
7/02, 9:05:20AM

File D:\PAB
BAP\BAP2000\PMO\개막식년백\마감백\WIN01.52k saved
97-07-22 9:05:21 in Ton-mm
SYSTEM
DOP=UX,UY,UZ,RX,RY,RZ LMDOT=mm FOR=2ton
LIRBS=99

JOINT
1 X=-1663 Y=0 Z=9456
2 X=-2759 Y=0 Z=9456
3 X=-1856 Y=0 Z=9456
4 X=-953 Y=0 Z=9456
5 X=0 Y=0 Z=9456
6 X=953 Y=0 Z=9456
7 X=1856 Y=0 Z=9456
8 X=2759 Y=0 Z=9456
9 X=3663 Y=0 Z=9456
10 X=4566 Y=0 Z=9456
11 X=5466 Y=0 Z=9456
12 X=6369 Y=0 Z=9456
13 X=7273 Y=0 Z=9456
14 X=8176 Y=0 Z=9456
15 X=-16056.33 Y=0 Z=13932
16 X=-15249 Y=0 Z=8989
17 X=10888 Y=0 Z=9456
18 X=11791 Y=0 Z=9456
19 X=-15249 Y=0 Z=13932
20 X=-16056.33 Y=0 Z=29212
21 X=-14749 Y=0 Z=7131
22 X=-15249 Y=0 Z=9456
23 X=-16056.33 Y=0 Z=38312
24 X=-14749 Y=0 Z=9456
25 X=-15249 Y=0 Z=9456
26 X=-14749 Y=0 Z=12326
27 X=-16056.33 Y=0 Z=9456
28 X=-16056.33 Y=0 Z=9590
29 X=-15249 Y=0 Z=9456
30 X=-14749 Y=0 Z=9456
31 X=-15249 Y=0 Z=9456
32 X=-16056.33 Y=0 Z=4656
33 X=-14749 Y=0 Z=9456
34 X=-14500 Y=0 Z=9456
35 X=-13897 Y=0 Z=9456
36 X=-14749 Y=0 Z=7131
37 X=-15249 Y=0 Z=9456
38 X=-14749 Y=0 Z=9456
39 X=-16056.33 Y=0 Z=4656
40 X=-14749 Y=0 Z=9590
41 X=-16056.33 Y=0 Z=9456
42 X=-15249 Y=0 Z=9456
43 X=-14749 Y=0 Z=12326
44 X=-16056.33 Y=0 Z=9456
45 X=-15249 Y=0 Z=9456
46 X=-16056.33 Y=0 Z=9456
47 X=-15249 Y=0 Z=9456
48 X=-14749 Y=0 Z=9456
49 X=-14749 Y=0 Z=9456
50 X=-11791 Y=0 Z=9456
51 X=-10888 Y=0 Z=9456
52 X=-16056.33 Y=0 Z=7131
53 X=-14749 Y=0 Z=13932
54 X=-15249 Y=0 Z=9456
55 X=-14749 Y=0 Z=9456
56 X=-1456 Y=0 Z=9456
57 X=-12694 Y=0 Z=9456
58 X=-14500 Y=0 Z=7131
59 X=-14500 Y=0 Z=9456
60 X=-14500 Y=0 Z=12326
61 X=-16056.33 Y=0 Z=8174
62 X=-12694 Y=0 Z=9456
63 X=-12694 Y=0 Z=9590
64 X=-12694 Y=0 Z=12326
65 X=-15249 Y=0 Z=8174
66 X=-10888 Y=0 Z=9456
67 X=-10888 Y=0 Z=9590
68 X=-10888 Y=0 Z=12326
69 X=-16056.33 Y=0 Z=10138.67
70 X=-9881 Y=0 Z=9456
71 X=-9881 Y=0 Z=9590
72 X=-9881 Y=0 Z=10138.67
73 X=-15249 Y=0 Z=10138.67
74 X=-7275 Y=0 Z=12326
75 X=-7275 Y=0 Z=12326
76 X=-16056.33 Y=0 Z=10687.33
77 X=-5469 Y=0 Z=9590
78 X=-5469 Y=0 Z=9590
79 X=-5469 Y=0 Z=12326
80 X=-15249 Y=0 Z=10687.33

Page: 1

File: \\박우현\BAP2000 DATA\마감백\WIN01.52k 9/2
7/02, 9:05:20AM

81 X=-1663 Y=0 Z=9000
82 X=-1663 Y=0 Z=9590
83 X=-1663 Y=0 Z=12326
84 X=-16056.33 Y=0 Z=12326
85 X=-1856 Y=0 Z=8174
86 X=-1856 Y=0 Z=9590
87 X=-1856 Y=0 Z=12326
88 X=-15249 Y=0 Z=12326
89 X=0 Y=0 Z=1071
90 X=0 Y=0 Z=9590
91 X=0 Y=0 Z=12326
92 X=15249 Y=0 Z=9000
93 X=1856 Y=0 Z=8174
94 X=1856 Y=0 Z=9590
95 X=1856 Y=0 Z=12326
96 X=15249 Y=0 Z=9456
97 X=1663 Y=0 Z=9000
98 X=1663 Y=0 Z=9590
99 X=1663 Y=0 Z=12326
100 X=-16056.33 Y=0 Z=9590
101 X=-1469 Y=0 Z=9456
102 X=-1469 Y=0 Z=9590
103 X=-1469 Y=0 Z=12326
104 X=-16056.33 Y=0 Z=9456
105 X=-7275 Y=0 Z=9590
106 X=-7275 Y=0 Z=12326
107 X=-15249 Y=0 Z=0
108 X=1088 Y=0 Z=9456
109 X=1088 Y=0 Z=9590
110 X=1088 Y=0 Z=12326
111 X=-15249 Y=0 Z=1071
112 X=10888 Y=0 Z=9000
113 X=10888 Y=0 Z=9590
114 X=10888 Y=0 Z=12326
115 X=-16056.33 Y=0 Z=0
116 X=-12694 Y=0 Z=8174
117 X=-12694 Y=0 Z=9590
118 X=-12694 Y=0 Z=12326
119 X=-16056.33 Y=0 Z=1071
120 X=-15249 Y=0 Z=9456
121 X=-15249 Y=0 Z=1071
122 X=-14500 Y=0 Z=7131
123 X=-14500 Y=0 Z=9590
124 X=-14500 Y=0 Z=12326
125 X=-16056.33 Y=0 Z=13932
126 X=-12791 Y=0 Z=9000
127 X=-15249 Y=0 Z=9311
128 X=-16056.33 Y=0 Z=9311
129 X=-14749 Y=0 Z=9456
130 X=-16056.33 Y=0 Z=38312
131 X=-15249 Y=0 Z=9590
132 X=-16056.33 Y=0 Z=9590
133 X=-14749 Y=0 Z=9000
134 X=-14500 Y=0 Z=9000
135 X=-13897 Y=0 Z=9000
136 X=-12694 Y=0 Z=9000
137 X=-2759 Y=0 Z=9000
138 X=-1856 Y=0 Z=9000
139 X=-953 Y=0 Z=9000
140 X=0 Y=0 Z=9000
141 X=953 Y=0 Z=9000
142 X=1856 Y=0 Z=9000
143 X=2759 Y=0 Z=9000
144 X=3663 Y=0 Z=9000
145 X=4566 Y=0 Z=9000
146 X=5466 Y=0 Z=7131
147 X=6369 Y=0 Z=8174
148 X=7273 Y=0 Z=7131
149 X=8176 Y=0 Z=8174
150 X=9079 Y=0 Z=8174
151 X=-16056.33 Y=0 Z=4656
152 X=-15249 Y=0 Z=5461
153 X=-16056.33 Y=0 Z=5461
154 X=-15249 Y=0 Z=9456
155 X=-16056.33 Y=0 Z=9456
156 X=-15249 Y=0 Z=10138.67
157 X=-14749 Y=0 Z=10138.67
158 X=-16056.33 Y=0 Z=10138.67
159 X=-15249 Y=0 Z=10138.67
160 X=-14500 Y=0 Z=38312
161 X=-11791 Y=0 Z=9000
162 X=-14749 Y=0 Z=8174
163 X=-12694 Y=0 Z=9000
164 X=-11857 Y=0 Z=9000
165 X=-9881 Y=0 Z=9456
166 X=-1800 Y=0 Z=8174
167 X=-16056.33 Y=0 Z=10687.33
168 X=-15249 Y=0 Z=12326
169 X=-16056.33 Y=0 Z=12326
170 X=-953 Y=0 Z=8174

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File: \\박우현\BAP2000 DATA\마감백\WIN01.52k 9/2
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171 X=0 Y=0 Z=8174
172 X=0 Y=0 Z=8174
173 X=953 Y=0 Z=8174
174 X=1857 Y=0 Z=8174
175 X=-16056.33 Y=0 Z=9592
180 X=14749 Y=0 Z=38312
181 X=-14500 Y=0 Z=38312
183 X=0 Y=0 Z=295
184 X=0 Y=0 Z=38312
187 X=0 Y=0 Z=4656
188 X=0 Y=0 Z=1601.5
195 X=-138 Y=0 Z=9591
196 X=-13897 Y=0 Z=9590
197 X=-13897 Y=0 Z=12326
199 X=-11791 Y=0 Z=8174
200 X=-11791 Y=0 Z=9590
201 X=-11791 Y=0 Z=12326
203 X=-9884 Y=0 Z=9590
204 X=-9884 Y=0 Z=9590
205 X=-9884 Y=0 Z=12326
207 X=-8178 Y=0 Z=9592
208 X=-8178 Y=0 Z=9590
209 X=-8178 Y=0 Z=12326
211 X=-6372 Y=0 Z=9592
212 X=-6372 Y=0 Z=9590
213 X=-6372 Y=0 Z=12326
215 X=-4566 Y=0 Z=9070
216 X=-4566 Y=0 Z=9590
217 X=-4566 Y=0 Z=12326
219 X=-2759 Y=0 Z=84818
220 X=-2759 Y=0 Z=9590
221 X=-2759 Y=0 Z=12326
223 X=-953 Y=0 Z=8174
224 X=-953 Y=0 Z=9590
225 X=-953 Y=0 Z=12326
227 X=953 Y=0 Z=8174
228 X=953 Y=0 Z=9590
229 X=953 Y=0 Z=12326
231 X=-2759 Y=0 Z=84818
232 X=-2759 Y=0 Z=9590
233 X=-2759 Y=0 Z=12326
235 X=-2759 Y=0 Z=9590
236 X=-4566 Y=0 Z=9070
237 X=-4566 Y=0 Z=9590
238 X=-4566 Y=0 Z=12326
239 X=-6372 Y=0 Z=9592
240 X=-6372 Y=0 Z=9590
241 X=-6372 Y=0 Z=12326
243 X=8178 Y=0 Z=9592
244 X=8178 Y=0 Z=9590
245 X=8178 Y=0 Z=12326
247 X=9884 Y=0 Z=9590
248 X=9884 Y=0 Z=9590
249 X=9884 Y=0 Z=12326
251 X=11791 Y=0 Z=84818
252 X=11791 Y=0 Z=9590
253 X=11791 Y=0 Z=12326
255 X=13897 Y=0 Z=7651
256 X=13897 Y=0 Z=9590
257 X=13897 Y=0 Z=12326
259 X=-14749 Y=0 Z=8174
260 X=-14500 Y=0 Z=8174
261 X=-13897 Y=0 Z=8174
262 X=1856 Y=0 Z=9392
263 X=-14749 Y=0 Z=4656
272 X=-14749 Y=0 Z=5461
273 X=-14749 Y=0 Z=6306
274 X=-14500 Y=0 Z=6306
275 X=-14500 Y=0 Z=5461
276 X=-14500 Y=0 Z=6306
277 X=-14749 Y=0 Z=4656
278 X=-14500 Y=0 Z=4656
279 X=-14749 Y=0 Z=5461
280 X=-14500 Y=0 Z=5461
281 X=-14749 Y=0 Z=6306
282 X=-14500 Y=0 Z=6306
333 X=16770 Y=0 Z=9000
344 X=16770 Y=0 Z=9456
345 X=-16710 Y=0 Z=8989
346 X=-16710 Y=0 Z=13932
347 X=-16710 Y=0 Z=8174
348 X=-16710 Y=0 Z=38312
349 X=-16710 Y=0 Z=9456
350 X=-16710 Y=0 Z=9590
351 X=-16770 Y=0 Z=0
352 X=-16770 Y=0 Z=1071
353 X=-16770 Y=0 Z=1991
357 X=-16770 Y=0 Z=38312
358 X=-16770 Y=0 Z=38312
361 X=-16770 Y=0 Z=9590
364 X=-16710 Y=0 Z=4656
365 X=-16710 Y=0 Z=5461

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File: \\박우현\BAP2000 DATA\마감백\WIN01.52k 9/2
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368 X=-16710 Y=0 Z=6306
370 X=-16710 Y=0 Z=9000
372 X=-16710 Y=0 Z=7131
373 X=-16770 Y=0 Z=12326
374 X=-16770 Y=0 Z=8174
376 X=-16710 Y=0 Z=0
379 X=-16770 Y=0 Z=4656
381 X=-16770 Y=0 Z=5461
383 X=-16770 Y=0 Z=10138.67
386 X=-16710 Y=0 Z=10138.67
388 X=-16710 Y=0 Z=10687.33
390 X=-16710 Y=0 Z=12326
391 X=-16770 Y=0 Z=10138.67
393 X=-16770 Y=0 Z=10687.33
395 X=-16770 Y=0 Z=12326
469 X=-14500 Y=0 Z=10138.67
470 X=-14749 Y=0 Z=10138.67
471 X=-14500 Y=0 Z=10687.33
472 X=-14749 Y=0 Z=10687.33
474 X=-14749 Y=0 Z=10138.67
475 X=-14500 Y=0 Z=10138.67
476 X=-14500 Y=0 Z=10138.67
477 X=-14749 Y=0 Z=10138.67
483 X=-12694 Y=0 Z=10138.67
484 X=-12694 Y=0 Z=10687.33
485 X=-11791 Y=0 Z=10138.67
486 X=-11791 Y=0 Z=10687.33
487 X=-10888 Y=0 Z=10138.67
488 X=-10888 Y=0 Z=10687.33
489 X=-9884 Y=0 Z=10138.67
490 X=-9884 Y=0 Z=10687.33
491 X=-9881 Y=0 Z=10138.67
492 X=-9881 Y=0 Z=10687.33
493 X=-8178 Y=0 Z=10138.67
494 X=-8178 Y=0 Z=10687.33
495 X=-7275 Y=0 Z=10138.67
496 X=-7275 Y=0 Z=10687.33
497 X=-6372 Y=0 Z=10138.67
498 X=-6372 Y=0 Z=10687.33
499 X=-6372 Y=0 Z=10687.33
500 X=-5469 Y=0 Z=10138.67
501 X=-5466 Y=0 Z=10138.67
502 X=-4566 Y=0 Z=10687.33
503 X=-3663 Y=0 Z=10138.67
504 X=-3663 Y=0 Z=10687.33
505 X=-3663 Y=0 Z=10687.33
506 X=-2759 Y=0 Z=10687.33
507 X=-1856 Y=0 Z=10138.67
508 X=-1856 Y=0 Z=10687.33
509 X=-953 Y=0 Z=10138.67
510 X=-953 Y=0 Z=10687.33
511 X=0 Y=0 Z=10138.67
512 X=0 Y=0 Z=10687.33
513 X=953 Y=0 Z=10138.67
514 X=953 Y=0 Z=10687.33
515 X=1856 Y=0 Z=10138.67
516 X=1856 Y=0 Z=10687.33
517 X=2759 Y=0 Z=10138.67
518 X=2759 Y=0 Z=10687.33
519 X=3663 Y=0 Z=10138.67
520 X=3663 Y=0 Z=10687.33
521 X=4566 Y=0 Z=10138.67
522 X=4566 Y=0 Z=10687.33
523 X=5466 Y=0 Z=10138.67
524 X=5466 Y=0 Z=10687.33
525 X=6369 Y=0 Z=10138.67
526 X=6372 Y=0 Z=10687.33
527 X=7275 Y=0 Z=10138.67
528 X=7275 Y=0 Z=10687.33
529 X=8178 Y=0 Z=10138.67
530 X=8178 Y=0 Z=10687.33
531 X=9081 Y=0 Z=10138.67
532 X=9081 Y=0 Z=10687.33
533 X=9984 Y=0 Z=10138.67
534 X=9984 Y=0 Z=10687.33
535 X=10888 Y=0 Z=10138.67
536 X=10888 Y=0 Z=10687.33
541 X=11791 Y=0 Z=10138.67
542 X=11791 Y=0 Z=10687.33
543 X=12694 Y=0 Z=10138.67
544 X=12694 Y=0 Z=10687.33
545 X=13897 Y=0 Z=10138.67
546 X=13897 Y=0 Z=10687.33

RESTRAPT
ADD-16 DOP=U1,U2,U3,R1,R2,R3
ADD-19 DOP=U1,U2,U3,R1,R2,R3
ADD-21 DOP=U1,U2,U3,R1,R2,R3

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ADD-19 DOP=U1,U2,U3,R1,R2,R3
ADD-48 DOP=U1,U2,U3,R1,R2,R3
ADD-43 DOP=U1,U2,U3,R1,R2,R3
ADD-45 DOP=U1,U2,U3,R1,R2,R3
ADD-58 DOP=U2,R1,R3
ADD-62 DOP=U2,R1,R3
ADD-68 DOP=U2,R1,R3
ADD-64 DOP=U2,R1,R3
ADD-74 DOP=U2,R1,R3
ADD-77 DOP=U2,R1,R3
ADD-81 DOP=U2,R1,R3
ADD-85 DOP=U2,R1,R3
ADD-89 DOP=U2,R1,R3
ADD-93 DOP=U2,R1,R3
ADD-97 DOP=U2,R1,R3
ADD-101 DOP=U2,R1,R3
ADD-105 DOP=U2,R1,R3
ADD-107 DOP=U1,U2,U3,R1,R2,R3
ADD-108 DOP=U2,R1,R3
ADD-111 DOP=U1,U2,U3,R1,R2,R3
ADD-112 DOP=U2,R1,R3
ADD-114 DOP=U2,R1,R3
ADD-122 DOP=U2,R1,R3
ADD-157 DOP=U1,U2,U3,R1,R2,R3
ADD-160 DOP=U2,R1,R3
ADD-180 DOP=U1,U2,U3,R1,R2,R3
ADD-181 DOP=U2,R1,R3
ADD-183 DOP=U1,U2,U3,R1,R2,R3
ADD-195 DOP=U2,R1,R3
ADD-199 DOP=U2,R1,R3
ADD-203 DOP=U2,R1,R3
ADD-207 DOP=U2,R1,R3
ADD-211 DOP=U2,R1,R3
ADD-215 DOP=U2,R1,R3
ADD-219 DOP=U2,R1,R3
ADD-223 DOP=U2,R1,R3
ADD-227 DOP=U2,R1,R3
ADD-231 DOP=U2,R1,R3
ADD-315 DOP=U2,R1,R3
ADD-239 DOP=U2,R1,R3
ADD-241 DOP=U2,R1,R3
ADD-247 DOP=U2,R1,R3
ADD-251 DOP=U2,R1,R3
ADD-255 DOP=U2,R1,R3
ADD-274 DOP=U2,R1,R3
ADD-275 DOP=U2,R1,R3
ADD-276 DOP=U2,R1,R3
ADD-278 DOP=U2,R1,R3
ADD-280 DOP=U2,R1,R3
ADD-282 DOP=U2,R1,R3

PARTTEN
RANK-BARTEN
ADD-1 V=2.623107
ADD-2 V=2.623107
ADD-3 V=2.623107
ADD-4 V=2.623107
ADD-5 V=2.623107
ADD-6 V=2.623107
ADD-7 V=2.623107
ADD-8 V=2.623107
ADD-9 V=2.623107
ADD-10 V=2.623107
ADD-11 V=2.623107
ADD-12 V=2.623107
ADD-13 V=2.623107
ADD-14 V=15.27057
ADD-15 V=13.64369
ADD-16 V=15.27057
ADD-17 V=2.623107
ADD-18 V=2.623107
ADD-19 V=13.64369
ADD-20 V=13.28549
ADD-21 V=6.055505
ADD-22 V=13.28549
ADD-23 V=10.92729
ADD-24 V=2.432583
ADD-25 V=10.92729
ADD-27 V= 0.047068
ADD-28 V=2.623107
ADD-29 V=2.432583
ADD-30 V=2.623107
ADD-31 V=13.64369
ADD-32 V=2.432583
ADD-33 V=9.70947
ADD-34 V=2.623107
ADD-35 V=2.623107
ADD-36 V=2.623107
ADD-37 V=6.055505
ADD-38 V=9.70947

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File: \\박우현\BAP2000 DATA\마감백\WIN01.52k 9/2
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ADD-39 V=13.28549
ADD-40 V=2.432583
ADD-41 V=8.4914
ADD-42 V=13.28549
ADD-43 V= 0.047068
ADD-44 V=7.273452
ADD-45 V=7.273452
ADD-46 V=3.2963
ADD-47 V=3.2963
ADD-48 V=15.00188
ADD-49 V=2.623107
ADD-51 V=2.623107
ADD-52 V=6.055505
ADD-53 V=13.64369
ADD-54 V=6.055505
ADD-55 V=13.28549
ADD-56 V=2.623107
ADD-57 V=2.623107
ADD-58 V=6.055505
ADD-59 V=2.432583
ADD-60 V=0.047068
ADD-61 V=4.515724
ADD-62 V=4.515724
ADD-63 V=4.515724
ADD-64 V=0.047068
ADD-65 V=4.515724
ADD-66 V=3.2963
ADD-67 V=2.432583
ADD-68 V= 0.047068
ADD-69 V=1.615281
ADD-70 V=2.623107
ADD-71 V=2.432583
ADD-72 V=0.047068
ADD-73 V=1.615281
ADD-74 V=2.432583
ADD-75 V= 0.047068
ADD-76 V= 8.052947
ADD-77 V=2.623107
ADD-78 V=2.432583
ADD-79 V= 0.047068
ADD-80 V= 8.052947
ADD-81 V=3.2963
ADD-82 V=2.432583
ADD-83 V= 0.047068
ADD-84 V= 0.047068
ADD-85 V=4.515724
ADD-86 V=2.432583
ADD-87 V= 0.047068
ADD-88 V= 0.047068
ADD-89 V=4.090316
ADD-90 V=2.432583
ADD-91 V= 0.047068
ADD-92 V=3.2963
ADD-93 V=4.515724
ADD-94 V=2.432583
ADD-95 V= 0.047068
ADD-96 V=2.623107
ADD-97 V=3.2963
ADD-98 V=2.432583
ADD-99 V= 0.047068
ADD-100 V=3.2963
ADD-101 V=2.623107
ADD-102 V=2.432583
ADD-103 V= 0.047068
ADD-104 V=2.623107
ADD-105 V=2.432583
ADD-106 V= 0.047068
ADD-107 V=6.983
ADD-108 V=2.623107
ADD-109 V=2.432583
ADD-110 V= 0.047068
ADD-111 V=15.00188
ADD-112 V=3.2963
ADD-113 V=2.432583
ADD-114 V= 0.047068
ADD-115 V=6.983
ADD-116 V=4.515724
ADD-117 V=2.432583
ADD-118 V= 0.047068
ADD-119 V=15.00188
ADD-120 V=2.623107
ADD-121 V=13.64369
ADD-122 V=6.055505
ADD-123 V=2.432583
ADD-124 V= 0.047068
ADD-125 V=13.64369
ADD-126 V=3.2963
ADD-127 V=12.28549
ADD-128 V=12.28549

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File: \\박우현\BAP2000 DATA\마감백\WIN01.52k 9/2
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ADD-129 V=10.92729
ADD-130 V=10.92729
ADD-131 V=2.432583
ADD-132 V=2.432583
ADD-133 V=3.2963
ADD-134 V=3.2963
ADD-135 V=3.2963
ADD-136 V=3.2963
ADD-137 V=3.2963
ADD-138 V=3.2963
ADD-139 V=3.2963
ADD-140 V=3.2963
ADD-141 V=3.2963
ADD-142 V=3.2963
ADD-143 V=3.2963
ADD-144 V=3.2963
ADD-145 V=3.2963
ADD-146 V=6.055505
ADD-147 V=4.515724
ADD-148 V=6.055505
ADD-149 V=4.515724
ADD-150 V=7.093947
ADD-151 V=7.093947
ADD-152 V=8.4914
ADD-153 V=8.4914
ADD-154 V=7.273452
ADD-155 V=6.15267
ADD-157 V=10.92729
ADD-158 V=10.92729
ADD-159 V=8.053095
ADD-160 V=10.92729
ADD-161 V=3.2963
ADD-162 V=4.515724
ADD-163 V=3.2963
ADD-164 V=3.2963
ADD-165 V=6.21107
ADD-166 V=4.515724
ADD-167 V=8.053243
ADD-168 V= 0.047068
ADD-169 V= 0.047068
ADD-170 V=4.515724
ADD-172 V=4.515724
ADD-173 V=4.515724
ADD-174 V=7.2759
ADD-180 V=10.92729
ADD-181 V=10.92729
ADD-183 V=16.14749
ADD-184 V=10.92729
ADD-187 V=6.489379
ADD-188 V=14.21575
ADD-189 V=15.287829
ADD-196 V=2.432583
ADD-197 V= 0.047068
ADD-199 V=8.070

File: \\박유원\SAF2000 DATA\LIFTING\Q!양.S2k 9/2
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[illegible]