HANKUK-15

【 포스코건설 아산레이크시티 2차 현장
외부 천장재(MP판넬) 】

구조 안전성 검토 보고서

2015. 02

HANKUK CONSTRUCTION &
RENOVATION TECHNOLOGY

(주)대한강재

진단기관 : 한국건설리노텍(주)

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제 출 문

(주) 대한강재 귀중

귀사 에서 의뢰하신 **『포스코건설 아산레이크시티 현장 2차 외부 천장재 (MP판넬)』** 의 구조안전성검토 과업을 완료하였기에 그 결과를 본 보고서로 제출합니다.

검토자 : 구조기술사 엄규환 (인)

2015. 02

한국건설리노텍주식회사

대표이사 정 명 래 (인)

목 차

1. 구조 검토 개요 .....

2. 검토 부재 및 위치도 .....

3. Frame 해석 .....

3.1 2.5m 천장재 .....

4. 부재 검토 근거 .....

4.1 2.5m 천장재 .....

1. 구조 검토 개요

1. 구조 검토 개요

1.1 공사명

포스코건설 아산레이크시티 2차 현장 외부 천장재(MP판넬) 구조검토

1.2 구조재료의 규격 및 재료의 강도

(1) 철골강도

- SS400 : Fy = 235 MPa

1.3 구조 검토 기준

(1) 설계기준

- 국토해양부 고시 건축구조기준 및 해설 (2009, 대한건축협회)

(2) 참고기준

- 건축물 하중기준 및 해설 (2000, 대한건축학회)
- 강구조 설계 (2009, 한국강구조학회)

1.4 적용하중

(1) 고정하중 (DEAD LOAD) = 0.3 KN/㎡

(2) 풍하중 (WIND LOAD)

① 설계속도압

- 설계기본풍속(Vo) : 45 m/sec
- 노 풍 도 : C
- 중요도 개수(Iw) : 1.0
- 고도분포계수(Kzr) : 1.0
- 지형계수(Kzt) : 1.0
- Vh (설계풍속)

  = Vo × Kzr × kzt × Iw = 40 × 1.0 × 1.0 × 1.0 = 45 m/sec
- qh (설계 속도압)

  = 1/2 × p × Vh^2 = 1/2 × 1.25 × 45^2 = 1,266 N/㎡

  [p (공기밀도) = 1.25 ($N.S^2/m^4$)]

② 외장재용 설계용 풍압(Pc)

= qh(GCpe-GCpi) = 1,266 × 1.8 ≒ 2.28 KN/㎡

1.5 구조해석

(1) 골조해석 : MIDAS GENw VER. 7.8.5

1.6 구조 검토 사항

(1) 포스코건설 아산레이크시티 2차 현장 외부 천장재(MP판넬) 구조 안전성 검토

1.7 구조 검토 결과

1.7.1 MP판넬

(1) 구조 검토 결과 - 천장재 내력상 안전한 것으로 판단됨.

(2) 2.5m 천장재

① 정압시

부 재	응력비	결 과
수직재(ㅁ-20×20×1.4)	0.458	OK
수평재(ㅁ-20×20×1.4)	0.041	OK
MP-BAR(ㄷ-40×30×0.5)	0.816	OK

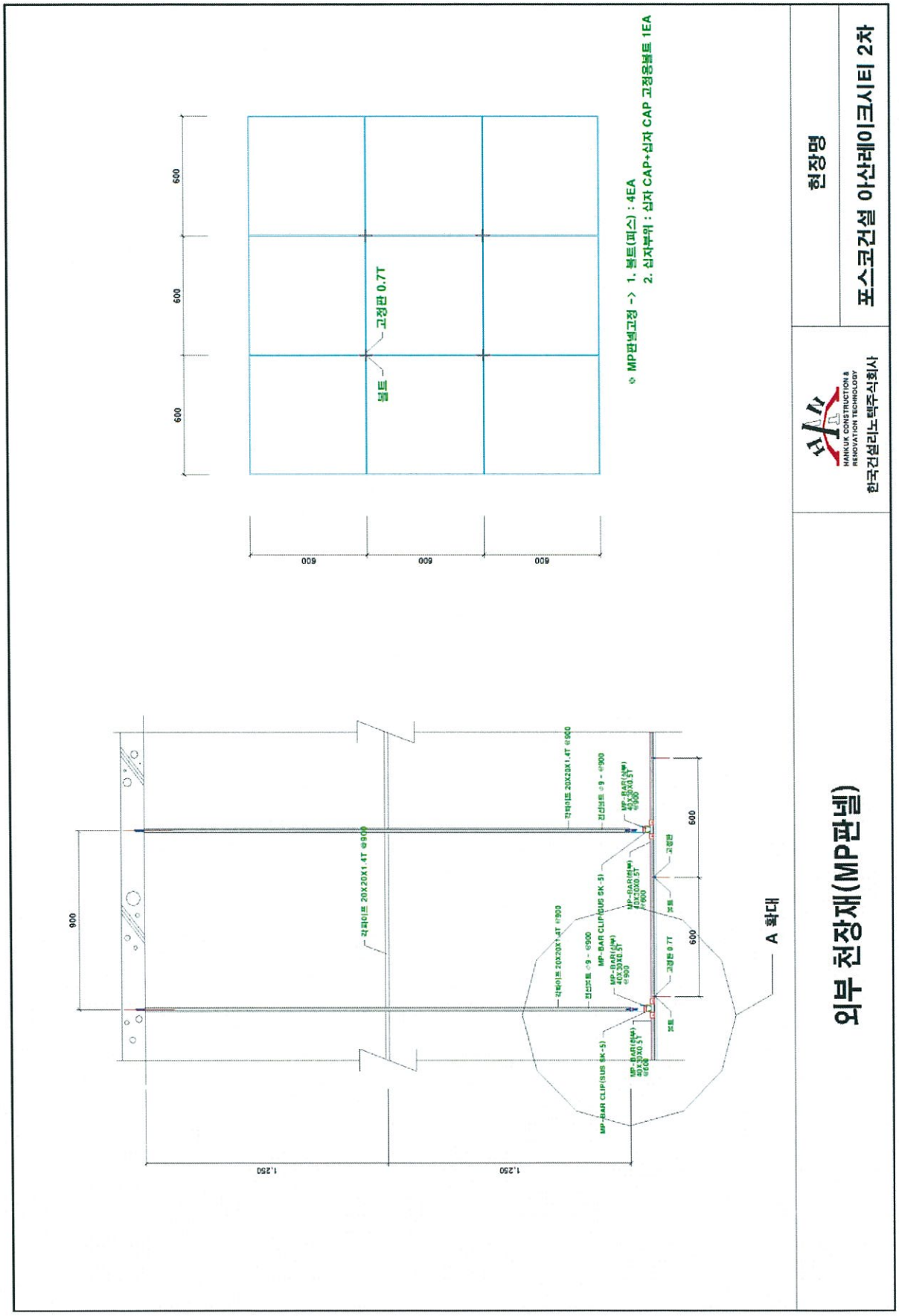
② 부압시

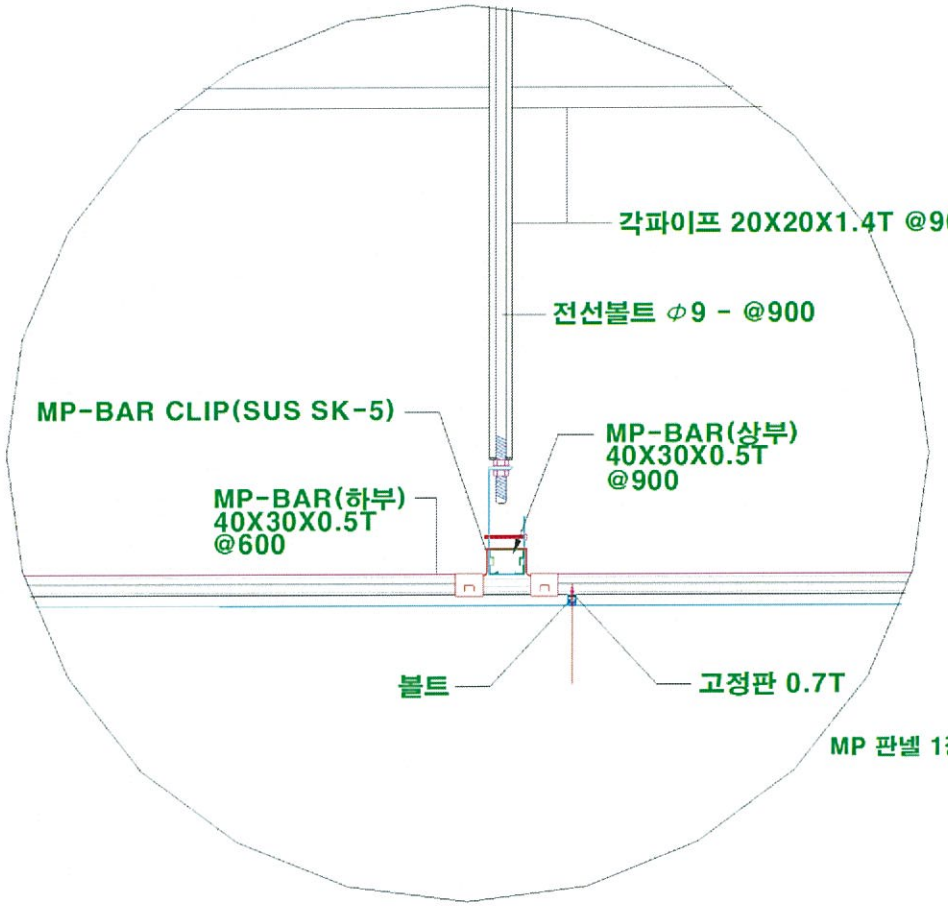
부 재	응력비	결 과
수직재(행거볼트-9mm)	0.268	OK
수평재(ㅁ-20×20×1.4)	0.01	OK
MP-BAR (ㄷ-40×30×0.5)	1.023	SAY OK

※. ① 위의 검토는 수직재의 간격이 가로, 세로 900mm로 시공되었을 경우에 한함

2. 검토부재

2.1 MP판넬


600
600
600
고정판 0.7T
볼트
600
600
600
◇ MP판넬고정 -> 1. 볼트(피스) : 4EA
2. 심자보위 : 심자 CAP+심자 CAP 고정용볼트 1EA
900
각파이프 20X20X1.4T @900
각파이프 20X20X1.4T @900
각파이프 20X20X1.4T @900
인장보트 ø9 - @900
인장보트 ø9 - @900
MP-BAR CLIP(SUS SK-5)
MP-BAR(상부) 40X30X0.5T @900
MP-BAR(상부) 40X30X0.5T @900
MP-BAR(상부) 40X30X0.5T @900
MP-BAR CLIP(SUS SK-5)
MP-BAR(상부) 40X30X0.5T @900
고정판
볼트
고정판 0.7T
볼트
600
600
1,250
1,250
A 확대
현장명
포스코건설 아산레이크시티 2차
HANKUK CONSTRUCTION & RENOVATION TECHNOLOGY
한국건설리노텍주식회사
외부 천장재(MP판넬)



MP 판넬 1장당 - 1. 볼트 : 4EA
2. 십자 CAP : 1EA
3. 십자 CAP 고정용볼트 : 1EA

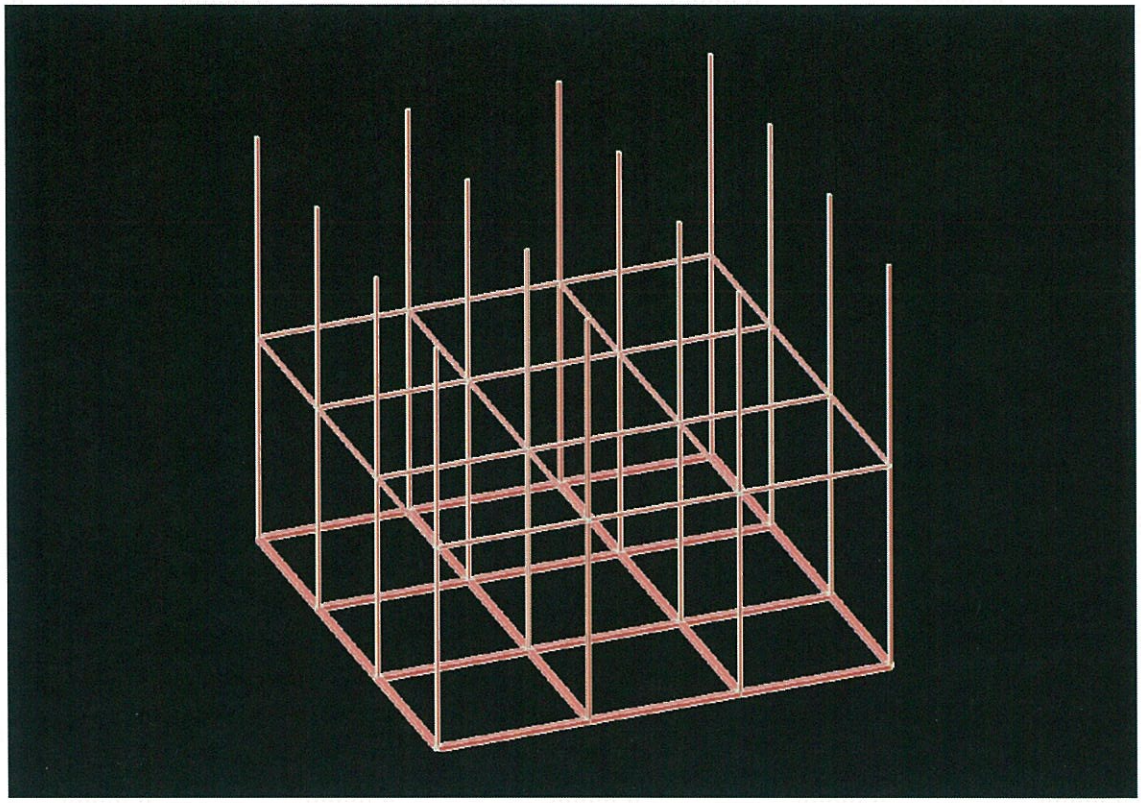
A 확대

외부 천장재(MP판넬)	HANKUK CONSTRUCTION & RENOVATION TECHNOLOGY 한국건설리노텍주식회사	현장명 포스코건설 아산레이크시티 2차

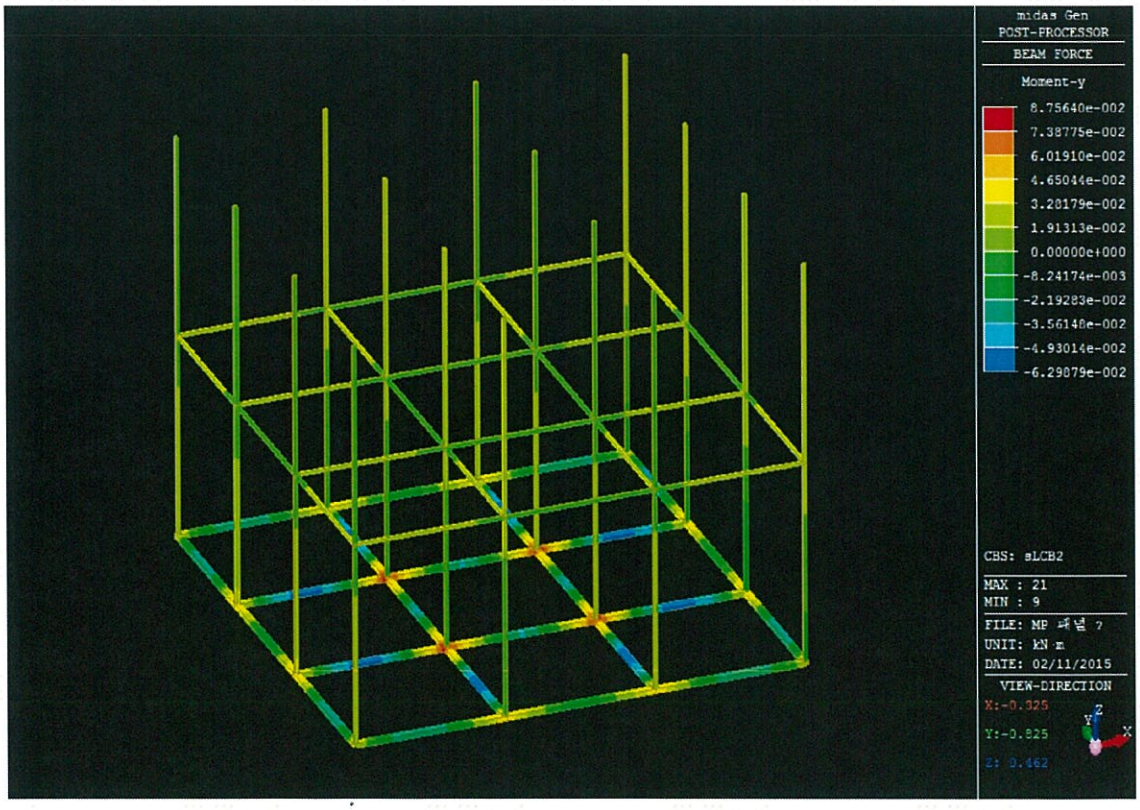
3. Frame 해석

3.1 MP판넬

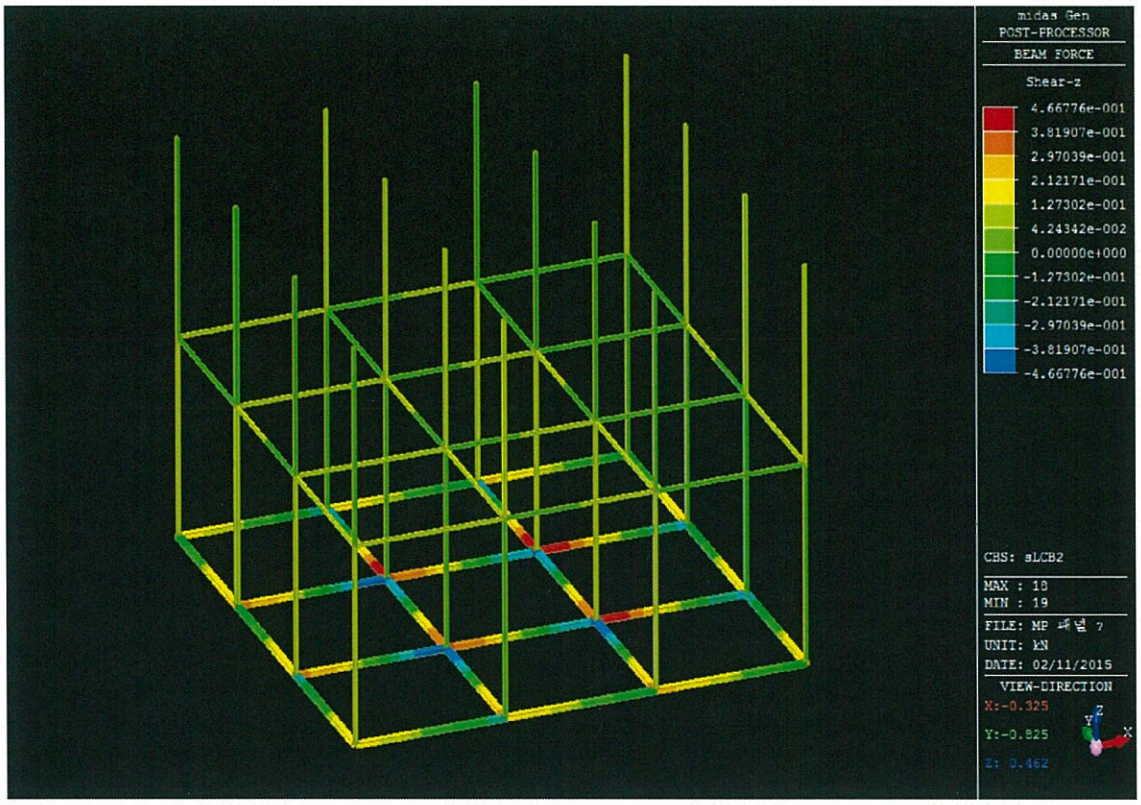
1) 정압



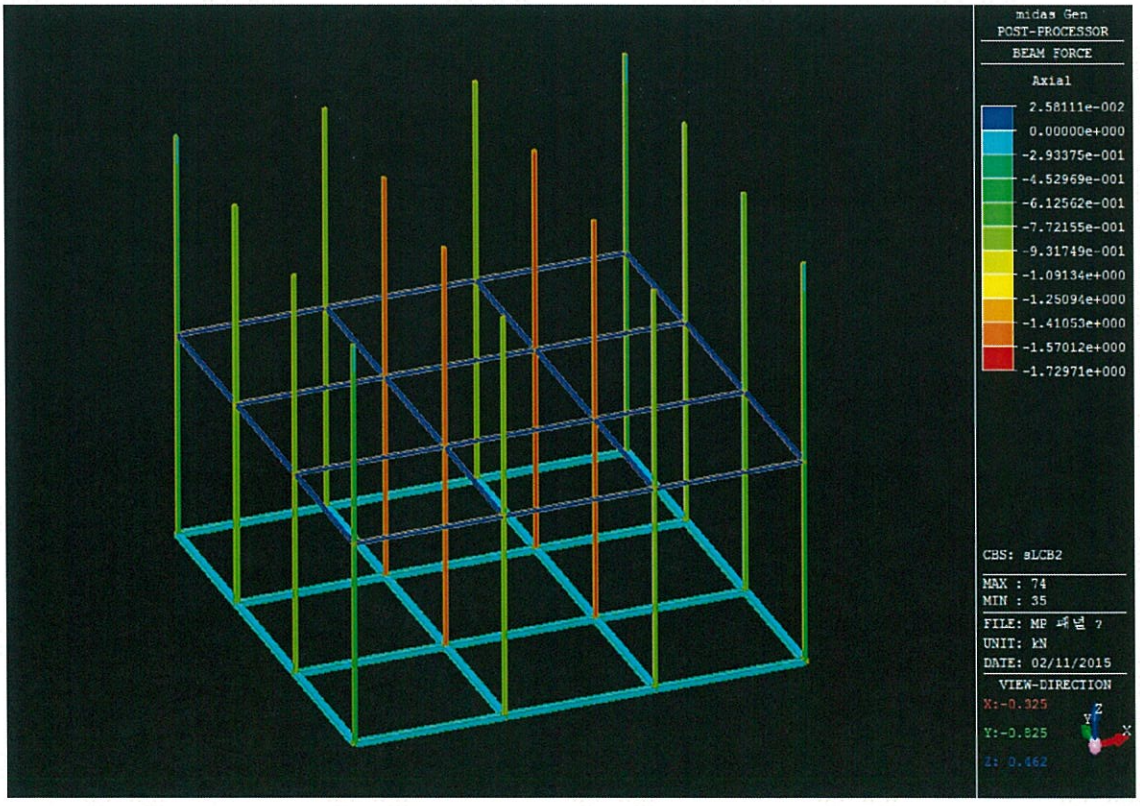
< 3D MODEL VIEW >



< 부재력 VIEW - 휨모멘트 >

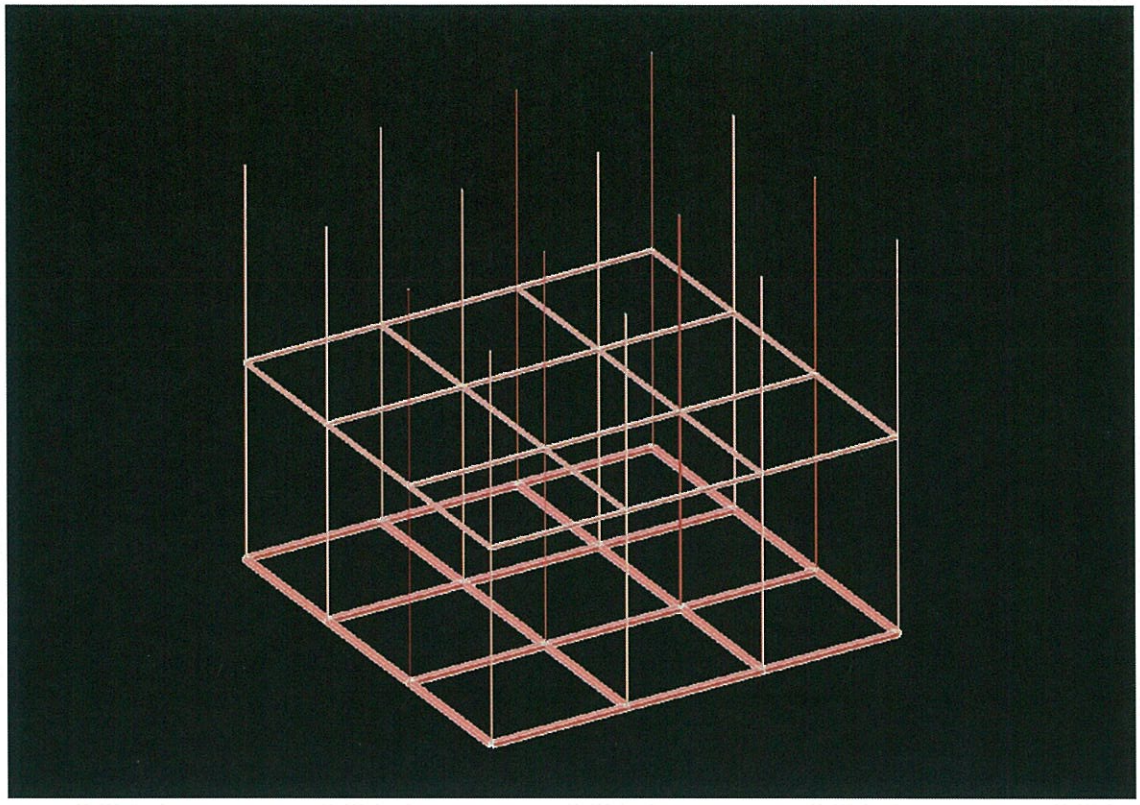


< 부재력 VIEW - 전단력 >

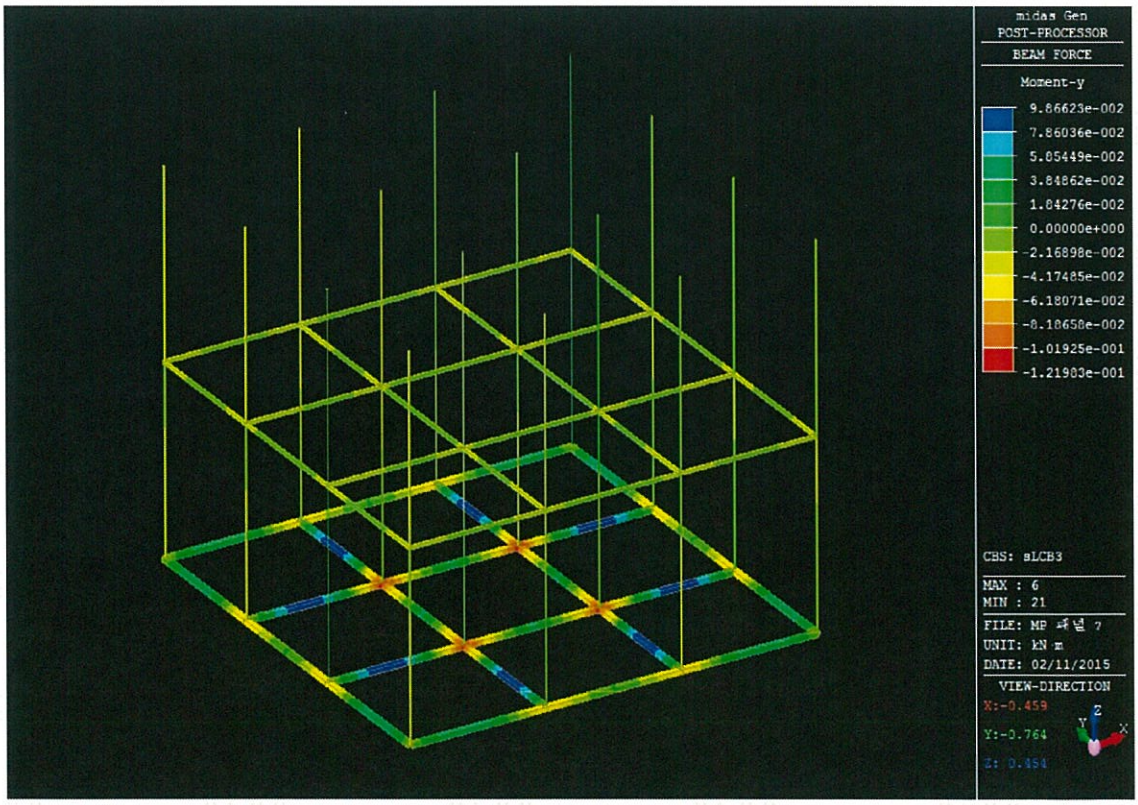


< 부재력 VIEW - 축력 >

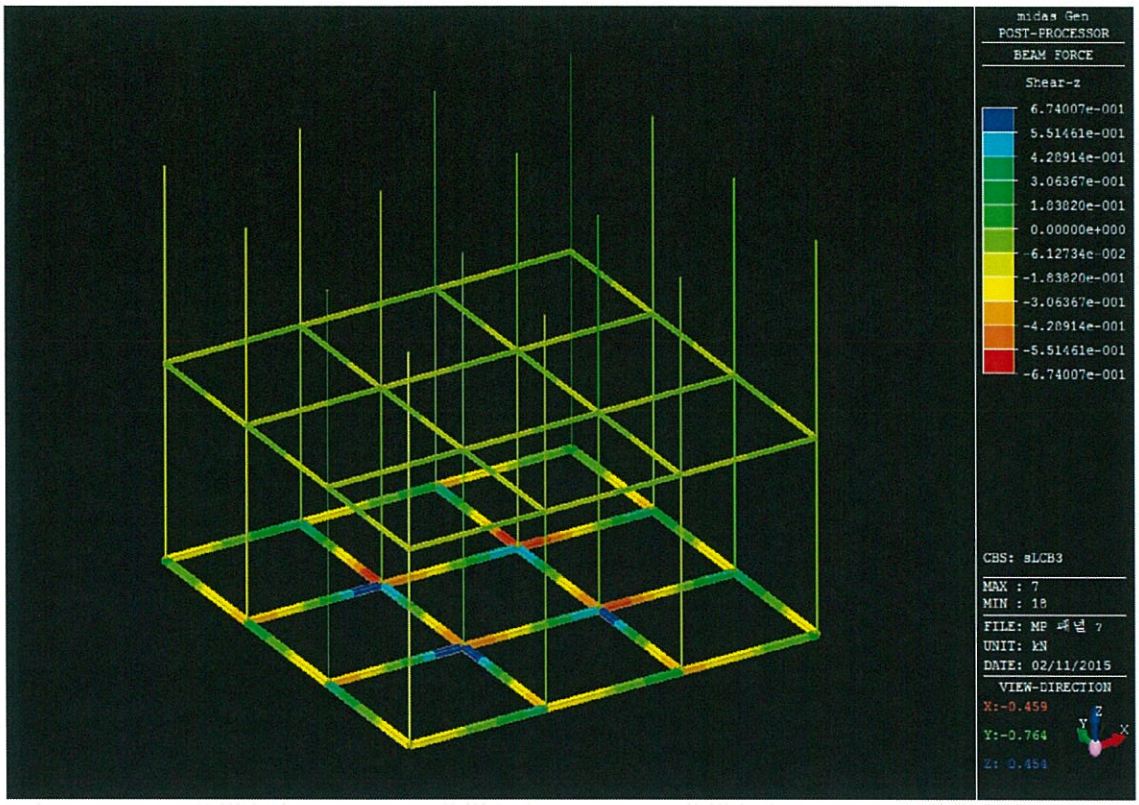
2) 부압



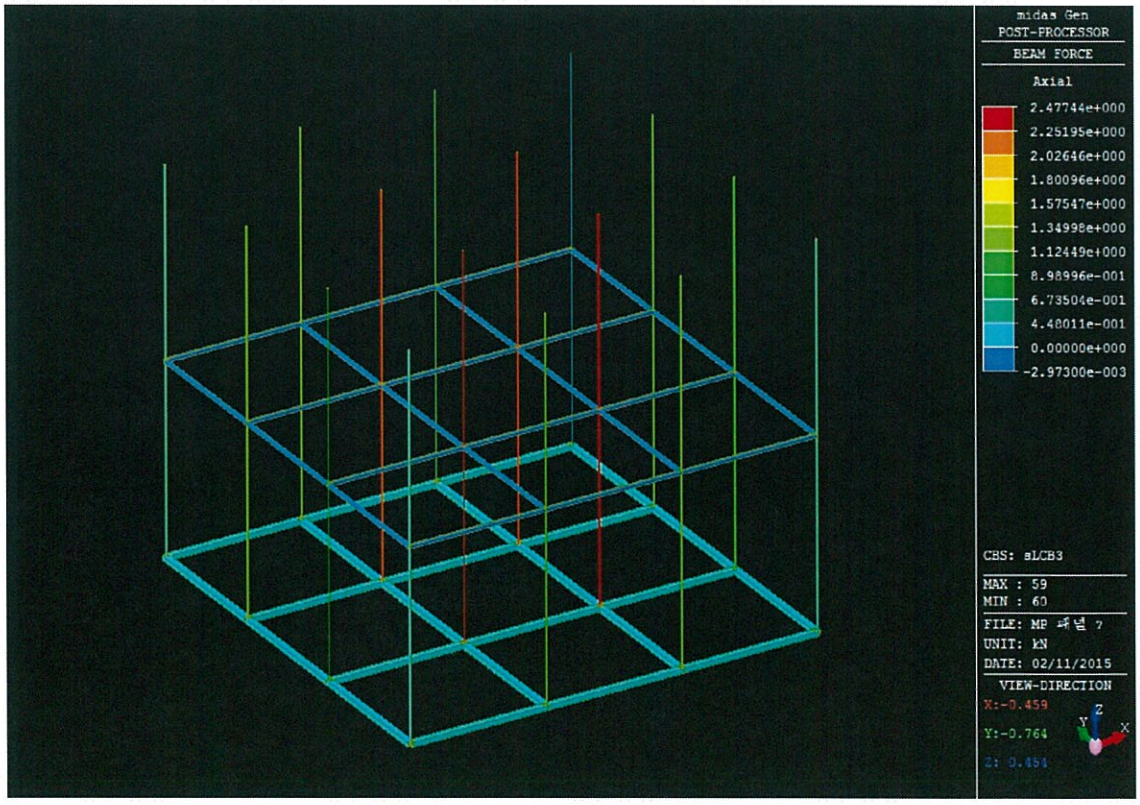
< 3D MODEL VIEW >



< 부재력 VIEW - 휨모멘트 >



< 부재력 VIEW - 전단력 >



< 부재력 VIEW - 축력 >

4. 부재검토 근거

4.1 MP판넬

1) 정압

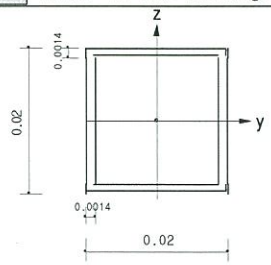
midas Gen **Steel Checking Result**

Certified by:

Company	한국건설리노텍	Project Title	
Author		File Name	D:\...\해석\MP 패널 천정재.mgb

1. Design Information

Design Code : KSSC-LSD09
Unit System : kN, m
Member No : 35
Material : SS400 (No:1)
(Fy = 235000, Es = 205000000)
Section Name : B 20x20x1.4(수직) (No:1)
(Built-up Section).
Member Length : 1.25000



2. Member Forces

Axial Force Fxx = -2.3609 (LCB: 3, POS:I)
Bending Moments My = 0.00655, Mz = -0.0066
End Moments Myi = 0.00671, Myj = -0.0018 (for Ly)
Myi = 0.00671, Myj = -0.0018 (for Lz)
Mzi = -0.0067, Mzj = 0.00175 (for Ly)
Shear Forces Fyy = -0.0068 (LCB: 3, POS:I)
Fzz = 0.00677 (LCB: 3, POS:I)

Depth	0.02000	Web Thick	0.00140
Flg Width	0.02000	Top F Thick	0.00140
Web Center	0.01860	Bot.F Thick	0.00140
Area	0.00010	Asz	0.00006
Qyb	0.00013	Qzb	0.00013
Iyy	0.00000	Izz	0.00000
Ybar	0.01000	Zbar	0.01000
Syy	0.00000	Szz	0.00000
ry	0.00761	rz	0.00761

3. Design Parameters

Unbraced Lengths Ly = 1.25000, Lz = 1.25000, Lb = 1.25000
Effective Length Factors Ky = 1.00, Kz = 1.00
Moment Factor / Bending Coefficient
Cmy = 0.85, Cmz = 0.85, Cb = 1.00

4. Checking Results

Slenderness Ratio
KL/r = 164.2 < 200.0 (Memb:35, LCB: 3)..... O.K
Axial Strength
Pu/phiPn = 2.36086/6.17312 = 0.382 < 1.000 ..... O.K
Bending Strength
Muy/phiMny = 0.00655/0.15395 = 0.043 < 1.000 ..... O.K
Muz/phiMnz = 0.00655/0.15395 = 0.043 < 1.000 ..... O.K
Combined Strength (Compression+Bending)
Pu/phiPn = 0.38 > 0.20
Rmax = Pu/phiPn + 8/9*[Muy/phiMny + Muz/phiMnz] = 0.458 < 1.000 ..... O.K
Shear Strength
Vuy/phiVny = 0.001 < 1.000 ..... O.K
Vuz/phiVnz = 0.001 < 1.000 ..... O.K

midas Gen **Steel Checking Result**

Certified by :

Company	한국건설리노텍	Project Title	
Author		File Name	D:\...\해석\MP 패널 천정재.mgb

1. Design Information

Design Code : KSSC-LSD09

Unit System : kN, m

Member No : 16

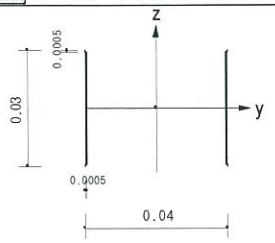
Material : SS400 (No:1)

(Fy = 235000, Es = 205000000)

Section Name : B 30x40x0.5T (No:2)

(Built-up Section).

Member Length : 0.90000



2. Member Forces

Axial Force Fxx = -0.0320 (LCB: 3, POS:J)

Bending Moments My = 0.11943, Mz = 0.00001

End Moments Myi = 0.03515, Myj = 0.11944 (for Ly)

Myi = 0.03515, Myj = 0.11944 (for Lyy)

Mzi = -0.0000, Mzj = 0.00001 (for Lzy)

Shear Forces Fyy = -0.0000 (LCB: 3, POS:I)

Fzz = -0.6370 (LCB: 3, POS:J)

Depth	0.03000	Web Thick	0.00050
Flg Width	0.04000	Top F Thick	0.00050
Web Center	0.03950	Bot.F Thick	0.00050
Area	0.00007	Asz	0.00003
Qyb	0.00040	Qzb	0.00049
Iyy	0.00000	Izz	0.00000
Ybar	0.02000	Zbar	0.01500
Syy	0.00000	Szz	0.00000
ry	0.01247	rz	0.01553

3. Design Parameters

Unbraced Lengths Ly = 0.90000, Lz = 0.90000, Lb = 0.90000

Effective Length Factors Ky = 1.00, Kz = 1.00

Moment Factor / Bending Coefficient

Cmy = 1.00, Cmz = 1.00, Cb = 1.00

4. Checking Results

Slenderness Ratio

KL/r = 72.2 < 200.0 (Memb:16, LCB: 3)..... O.K

Axial Strength

Pu/phiPn = 0.03200/8.57547 = 0.004 < 1.000 ..... O.K

Bending Strength

Muy/phiMny = 0.11943/0.14667 = 0.814 < 1.000 ..... O.K

Muz/phiMnz = 0.00001/0.16974 = 0.000 < 1.000 ..... O.K

Combined Strength (Compression+Bending)

Pu/phiPn = 0.00 < 0.20

Rmax = Pu/(2*phiPn) + [Muy/phiMny + Muz/phiMnz] = 0.816 < 1.000 ..... O.K

Shear Strength

Vuy/phiVny = 0.000 < 1.000 ..... O.K

Vuz/phiVnz = 0.187 < 1.000 ..... O.K

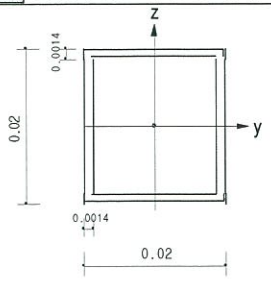
midas Gen **Steel Checking Result**

Certified by:

Company	한국건설리노텍	Project Title	
Author		File Name	D:\...\해석\MP 패널 천정재.mgb

1. Design Information

Design Code : KSSC-LSD09
Unit System : kN, m
Member No : 77
Material : SS400 (No:1)
(Fy = 235000, Es = 205000000)
Section Name : B 20x20x1.4(수평) (No:3)
(Built-up Section).
Member Length : 0.90000



2. Member Forces

Axial Force Fxx = 0.03527 (LCB: 3, POS:J)
Bending Moments My = 0.00621, Mz = -0.0000
End Moments Myi = -0.0020, Myj = 0.00621 (for Ly)
Myi = -0.0020, Myj = 0.00621 (for Ly)
Mzi = 0.00000, Mzj = -0.0000 (for Lz)
Shear Forces Fyy = 0.00000 (LCB: 3, POS:I)
Fzz = -0.0132 (LCB: 2, POS:I)

Depth	0.02000	Web Thick	0.00140
Flg Width	0.02000	Top F Thick	0.00140
Web Center	0.01860	Bot.F Thick	0.00140
Area	0.00010	Asz	0.00006
Qyb	0.00013	Qzb	0.00013
Iyy	0.00000	Izz	0.00000
Ybar	0.01000	Zbar	0.01000
Syy	0.00000	Szz	0.00000
ry	0.00761	rz	0.00761

3. Design Parameters

Unbraced Lengths Ly = 0.90000, Lz = 0.90000, Lb = 0.90000
Effective Length Factors Ky = 1.00, Kz = 1.00
Moment Factor / Bending Coefficient
Cmy = 1.00, Cmz = 1.00, Cb = 1.00

4. Checking Results

Slenderness Ratio
KL/r = 118.2 < 200.0 (Memb:41, LCB: 1)..... O.K
Axial Strength
Pu/phiPn = 0.0353/22.0298 = 0.002 < 1.000 ..... O.K
Bending Strength
Muy/phiMny = 0.00621/0.15395 = 0.040 < 1.000 ..... O.K
Muz/phiMnz = 0.00000/0.15395 = 0.000 < 1.000 ..... O.K
Combined Strength
Combined Stress
Pu/phiPn = 0.00 < 0.20
Rmax = Pu/(2*phiPn) + [Muy/phiMny + Muz/phiMnz] = 0.041 < 1.000 ..... O.K
Shear Strength
Vuy/phiVny = 0.000 < 1.000 ..... O.K
Vuz/phiVnz = 0.002 < 1.000 ..... O.K

2) 부압

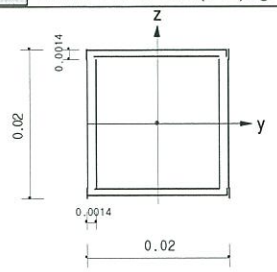
midas Gen **Steel Checking Result**

Certified by :

Company	한국건설리노텍	Project Title	
Author		File Name	D:\...\MP 패널 천정재(볼트).mgb

1. Design Information

Design Code : KSSC-LSD09
Unit System : kN, m
Member No : 60
Material : SS400 (No:1)
(Fy = 235000, Es = 205000000)
Section Name : B 20x20x1.4 (No:1)
(Built-up Section).
Member Length : 0.90000



2. Member Forces

Axial Force Fxx = -0.0037 (LCB: 2, POS:J)
Bending Moments My = -0.0015, Mz = 0.00000
End Moments Myi = -0.0003, Myj = -0.0015 (for Lby)
Myi = -0.0003, Myj = -0.0015 (for Lbz)
Mzi = 0.00000, Mzj = 0.00000 (for Lby)
Shear Forces Fyy = 0.00000 (LCB: 3, POS:I)
Fzz = -0.0057 (LCB: 1, POS:I)

Depth	0.02000	Web Thick	0.00140
Flg Width	0.02000	Top F Thick	0.00140
Web Center	0.01860	Bot.F Thick	0.00140
Area	0.00010	Asz	0.00006
Qyb	0.00013	Qzb	0.00013
Iyy	0.00000	Izz	0.00000
Ybar	0.01000	Zbar	0.01000
Syy	0.00000	Szz	0.00000
ry	0.00761	rz	0.00761

3. Design Parameters

Unbraced Lengths Ly = 0.90000, Lz = 0.90000, Lb = 0.90000
Effective Length Factors Ky = 1.00, Kz = 1.00
Moment Factor / Bending Coefficient
Cmy = 1.00, Cmz = 1.00, Cb = 1.00

4. Checking Results

Slenderness Ratio
KL/r = 118.2 < 200.0 (Memb:60, LCB: 2)..... O.K
Axial Strength
Pu/phiPn = 0.0037/11.1710 = 0.000 < 1.000 ..... O.K
Bending Strength
Muy/phiMny = 0.00152/0.15395 = 0.010 < 1.000 ..... O.K
Muz/phiMnz = 0.00000/0.12774 = 0.000 < 1.000 ..... O.K
Combined Strength (Compression+Bending)
Pu/phiPn = 0.00 < 0.20
Rmax = Pu/(2*phiPn) + [Muy/phiMny + Muz/phiMnz] = 0.010 < 1.000 ..... O.K
Shear Strength
Vuy/phiVny = 0.000 < 1.000 ..... O.K
Vuz/phiVnz = 0.001 < 1.000 ..... O.K

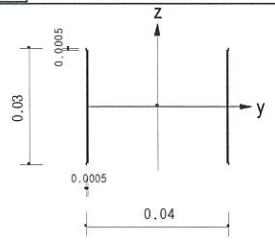
midas Gen **Steel Checking Result**

Certified by :

Company	한국건설리노텍	Project Title	
Author		File Name	D:\...\WP 패널 천정재(볼트).mgb

1. Design Information

Design Code : KSSC-LSD09
Unit System : kN, m
Member No : 16
Material : SS400 (No:1)
(Fy = 235000, Es = 205000000)
Section Name : B 30x40x0.5 (No:2)
(Built-up Section).
Member Length : 0.90000



2. Member Forces

Axial Force Fxx = 0.00365 (LCB: 2, POS:J)
Bending Moments My = -0.1501, Mz = 0.00000
End Moments Myi = -0.0123, Myj = -0.1501 (for Ly)
Myi = -0.0123, Myj = -0.1501 (for Lyb)
Mzi = 0.00000, Mzj = 0.00000 (for Lzy)
Shear Forces Fyy = 0.00000 (LCB: 3, POS:I)
Fzz = 0.82899 (LCB: 2, POS:J)

Depth	0.03000	Web Thick	0.00050
Flg Width	0.04000	Top F Thick	0.00050
Web Center	0.03950	Bot.F Thick	0.00050
Area	0.00007	Asz	0.00003
Qyb	0.00040	Qzb	0.00049
Iyy	0.00000	Izz	0.00000
Ybar	0.02000	Zbar	0.01500
Syy	0.00000	Szz	0.00000
ry	0.01247	rz	0.01553

3. Design Parameters

Unbraced Lengths Ly = 0.90000, Lz = 0.90000, Lb = 0.90000
Effective Length Factors Ky = 1.00, Kz = 1.00
Moment Factor / Bending Coefficient
Cmy = 1.00, Cmz = 1.00, Cb = 1.00

4. Checking Results

Slenderness Ratio
L/r = 72.2 < 300.0 (Memb:16, LCB: 2)..... O.K
Axial Strength
Pu/phiPn = 0.0037/14.5935 = 0.000 < 1.000 ..... O.K
Bending Strength
Muy/phiMny = 0.15006/0.14667 = 1.023 > 1.000 ..... N.G
Muz/phiMnz = 0.00000/0.17603 = 0.000 < 1.000 ..... O.K
Combined Strength
Combined Stress
Pu/phiPn = 0.00 < 0.20
Rmax = Pu/(2*phiPn) + [Muy/phiMny + Muz/phiMnz] = 1.023 > 1.000 ..... N.G
Shear Strength
Vuy/phiVny = 0.000 < 1.000 ..... O.K
Vuz/phiVnz = 0.243 < 1.000 ..... O.K

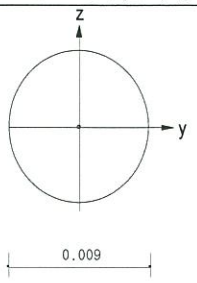
midas Gen **Steel Checking Result**

Certified by :

Company	한국건설리노텍	Project Title	
Author		File Name	D:\...\WP 패널 천정재(볼트).mgb

1. Design Information

Design Code : KSSC-LSD09
Unit System : kN, m
Member No : 35
Material : SS400 (No:1)
(Fy = 235000, Es = 205000000)
Section Name : D9 볼트 (No:3)
(Built-up Section).
Member Length : 1.25000



2. Member Forces

Outer Dia.	0.00900			
Area	0.00006	Asz	0.00006	
Qyb	0.00001	Qzb	0.00001	
Iyy	0.00000	Izz	0.00000	
Ybar	0.00450	Zbar	0.00450	
Syy	0.00000	Szz	0.00000	
ry	0.00225	rz	0.00225	

Axial Force Fxx = 3.00994 (LCB: 2, POS:I)
Bending Moments My = -0.0009, Mz = 0.00086
End Moments Myi = -0.0009, Myj = 0.00039 (for Ly)
Myi = -0.0009, Myj = 0.00039 (for Ly)
Mzi = 0.00086, Mzj = -0.0004 (for Lz)
Shear Forces Fyy = 0.00100 (LCB: 2, POS:I)
Fzz = -0.0010 (LCB: 2, POS:I)

3. Design Parameters

Unbraced Lengths Ly = 1.25000, Lz = 1.25000, Lb = 1.25000
Effective Length Factors Ky = 1.00, Kz = 1.00
Moment Factor / Bending Coefficient
Cmy = 0.85, Cmz = 0.85, Cb = 1.00

4. Checking Results

Slenderness Ratio
L/r = 555.6 > 300.0 (Memb:35, LCB: 2)..... N.G
Axial Strength
Pu/phiPn = 3.0099/13.4550 = 0.224 < 1.000 ..... O.K
Bending Strength
Muy/phiMny = 0.00086/0.02422 = 0.035 < 1.000 ..... O.K
Muz/phiMnz = 0.00086/0.02422 = 0.035 < 1.000 ..... O.K
Combined Strength
Combined Stress
Pu/phiPn = 0.22 > 0.20
Rmax = Pu/phiPn + 8/9*SQRT[(Muy/phiMny)^2 + (Muz/phiMnz)^2] = 0.268 < 1.000 ..... O.K
Shear Strength
Vuy/phiVny = 0.000 < 1.000 ..... O.K
Vuz/phiVnz = 0.000 < 1.000 ..... O.K