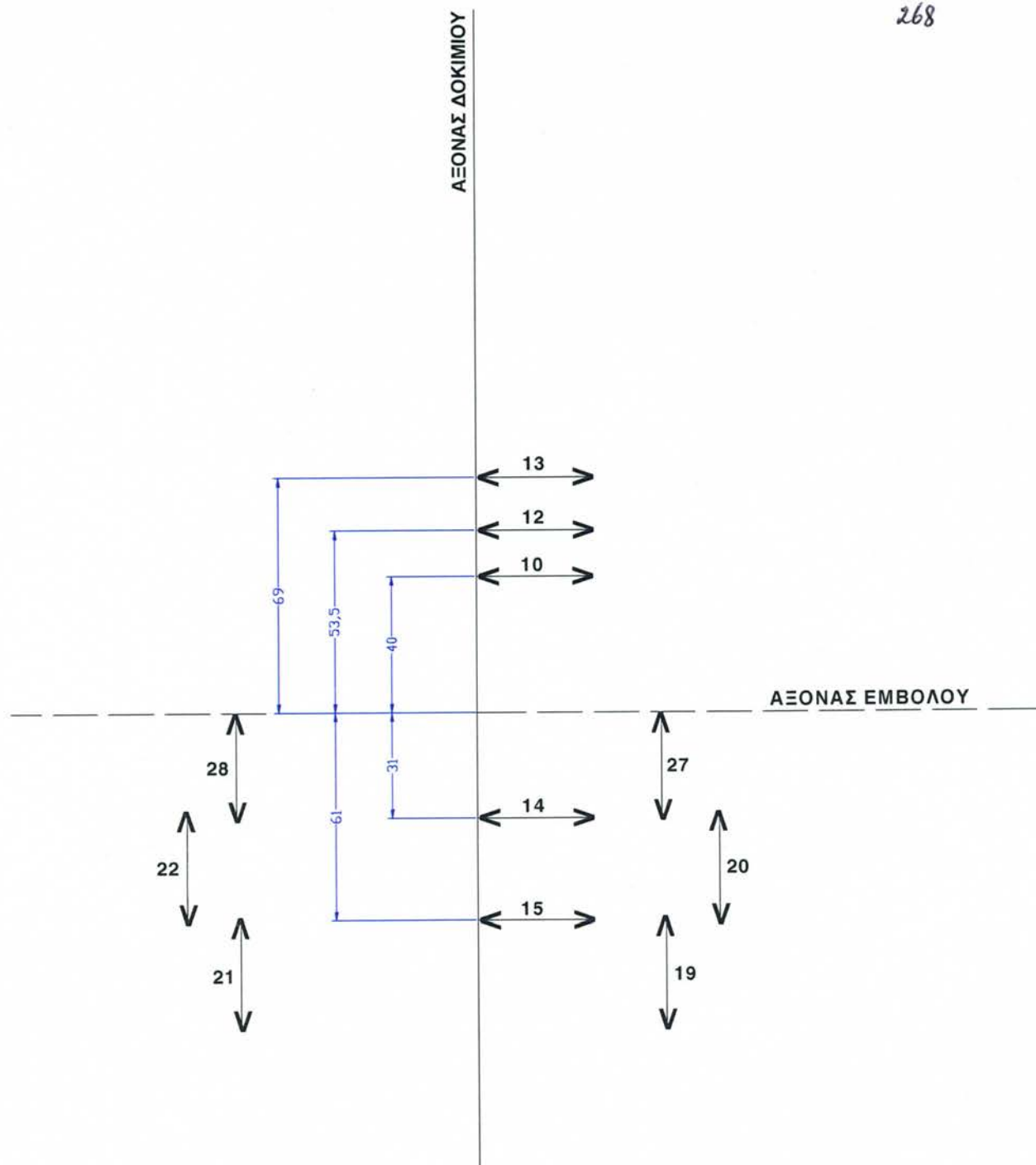


ΠΑΡΑΡΤΗΜΑΤΑ 1^ο ΤΟΜΟΥ



Σχήμα 9.1: Θέσεις μετρητικών οργάνων.

ΠΑΡΑΡΤΗΜΑ Ι

ΠΡΟΣΟΜΟΙΩΜΑΤΑ ΚΑΙ ΥΠΟΛΟΓΙΣΤΙΚΑ ΣΤΟΙΧΕΙΑ ΑΝΑΛΥΣΗΣ ΤΩΝ ΔΙΑΤΟΜΩΝ ΤΩΝ ΥΠΟΣΤΥΛΩΜΑΤΩΝ

ΠΑΡΑΡΤΗΜΑ Ι

ΠΡΟΣΟΜΟΙΩΜΑΤΑ ΚΑΙ ΥΠΟΛΟΓΙΣΤΙΚΑ ΣΤΟΙΧΕΙΑ ΑΝΑΛΥΣΗΣ ΤΩΝ ΔΙΑΤΟΜΩΝ ΤΩΝ ΥΠΟΣΤΥΛΩΜΑΤΩΝ

XTRACT Material Report -

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Material Name: Unconfined1

Material Type: Unconfined Concrete

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Input Parameters:

Tension Strength:	-2000 kPa
28 Day Strength:	21.00E+3 kPa
Post Crushing Strength:	5000 kPa
Tension Strain Capacity:	92.17E-6 Compression
Spalling Strain:	6.000E-3 Tension
Crushing Strain:	6.000E-3 Compression
Elastic Modulus:	2.17E+7 kPa
Secant Modulus:	1523 kPa

Model Details:

For Strain - $\varepsilon < 2 \cdot \varepsilon_t$ $f_c = 0$

For Strain - $\varepsilon < 0$ $f_c = \varepsilon \cdot E_c$

For Strain - $\varepsilon < \varepsilon_{cu}$ $f_c = \frac{f_c \cdot x \cdot r}{r - 1 + x^r}$

For Strain - $\varepsilon < \varepsilon_{sp}$ $f_c = f_{cu} + (f_{cp} - f_{cu}) \cdot \frac{(\varepsilon - \varepsilon_{cu})}{(\varepsilon_{sp} - \varepsilon_{cu})}$

$$x = \frac{\varepsilon}{\varepsilon_{cc}}$$

$$r = \frac{E_c}{E_c - E_{sec}}$$

$$E_{sec} = \frac{f_c}{\varepsilon_{cc}}$$

ε = Concrete Strain

f_c = Concrete Stress

E_c = Elastic Modulus

E_{sec} = Secant Modulus

ε_t = Tension Strain Capacity

ε_{cu} = Ultimate Concrete Strain

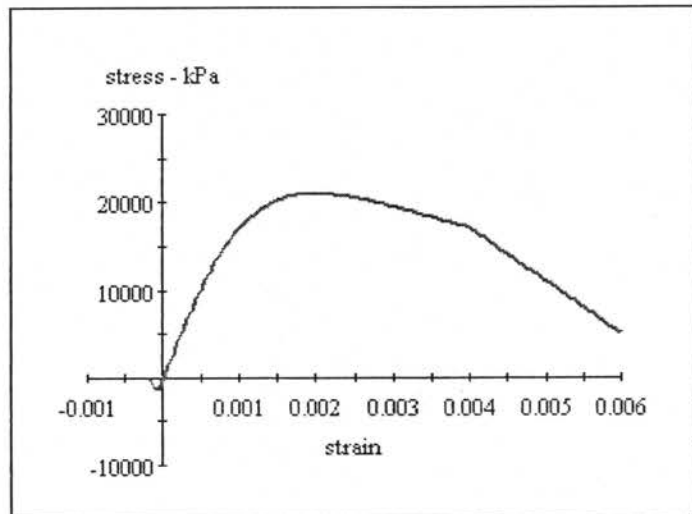
ε_{cc} = Strain at Peak Stress = .002

ε_{sp} = Spalling Strain

f_c = 28 Day Compressive Strength

f_{cu} = Stress at ε_{cu}

f_{cp} = Post Spalling Strength



Material Color States:

- Tension strain after tension capacity
- Tension strain before tension capacity
- Initial state
- Compression before crushing strain
- Compression before end of spalling
- Compression after spalling

Reference:

Mander, J.B., Priestley, M. J. N., "Observed Stress-Strain Behavior of Confined Concrete", Journal of Structural Engineering, ASCE, Vol. 114, No. 8, August 1988, pp. 1827-1849

XTRACT Material Report -

For use only in an academic or research setting.

Material Name: Confined1

Material Type: Confined Concrete

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Input Parameters:

Tension Strength:	-2000 kPa
28 Day Strength:	21.00E+3 kPa
Confined Concrete Strength:	21.28E+3 kPa
Tension Strain Capacity:	92.17E-6 Compression
Strain at Peak Stress:	2.133E-3
Crushing Strain:	14.35E-3 Compression
Elastic Modulus:	2.17E+7 kPa
Secant Modulus:	1447 kPa

Model Details:

For Strain - $\varepsilon < 2 \cdot \varepsilon_t$	$f_c = 0$
For Strain - $\varepsilon < 0$	$f_c = \varepsilon \cdot E_c$
For Strain - $\varepsilon < \varepsilon_{cu}$	$f_c = \frac{f_{cc} \cdot x \cdot r}{r - 1 + x^r}$

$$x = \frac{\varepsilon}{\varepsilon_{cc}}$$

$$\varepsilon_{cc} = .002 \cdot \left[1 + 5 \cdot \left(\frac{f_{cc}}{f_c} - 1 \right) \right]$$

$$r = \frac{E_c}{E_c - E_{sec}}$$

$$E_{sec} = \frac{f_{cc}}{\varepsilon_{cc}}$$

ε = Concrete Strain

f_c = Concrete Stress

E_c = Elastic Modulus

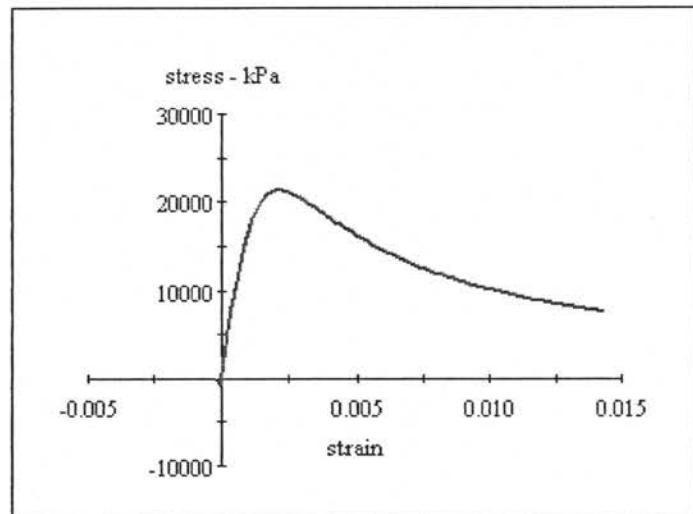
ε_t = Tension Strain Capacity

ε_{cu} = Ultimate Concrete Strain

ε_{cc} = Strain at Peak Stress

f_c = 28 Day Compressive Strength

f_{cc} = Confined Concrete Strength



Material Color States:

- ☐ Tension strain after tension capacity
- ☐ Tension strain before tension capacity
- ☐ Initial state
- ☐ Compression before crushing strain

Reference:

Mander, J.B., Priestley, M. J. N., "Observed Stress-Strain Behavior of Confined Concrete", Journal of Structural Engineering, ASCE, Vol. 114, No. 8, August 1988, pp. 1827-1849

XTRACT Material Report -

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Material Name: unconfined2

Material Type: Unconfined Concrete

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Input Parameters:

Tension Strength:	-1800 kPa
28 Day Strength:	18.00E+3 kPa
Post Crushing Strength:	0 kPa
Tension Strain Capacity:	89.55E-6 Compression
Spalling Strain:	6.000E-3 Tension
Crushing Strain:	6.000E-3 Compression
Elastic Modulus:	2.01E+7 kPa
Secant Modulus:	1305 kPa

Model Details:

For Strain - $\varepsilon < 2 \cdot \varepsilon_t$ $f_c = 0$

For Strain - $\varepsilon < 0$ $f_c = \varepsilon \cdot E_c$

For Strain - $\varepsilon < \varepsilon_{cu}$ $f_c = \frac{f_c \cdot x \cdot r}{r - 1 + x^r}$

For Strain - $\varepsilon < \varepsilon_{sp}$ $f_c = f_{cu} + (f_{cp} - f_{cu}) \cdot \frac{(\varepsilon - \varepsilon_{cu})}{(\varepsilon_{sp} - \varepsilon_{cu})}$

$$x = \frac{\varepsilon}{\varepsilon_{cc}}$$

$$r = \frac{E_c}{E_c - E_{sec}}$$

$$E_{sec} = \frac{f_c}{\varepsilon_{cc}}$$

ε = Concrete Strain

f_c = Concrete Stress

E_c = Elastic Modulus

E_{sec} = Secant Modulus

ε_t = Tension Strain Capacity

ε_{cu} = Ultimate Concrete Strain

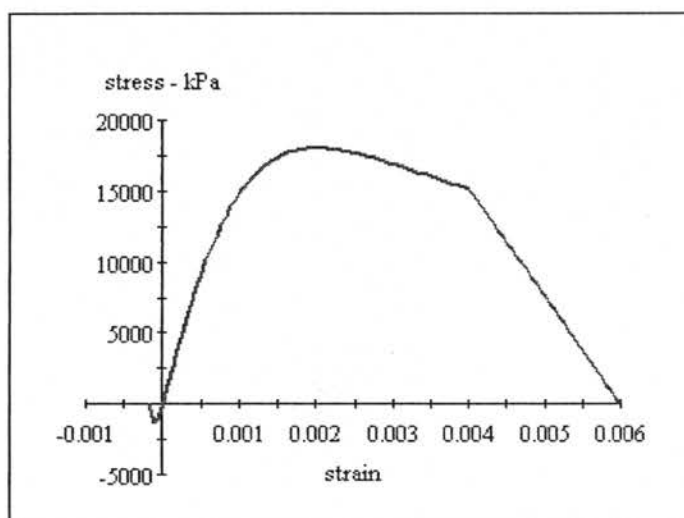
ε_{cc} = Strain at Peak Stress = .002

ε_{sp} = Spalling Strain

f_c = 28 Day Compressive Strength

f_{cu} = Stress at ε_{cu}

f_{cp} = Post Spalling Strength



Material Color States:

- Tension strain after tension capacity
- Tension strain before tension capacity
- Initial state
- Compression before crushing strain
- Compression before end of spalling
- Compression after spalling

Reference:

Mander, J.B., Priestley, M. J. N., "Observed Stress-Strain Behavior of Confined Concrete", Journal of Structural Engineering, ASCE, Vol. 114, No. 8, August 1988, pp. 1827-1849

XTRACT Material Report -

For use only in an academic or research setting.

Material Name: Confined2

Material Type: Confined Concrete

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Input Parameters:

Tension Strength: -2000 kPa
 28 Day Strength: 21.00E+3 kPa
 Confined Concrete Strength: 30.18E+3 kPa
 Tension Strain Capacity: 92.17E-6 Compression
 Strain at Peak Stress: 6.371E-3
 Crushing Strain: 20.00E-3 Compression
 Elastic Modulus: 2.17E+7 kPa
 Secant Modulus: 687.0 kPa

Model Details:

For Strain - $\varepsilon < 2 \cdot \varepsilon_t$ $f_c = 0$

For Strain - $\varepsilon < 0$ $f_c = \varepsilon \cdot E_c$

For Strain - $\varepsilon < \varepsilon_{cu}$ $f_c = \frac{f_{cc} \cdot x \cdot r}{r - 1 + x^r}$

$$x = \frac{\varepsilon}{\varepsilon_{cc}}$$

$$\varepsilon_{cc} = .002 \cdot \left[1 + 5 \cdot \left(\frac{f_{cc}}{f_c} - 1 \right) \right]$$

$$r = \frac{E_c}{E_c - E_{sec}}$$

$$E_{sec} = \frac{f_{cc}}{\varepsilon_{cc}}$$

ε = Concrete Strain

f_c = Concrete Stress

E_c = Elastic Modulus

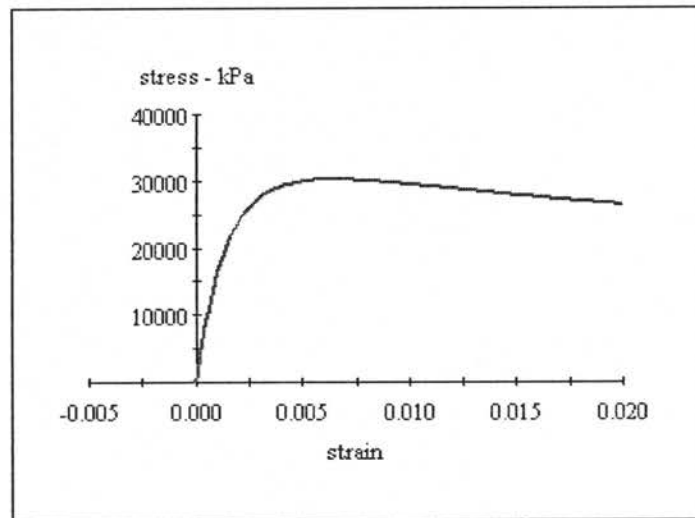
ε_t = Tension Strain Capacity

ε_{cu} = Ultimate Concrete Strain

ε_{cc} = Strain at Peak Stress

f_c = 28 Day Compressive Strength

f_{cc} = Confined Concrete Strength



Material Color States:

- ☐ Tension strain after tension capacity
- ☐ Tension strain before tension capacity
- ☐ Initial state
- ☐ Compression before crushing strain

Reference:

Mander, J.B., Priestley, M. J. N., "Observed Stress-Strain Behavior of Confined Concrete", Journal of Structural Engineering, ASCE, Vol. 114, No. 8, August 1988, pp. 1827-1849

XTRACT Section Report -

For use only in an academic or research setting.

Section Name: coll

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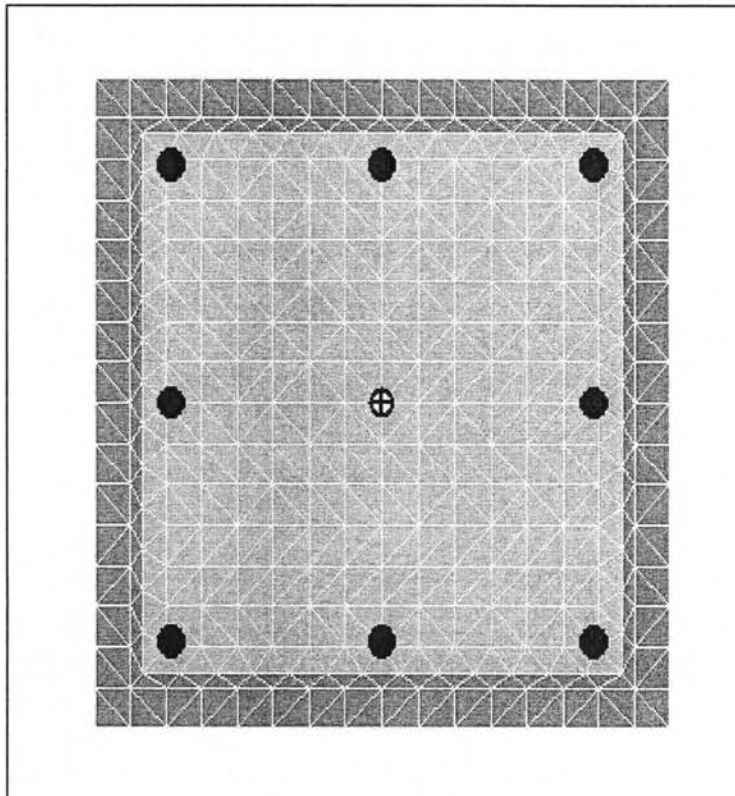
Page __ of __

Section Details:

X Centroid: $-1.701\text{E-}16$ m
 Y Centroid: $-2.034\text{E-}16$ m
 Section Area: $90.00\text{E-}3$ m²
 I gross about X: $.6846\text{E-}3$ m⁴
 I gross about Y: $.6846\text{E-}3$ m⁴
 Reinforcing Bar Area: $1.232\text{E-}3$ m²
 Percent Longitudinal Steel: 1.368 %
 Overall Width: .3000 m
 Overall Height: .3000 m
 Number of Fibers: 616
 Number of Bars: 8
 Number of Materials: 3

Material Types and Names:

Unconfined Concrete:  Unconfined1
 Confined Concrete:  Confined1
 Strain Hardening Steel:  Steel1



Comments:

Section Type: Rectangular Column
 Type of Reinforcing: Single Hoop
 Transverse Reinforcing Bar Size: 8 mm
 Spacing of Transverse Steel: 0.35 m
 Section Width: .3 m
 Section Height: .3 m
 Cover Thickness: $25.10\text{E-}3$ m
 Number of Longitudinal Bars: 8
 Longitudinal Bar Size: 14 mm
 Cover Concrete: Unconfined1
 Column Core Concrete: Confined1
 Longitudinal Steel: Steel1

XTRACT Section Report -

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Section Name: coll

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Reinforcing Bar List:

Bar Number	X (m)	Y (m)	Bar Size	Area (m ²)	Prestress (kN)	Material Type
1	-.1099	-.1099	14 mm	.1539E-3	0	Steel1
2	0	-.1099	14 mm	.1539E-3	0	Steel1
3	.1099	-.1099	14 mm	.1539E-3	0	Steel1
4	-.1099	0	14 mm	.1539E-3	0	Steel1
5	.1099	0	14 mm	.1539E-3	0	Steel1
6	-.1099	.1099	14 mm	.1539E-3	0	Steel1
7	0	.1099	14 mm	.1539E-3	0	Steel1
8	.1099	.1099	14 mm	.1539E-3	0	Steel1

XTRACT Section Report -

For use only in an academic or research setting.

Section Name: colC130

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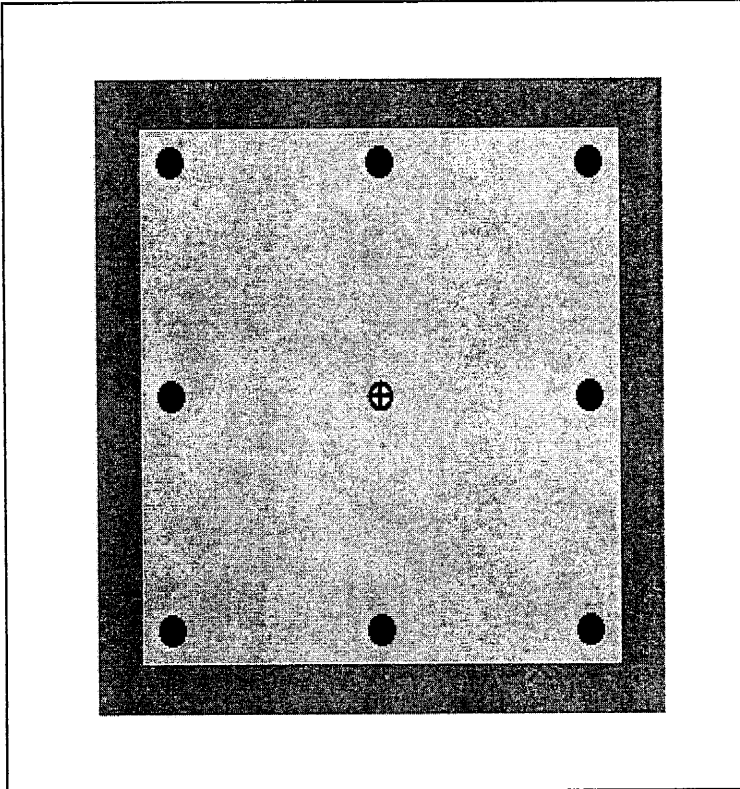
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Page __ of __

Section Details:

X Centroid: $-.1701\text{E-}16$ m
 Y Centroid: $-.2034\text{E-}16$ m
 Section Area: $92.05\text{E-}3$ m²
 I gross about X: $.7157\text{E-}3$ m⁴
 I gross about Y: $.7157\text{E-}3$ m⁴
 Reinforcing Bar Area: $1.232\text{E-}3$ m²
 Percent Longitudinal Steel: 1.338 %
 Overall Width: .3034 m
 Overall Height: .3034 m
 Number of Fibers: 864
 Number of Bars: 8
 Number of Materials: 4



Material Types and Names:

Unconfined Concrete: ☒ Unconfined1
 Confined Concrete: ☒ Confined1
 Strain Hardening Steel: ☒ Steel1
 User Defined: ☐ C130

Comments:

Section Type: Rectangular Column
 Type of Reinforcing: Single Hoop
 Transverse Reinforcing Bar Size: 8 mm
 Spacing of Transverse Steel: 0.35 m
 Section Width: .3 m
 Section Height: .3 m
 Cover Thickness: $25.10\text{E-}3$ m
 Number of Longitudinal Bars: 8
 Longitudinal Bar Size: 14 mm
 Cover Concrete: Unconfined1
 Column Core Concrete: Confined1
 Longitudinal Steel: Steel1

XTRACT Section Report -

For use only in an academic or research setting.

Section Name: colC130

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Reinforcing Bar List:

Bar Number	X (m)	Y (m)	Bar Size	Area (m ²)	Prestress (kN)	Material Type
1	-.1099	-.1099	14 mm	.1539E-3	0	Steel1
2	0	-.1099	14 mm	.1539E-3	0	Steel1
3	.1099	-.1099	14 mm	.1539E-3	0	Steel1
4	-.1099	0	14 mm	.1539E-3	0	Steel1
5	.1099	0	14 mm	.1539E-3	0	Steel1
6	-.1099	.1099	14 mm	.1539E-3	0	Steel1
7	0	.1099	14 mm	.1539E-3	0	Steel1
8	.1099	.1099	14 mm	.1539E-3	0	Steel1

XTRACT Section Report -

For use only in an academic or research setting.

Section Name: colC130EMACO

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Section Details:

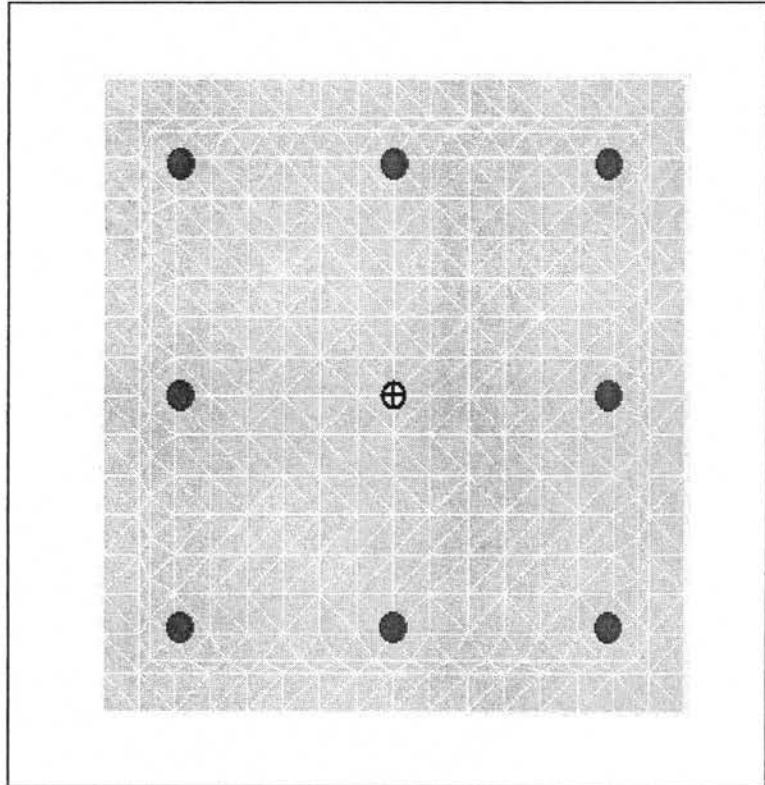
X Centroid: $-.2360E-16$ m
 Y Centroid: $-.1722E-16$ m
 Section Area: $92.05E-3$ m²
 I gross about X: $.7157E-3$ m⁴
 I gross about Y: $.7157E-3$ m⁴
 Reinforcing Bar Area: $1.232E-3$ m²
 Percent Longitudinal Steel: 1.338 %
 Overall Width: .3034 m
 Overall Height: .3034 m
 Number of Fibers: 864
 Number of Bars: 8
 Number of Materials: 3

Material Types and Names:

Strain Hardening Steel: ■ SteelI

User Defined: ■ C130

Confined Concrete: ■ emaco



Comments:

Section Type: Rectangular Column
 Type of Reinforcing: Single Hoop
 Transverse Reinforcing Bar Size: 8 mm
 Spacing of Transverse Steel: 0.35 m
 Section Width: .3 m
 Section Height: .3 m
 Cover Thickness: $25.10E-3$ m
 Number of Longitudinal Bars: 8
 Longitudinal Bar Size: 14 mm
 Cover Concrete: UnconfinedI
 Column Core Concrete: ConfinedI
 Longitudinal Steel: SteelI

XTRACT Section Report -

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Section Name: colC130EMACO

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Reinforcing Bar List:

Bar Number	X (m)	Y (m)	Bar Size	Area (m^2)	Prestress (kN)	Material Type
1	-.1099	-.1099	14 mm	.1539E-3	0	SteelI
2	0	-.1099	14 mm	.1539E-3	0	SteelI
3	.1099	-.1099	14 mm	.1539E-3	0	SteelI
4	-.1099	0	14 mm	.1539E-3	0	SteelI
5	.1099	0	14 mm	.1539E-3	0	SteelI
6	-.1099	.1099	14 mm	.1539E-3	0	SteelI
7	0	.1099	14 mm	.1539E-3	0	SteelI
8	.1099	.1099	14 mm	.1539E-3	0	SteelI

XTRACT Section Report -

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Section Name: YP301

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OASPColumn

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Section Details:

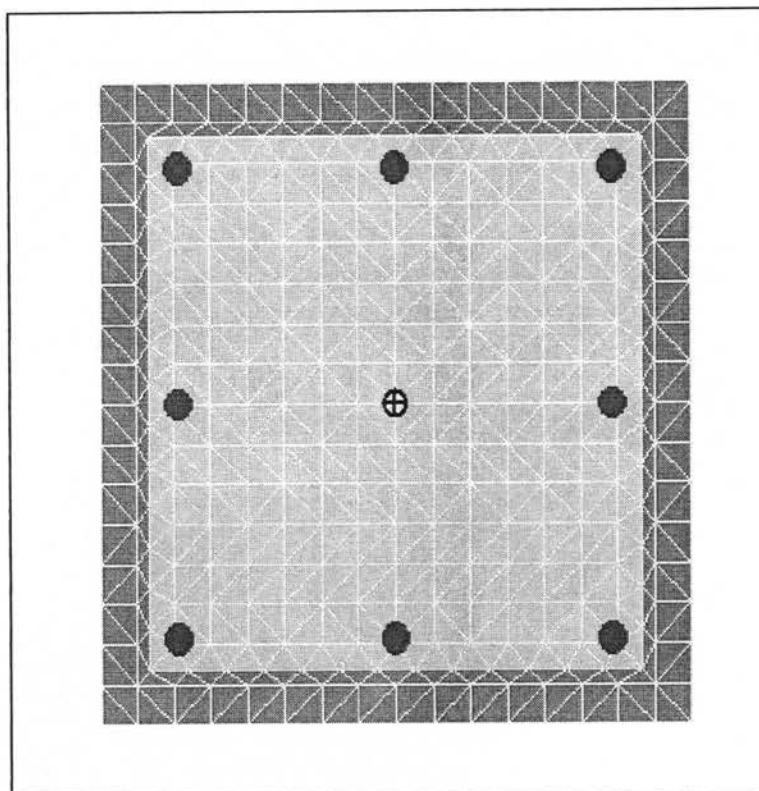
X Centroid: $-2.721\text{E-}16$ m
 Y Centroid: $-2.2002\text{E-}16$ m
 Section Area: $90.00\text{E-}3$ m²
 I gross about X: $.6846\text{E-}3$ m⁴
 I gross about Y: $.6846\text{E-}3$ m⁴
 Reinforcing Bar Area: $1.232\text{E-}3$ m²
 Percent Longitudinal Steel: 1.368 %
 Overall Width: .3000 m
 Overall Height: .3000 m
 Number of Fibers: 616
 Number of Bars: 8
 Number of Materials: 3

Material Types and Names:

Unconfined Concrete: ■ Unconfined1
 Strain Hardening Steel: ■ Steel1
 Confined Concrete: ■ Confined2

Comments:

Section Type: Rectangular Column
 Type of Reinforcing: Single Hoop
 Transverse Reinforcing Bar Size: 8 mm
 Spacing of Transverse Steel: 0.35 m
 Section Width: .3 m
 Section Height: .3 m
 Cover Thickness: $25.10\text{E-}3$ m
 Number of Longitudinal Bars: 8
 Longitudinal Bar Size: 14 mm
 Cover Concrete: Unconfined1
 Column Core Concrete: Confined1
 Longitudinal Steel: Steel1



XTRACT Section Report -

For use only in an academic or research setting.

Section Name: YP301

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Reinforcing Bar List:

Bar Number	X (m)	Y (m)	Bar Size	Area (m ²)	Prestress (kN)	Material Type
1	-.1099	-.1099	14 mm	.1539E-3	0	Steel1
2	0	-.1099	14 mm	.1539E-3	0	Steel1
3	.1099	-.1099	14 mm	.1539E-3	0	Steel1
4	-.1099	0	14 mm	.1539E-3	0	Steel1
5	.1099	0	14 mm	.1539E-3	0	Steel1
6	-.1099	.1099	14 mm	.1539E-3	0	Steel1
7	0	.1099	14 mm	.1539E-3	0	Steel1
8	.1099	.1099	14 mm	.1539E-3	0	Steel1

XTRACT Section Report -

For use only in an academic or research setting.

Section Name: XP305

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Section Details:

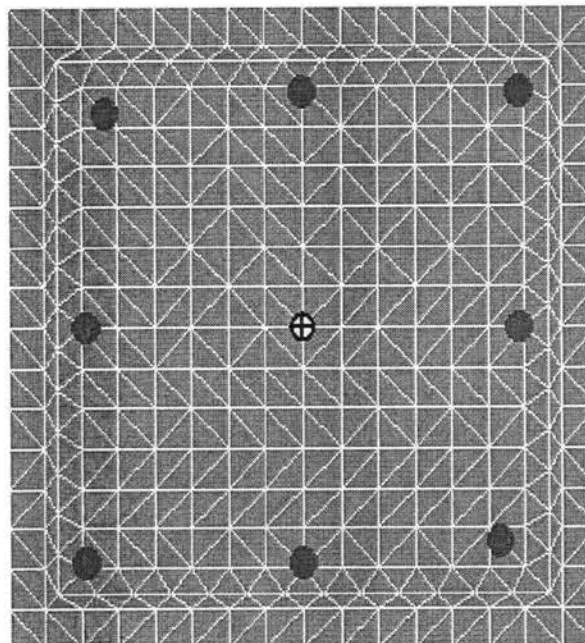
X Centroid: $-.3676\text{E-}17$ m
 Y Centroid: $-.1663\text{E-}16$ m
 Section Area: $90.00\text{E-}3$ m²
 I gross about X: $.6839\text{E-}3$ m⁴
 I gross about Y: $.6839\text{E-}3$ m⁴
 Reinforcing Bar Area: $1.232\text{E-}3$ m²
 Percent Longitudinal Steel: 1.368 %
 Overall Width: .3000 m
 Overall Height: .3000 m
 Number of Fibers: 616
 Number of Bars: 8
 Number of Materials: 2

Material Types and Names:

Strain Hardening Steel: ■ Steel1
 Unconfined Concrete: ■ unconfined2

Comments:

Section Type: Rectangular Column
 Type of Reinforcing: Single Hoop
 Transverse Reinforcing Bar Size: 8 mm
 Spacing of Transverse Steel: 0.35 m
 Section Width: .3 m
 Section Height: .3 m
 Cover Thickness: $25.10\text{E-}3$ m
 Number of Longitudinal Bars: 8
 Longitudinal Bar Size: 14 mm
 Cover Concrete: Unconfined1
 Column Core Concrete: Confined1
 Longitudinal Steel: Steel1



XTRACT Section Report -

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Section Name: XP305

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Reinforcing Bar List:

Bar Number	X (m)	Y (m)	Bar Size	Area (m ²)	Prestress (kN)	Material Type
1	-.1099	-.1099	14 mm	.1539E-3	0	Steel1
2	0	-.1099	14 mm	.1539E-3	0	Steel1
3	99.90E-3	-99.90E-3	14 mm	.1539E-3	0	Steel1
4	-.1099	0	14 mm	.1539E-3	0	Steel1
5	.1099	0	14 mm	.1539E-3	0	Steel1
6	-99.90E-3	99.90E-3	14 mm	.1539E-3	0	Steel1
7	0	.1099	14 mm	.1539E-3	0	Steel1
8	.1099	.1099	14 mm	.1539E-3	0	Steel1

XTRACT Section Report -

For use only in an academic or research setting.

Section Name: XP30_EMACO

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OASPColumn

OASPCol

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Section Details:

X Centroid: $-.2360E-16$ m
 Y Centroid: $-.1722E-16$ m
 Section Area: $90.00E-3$ m²
 I gross about X: $.6846E-3$ m⁴
 I gross about Y: $.6846E-3$ m⁴
 Reinforcing Bar Area: $1.232E-3$ m²
 Percent Longitudinal Steel: 1.368 %
 Overall Width: .3000 m
 Overall Height: .3000 m
 Number of Fibers: 616
 Number of Bars: 8
 Number of Materials: 2

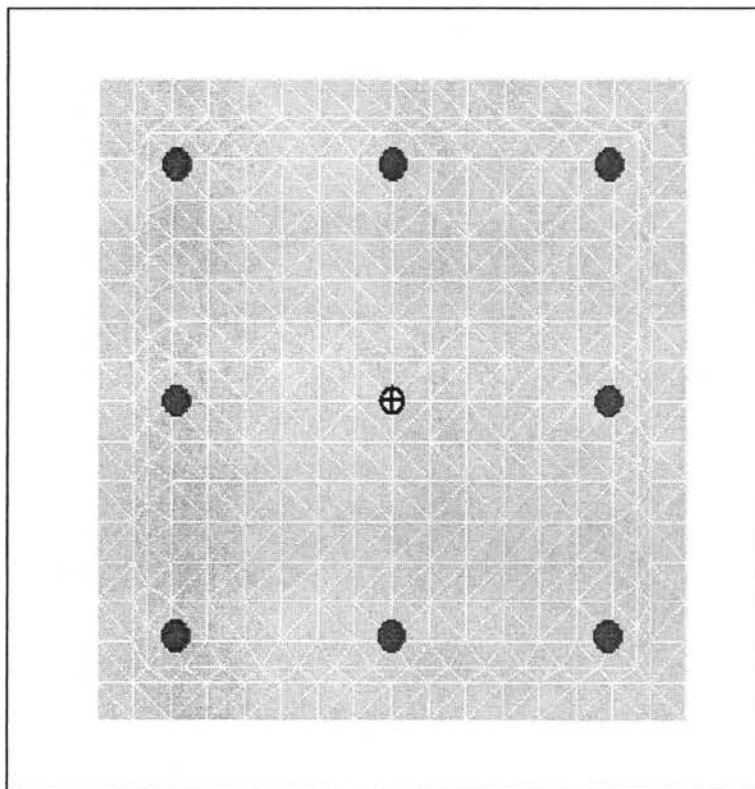
Material Types and Names:

Strain Hardening Steel: ■ Steel1

Confined Concrete: ■ emaco

Comments:

Section Type: Rectangular Column
 Type of Reinforcing: Single Hoop
 Transverse Reinforcing Bar Size: 8 mm
 Spacing of Transverse Steel: 0.35 m
 Section Width: .3 m
 Section Height: .3 m
 Cover Thickness: $25.10E-3$ m
 Number of Longitudinal Bars: 8
 Longitudinal Bar Size: 14 mm
 Cover Concrete: Unconfined1
 Column Core Concrete: Confined1
 Longitudinal Steel: Steel1



XTRACT Section Report -

For use only in an academic or research setting.

Section Name: XP30_EMACO

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Reinforcing Bar List:

Bar Number	X (m)	Y (m)	Bar Size	Area (m ²)	Prestress (kN)	Material Type
1	-.1099	-.1099	14 mm	.1539E-3	0	Steel1
2	0	-.1099	14 mm	.1539E-3	0	Steel1
3	.1099	-.1099	14 mm	.1539E-3	0	Steel1
4	-.1099	0	14 mm	.1539E-3	0	Steel1
5	.1099	0	14 mm	.1539E-3	0	Steel1
6	-.1099	.1099	14 mm	.1539E-3	0	Steel1
7	0	.1099	14 mm	.1539E-3	0	Steel1
8	.1099	.1099	14 mm	.1539E-3	0	Steel1

XTRACT Analysis Report -

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Section Name: coll

Loading Name: mphil90bx

Analysis Type: Moment Curvature

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Section Details:

X Centroid: -2.000E-16 m

Y Centroid: -2.076E-16 m

Section Area: 90.00E-3 m^2

Loading Details:

Constant Load - P: 190.0 kN

Incrementing Loads: Mxx and Myy

Angle of Loading: 45 deg

Number of Points: 30

Analysis Strategy: Displacement Control

Analysis Results:

Failing Material: Unconfined I

Failure Strain: 6.000E-3 Compression

Curvature at Initial Load: $.1012\text{E-19 1/m}$

Curvature at First Yield: 8.658E-3 1/m

Ultimate Curvature: 42.47E-3 1/m

Moment at First Yield: 52.64 kN-m

Ultimate Moment: 72.68 kN-m

Centroid Strain at Yield: $.3218\text{E-3}$ Tension

Centroid Strain at Ultimate: 2.441E-3 Tension

N.A. at First Yield: 37.17E-3 m

N.A. at Ultimate: 57.48E-3 m

Energy per Length: 2.679 kN

Effective Yield Curvature: 12.25E-3 1/m

Effective Yield Moment: 74.45 kN-m

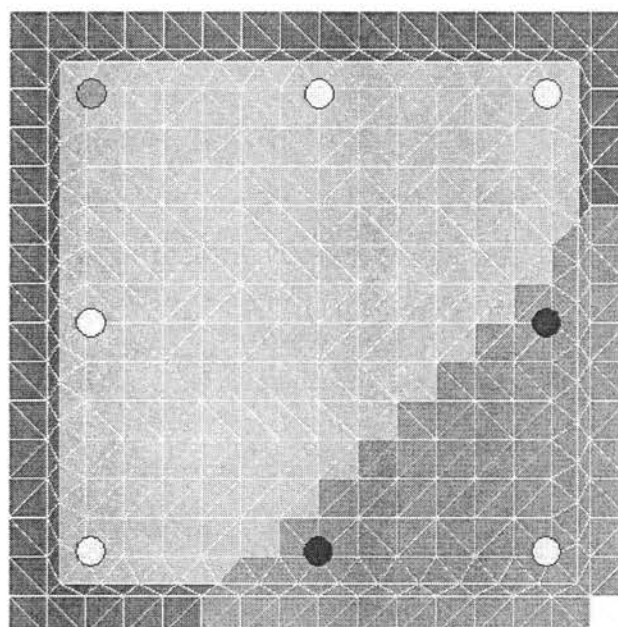
Over Strength Factor: .9762

EI Effective: 6.080E+6 N-m^2

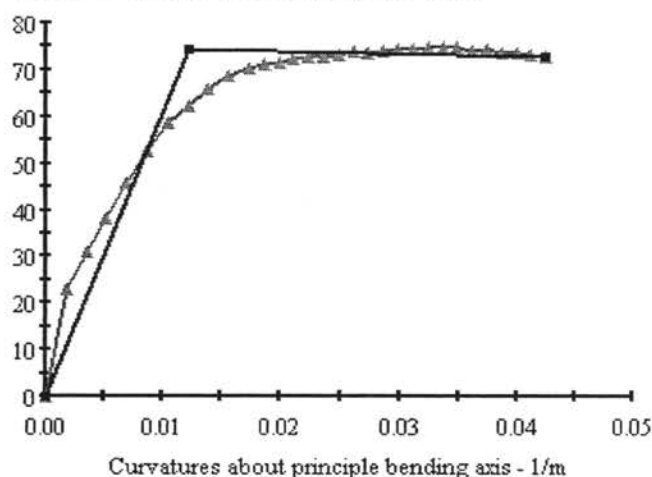
Yield EI Effective: -58.58E+3 N-m^2

Bilinear Harding Slope: $-.9636 \%$

Curvature Ductility: 3.468



Moments about principle bending axis - kN-m



—▲— Moment Curvature Relation
—■— Moment Curvature Bilinearization

XTRACT Analysis Report -

For use only in an academic or research setting.

Section Name: coll
Loading Name: mph190
Analysis Type: Moment Curvature

caz
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26/4/2005
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Section Details:

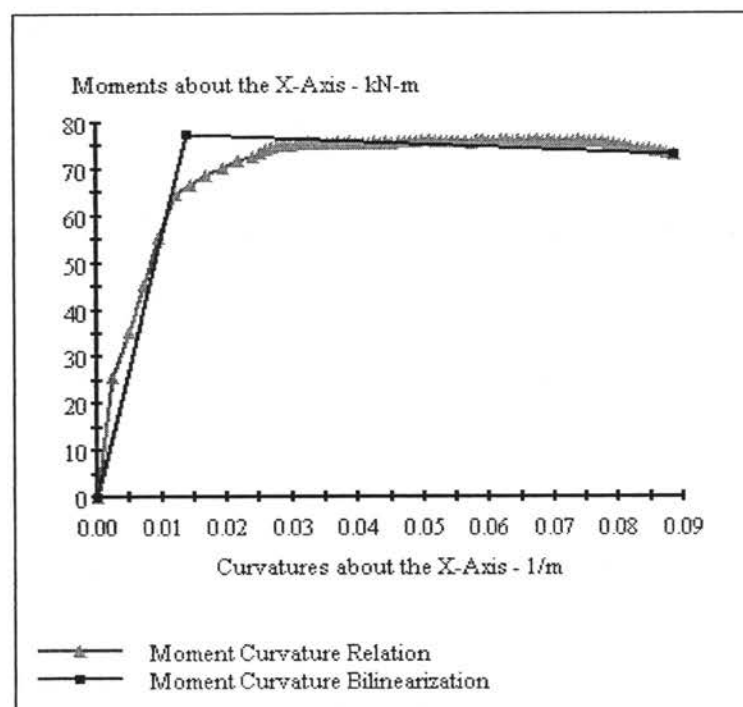
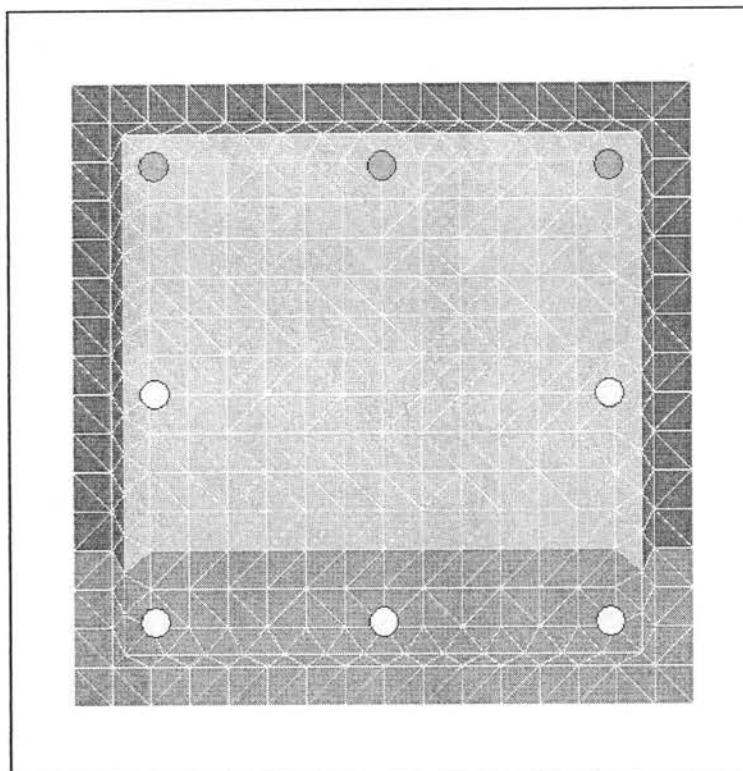
X Centroid: $-2.2000\text{E-}16$ m
Y Centroid: $-2.2076\text{E-}16$ m
Section Area: $90.00\text{E-}3$ m²

Loading Details:

Constant Load - P: 190.0 kN
Incrementing Loads: Mxx Only
Number of Points: 80
Analysis Strategy: Displacement Control

Analysis Results:

Failing Material: UnconfinedI
Failure Strain: $6.000\text{E-}3$ Compression
Curvature at Initial Load: $.1570\text{E-}19$ 1/m
Curvature at First Yield: $11.74\text{E-}3$ 1/m
Ultimate Curvature: $88.45\text{E-}3$ 1/m
Moment at First Yield: 66.05 kN-m
Ultimate Moment: 73.23 kN-m
Centroid Strain at Yield: $.6098\text{E-}3$ Tension
Centroid Strain at Ultimate: $6.955\text{E-}3$ Tension
N.A. at First Yield: $51.94\text{E-}3$ m
N.A. at Ultimate: $78.63\text{E-}3$ m
Energy per Length: 6.167 kN
Effective Yield Curvature: $13.80\text{E-}3$ 1/m
Effective Yield Moment: 77.66 kN-m
Over Strength Factor: .9430
EI Effective: $5.626\text{E+}6$ N-m²
Yield EI Effective: $-59.33\text{E+}3$ N-m²
Bilinear Harding Slope: -1.055 %
Curvature Ductility: 6.408



XTRACT Analysis Report -

For use only in an academic or research setting.

Section Name: colC130

Loading Name: mph190

Analysis Type: Moment Curvature

caz

NTUA

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Section Details:

X Centroid: -2.000E-16 m

Y Centroid: -2.076E-16 m

Section Area: 92.05E-3 m²

Loading Details:

Constant Load - P: 190.0 kN

Incrementing Loads: Mxx Only

Number of Points: 210

Analysis Strategy: Displacement Control

Analysis Results:

Failing Material: Unconfined1

Failure Strain: 6.000E-3 Compression

Curvature at Initial Load: -1.189E-20 1/m

Curvature at First Yield: 11.98E-3 1/m

Ultimate Curvature: 55.92E-3 1/m

Moment at First Yield: 73.51 kN-m

Ultimate Moment: 108.5 kN-m

Centroid Strain at Yield: .5837E-3 Tension

Centroid Strain at Ultimate: 1.963E-3 Tension

N.A. at First Yield: 48.73E-3 m

N.A. at Ultimate: 35.10E-3 m

Energy per Length: 4.921 kN

Effective Yield Curvature: 16.08E-3 1/m

Effective Yield Moment: 98.70 kN-m

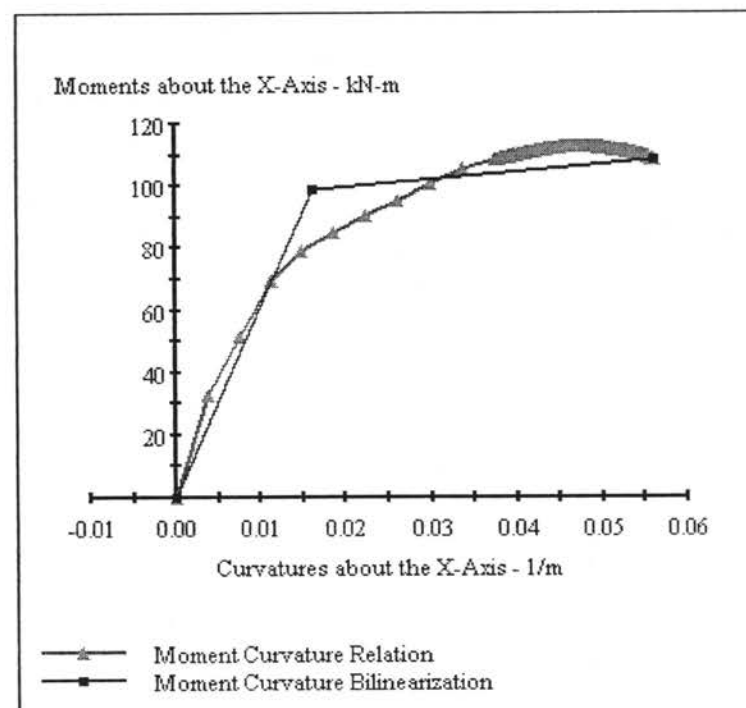
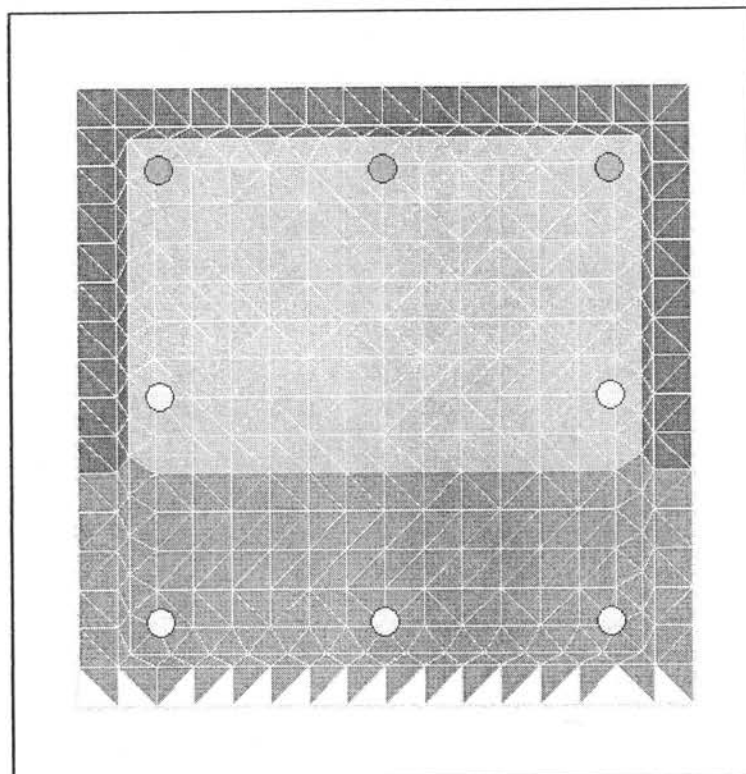
Over Strength Factor: 1.099

EI Effective: 6.138E+6 N-m²

Yield EI Effective: 245.4E+3 N-m²

Bilinear Harding Slope: 3.999 %

Curvature Ductility: 3.478



XTRACT Analysis Report -

For use only in an academic or research setting.

Section Name: colC130
 Loading Name: mph190bx
 Analysis Type: Moment Curvature

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Section Details:

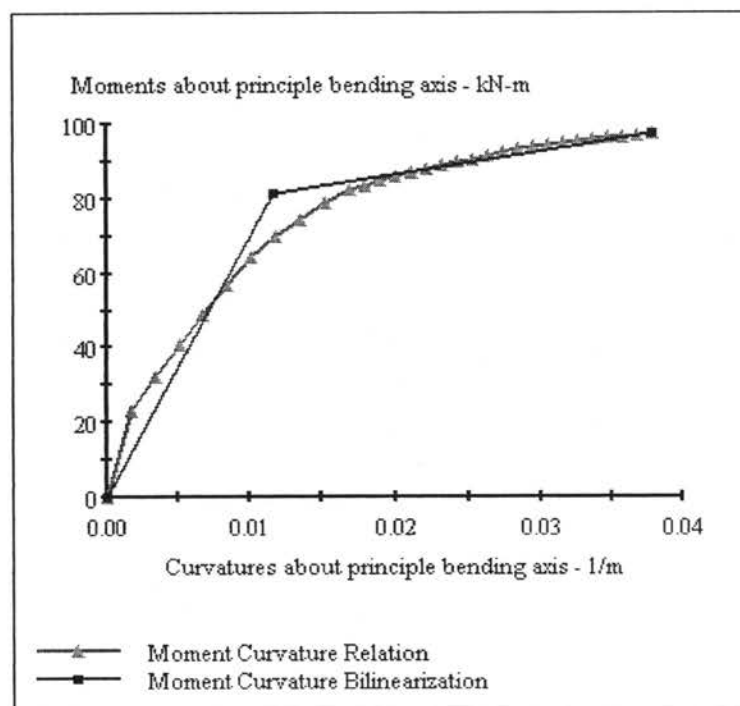
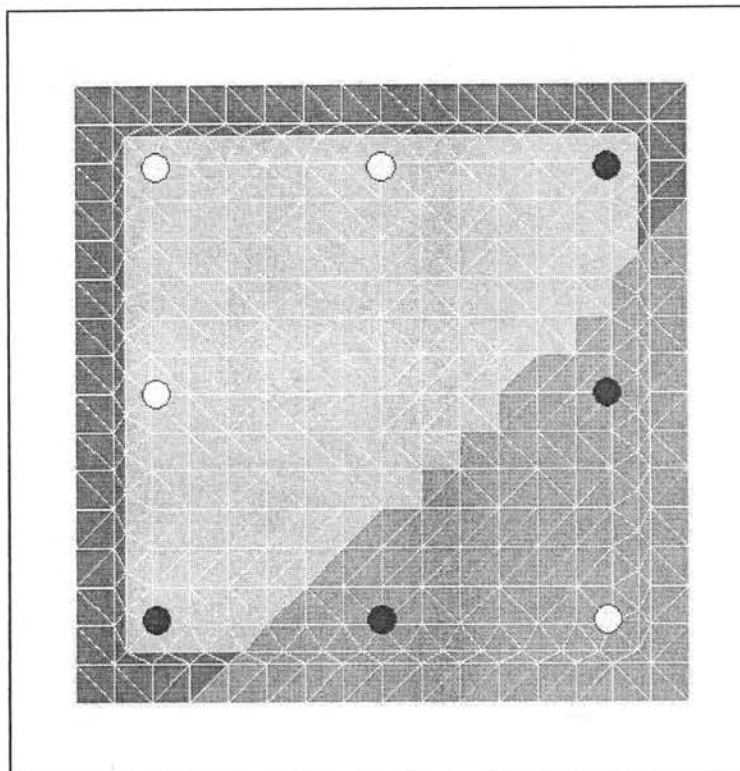
X Centroid: $-2.000\text{E-}16$ m
 Y Centroid: $-2.076\text{E-}16$ m
 Section Area: $92.05\text{E-}3$ m²

Loading Details:

Constant Load - P: 190.0 kN
 Incrementing Loads: Mxx and Myy
 Angle of Loading: 45 deg
 Number of Points: 30
 Analysis Strategy: Displacement Control

Analysis Results:

Failing Material: UnconfinedI
 Failure Strain: $6.000\text{E-}3$ Compression
 Curvature at Initial Load: $.4273\text{E-}19$ 1/m
 Curvature at First Yield: $8.757\text{E-}3$ 1/m
 Ultimate Curvature: $37.95\text{E-}3$ 1/m
 Moment at First Yield: 61.18 kN-m
 Ultimate Moment: 97.39 kN-m
 Centroid Strain at Yield: $.3416\text{E-}3$ Tension
 Centroid Strain at Ultimate: $1.563\text{E-}3$ Tension
 N.A. at First Yield: $39.01\text{E-}3$ m
 N.A. at Ultimate: $41.19\text{E-}3$ m
 Energy per Length: 2.823 kN
 Effective Yield Curvature: $11.63\text{E-}3$ 1/m
 Effective Yield Moment: 81.26 kN-m
 Over Strength Factor: 1.199
 EI Effective: $6.986\text{E+}6$ N-m²
 Yield EI Effective: $613.1\text{E+}3$ N-m²
 Bilinear Harding Slope: 8.776 %
 Curvature Ductility: 3.263



XTRACT Analysis Report -

For use only in an academic or research setting.

Section Name: YP301

Loading Name: mph190

Analysis Type: Moment Curvature

caz

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Section Details:

X Centroid: $-2.721\text{E-}16$ m

Y Centroid: $-2.2002\text{E-}16$ m

Section Area: $90.00\text{E-}3$ m²

Loading Details:

Constant Load - P: 190.0 kN

Incrementing Loads: Mxx Only

Number of Points: 60

Analysis Strategy: Displacement Control

Analysis Results:

Failing Material: Unconfined1

Failure Strain: $6.000\text{E-}3$ Compression

Curvature at Initial Load: $-9.335\text{E-}20$ 1/m

Curvature at First Yield: $11.88\text{E-}3$ 1/m

Ultimate Curvature: $98.56\text{E-}3$ 1/m

Moment at First Yield: 58.48 kN-m

Ultimate Moment: 74.29 kN-m

Centroid Strain at Yield: $.5941\text{E-}3$ Tension

Centroid Strain at Ultimate: $8.063\text{E-}3$ Tension

N.A. at First Yield: $49.99\text{E-}3$ m

N.A. at Ultimate: $81.81\text{E-}3$ m

Energy per Length: 6.859 kN

Effective Yield Curvature: $15.57\text{E-}3$ 1/m

Effective Yield Moment: 76.64 kN-m

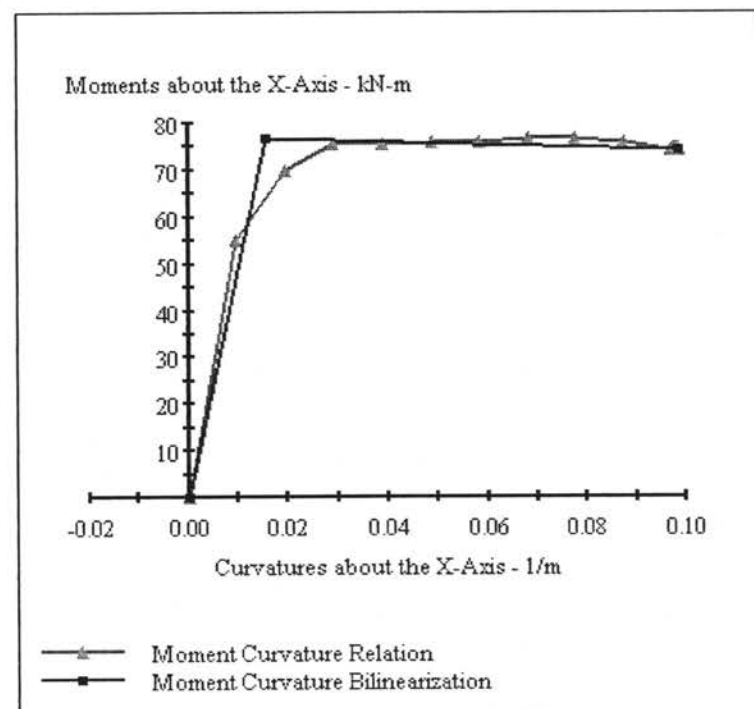
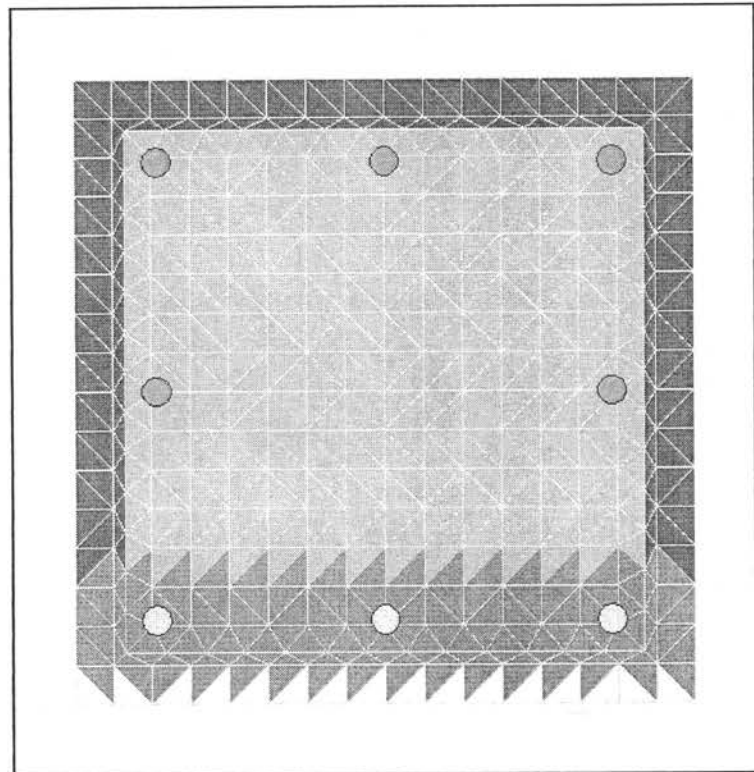
Over Strength Factor: .9694

EI Effective: $4.921\text{E+}6$ N-m²

Yield EI Effective: $-28.30\text{E+}3$ N-m²

Bilinear Harding Slope: -5.751 %

Curvature Ductility: 6.329



XTRACT Analysis Report -

For use only in an academic or research setting.

Section Name: YP301

Loading Name: mph190bx

Analysis Type: Moment Curvature

caz

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Section Details:

X Centroid: $-2.721\text{E-}16$ m

Y Centroid: $-2.002\text{E-}16$ m

Section Area: $90.00\text{E-}3$ m²

Loading Details:

Constant Load - P: 190.0 kN

Incrementing Loads: Mxx and Myy

Angle of Loading: 45 deg

Number of Points: 50

Analysis Strategy: Displacement Control

Analysis Results:

Failing Material: UnconfinedI

Failure Strain: $6.000\text{E-}3$ Compression

Curvature at Initial Load: $-1.271\text{E-}18$ 1/m

Curvature at First Yield: $8.653\text{E-}3$ 1/m

Ultimate Curvature: $43.84\text{E-}3$ 1/m

Moment at First Yield: 51.95 kN-m

Ultimate Moment: 74.87 kN-m

Centroid Strain at Yield: $.3208\text{E-}3$ Tension

Centroid Strain at Ultimate: $2.720\text{E-}3$ Tension

N.A. at First Yield: $37.07\text{E-}3$ m

N.A. at Ultimate: $62.03\text{E-}3$ m

Energy per Length: 2.779 kN

Effective Yield Curvature: $12.08\text{E-}3$ 1/m

Effective Yield Moment: 72.52 kN-m

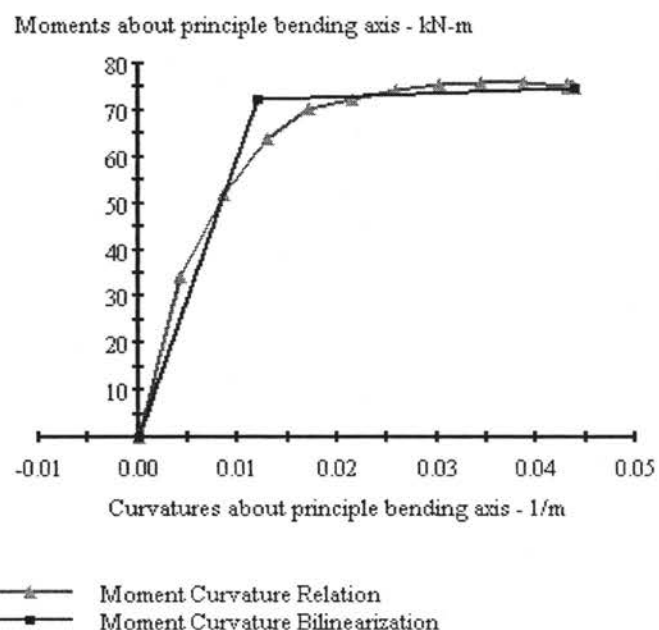
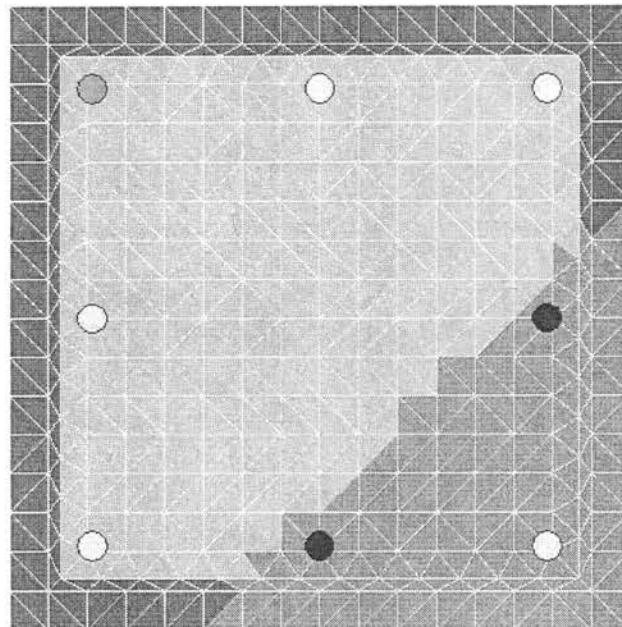
Over Strength Factor: 1.032

EI Effective: $6.004\text{E+}6$ N-m²

Yield EI Effective: $73.83\text{E+}3$ N-m²

Bilinear Harding Slope: 1.230 %

Curvature Ductility: 3.630



XTRACT Analysis Report -

For use only in an academic or research setting.

Section Name: XP305

Loading Name: mph190

Analysis Type: Moment Curvature

caz

NTUA

26/4/2005

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Section Details:

X Centroid: $-3.676E-17$ m

Y Centroid: $-1.663E-16$ m

Section Area: $90.00E-3$ m²

Loading Details:

Constant Load - P: 190.0 kN

Incrementing Loads: Mxx Only

Number of Points: 30

Analysis Strategy: Displacement Control

Analysis Results:

Failing Material: unconfined2

Failure Strain: $6.000E-3$ Compression

Curvature at Initial Load: $-1.931E-19$ 1/m

Curvature at First Yield: $12.37E-3$ 1/m

Ultimate Curvature: $70.76E-3$ 1/m

Moment at First Yield: 61.76 kN-m

Ultimate Moment: 66.06 kN-m

Centroid Strain at Yield: $.5402E-3$ Tension

Centroid Strain at Ultimate: $3.879E-3$ Tension

N.A. at First Yield: $43.66E-3$ m

N.A. at Ultimate: $54.82E-3$ m

Energy per Length: 4.644 kN

Effective Yield Curvature: $16.07E-3$ 1/m

Effective Yield Moment: 80.20 kN-m

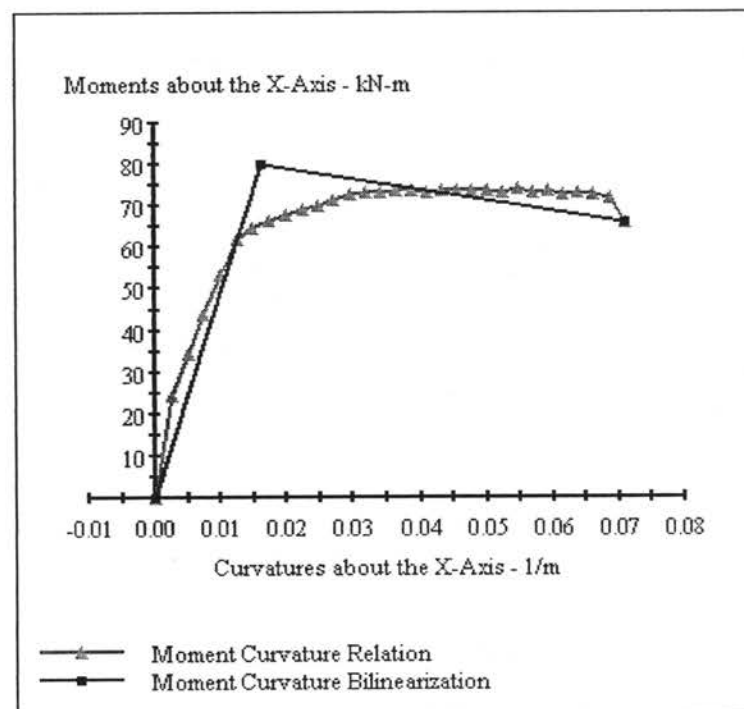
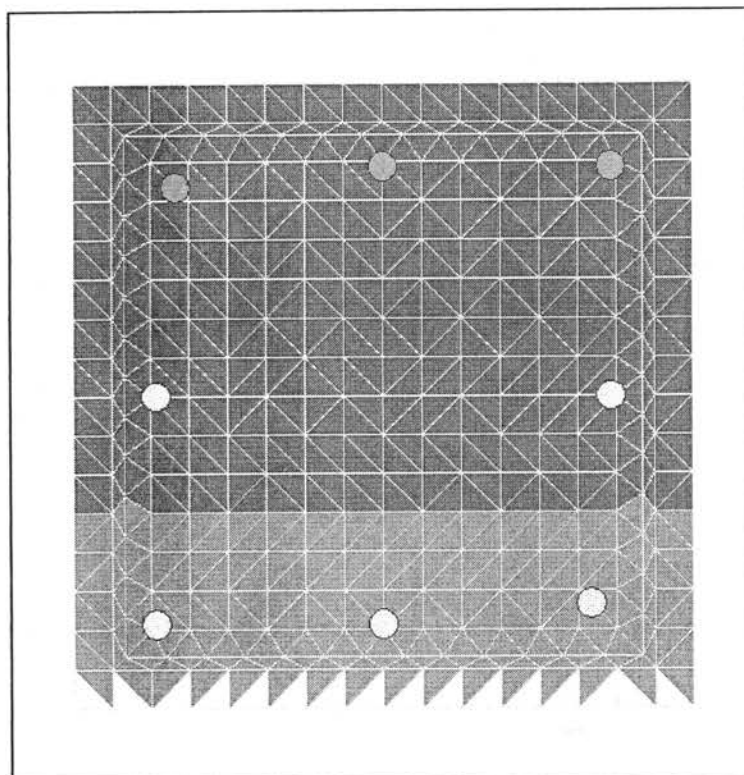
Over Strength Factor: .8237

EI Effective: $4.992E+6$ N-m²

Yield EI Effective: $-258.5E+3$ N-m²

Bilinear Harding Slope: -5.179 %

Curvature Ductility: 4.404



XTRACT Analysis Report -

For use only in an academic or research setting.

Section Name: XP305

Loading Name: mphibx190

Analysis Type: Moment Curvature

caz

NTUA

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Section Details:

X Centroid: -3.676×10^{-17} m

Y Centroid: -1.663×10^{-16} m

Section Area: 90.00×10^{-3} m²

Loading Details:

Constant Load - P: 190.0 kN

Incrementing Loads: Mxx and Myy

Angle of Loading: 45 deg

Number of Points: 30

Analysis Strategy: Displacement Control

Analysis Results:

Failing Material: unconfined2

Failure Strain: 6.000×10^{-3} Compression

Curvature at Initial Load: -3.816×10^{-19} 1/m

Curvature at First Yield: 8.402×10^{-3} 1/m

Ultimate Curvature: 39.73×10^{-3} 1/m

Moment at First Yield: 47.27 kN-m

Ultimate Moment: 67.79 kN-m

Centroid Strain at Yield: $.2709 \times 10^{-3}$ Tension

Centroid Strain at Ultimate: 1.902×10^{-3} Tension

N.A. at First Yield: 32.25×10^{-3} m

N.A. at Ultimate: 47.88×10^{-3} m

Energy per Length: 2.307 kN

Effective Yield Curvature: 12.33×10^{-3} 1/m

Effective Yield Moment: 69.37 kN-m

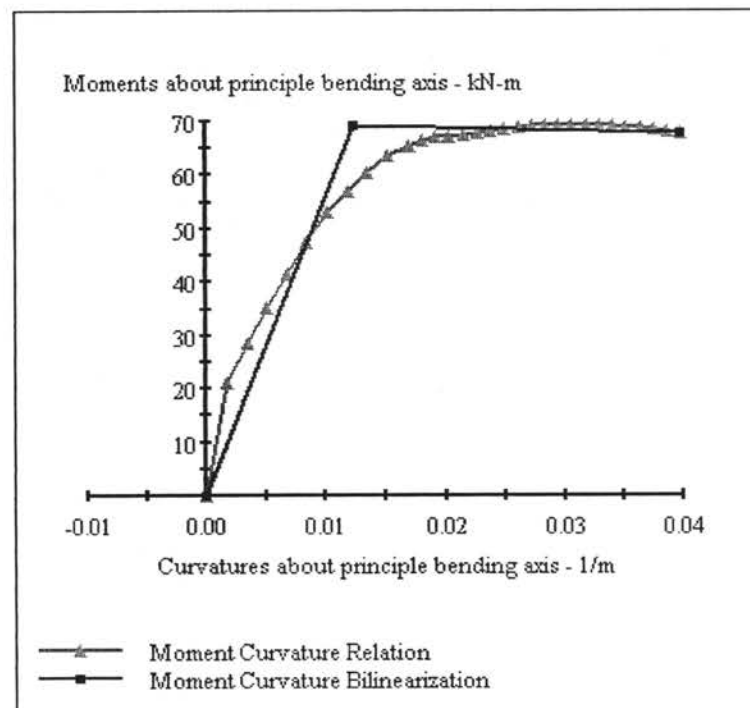
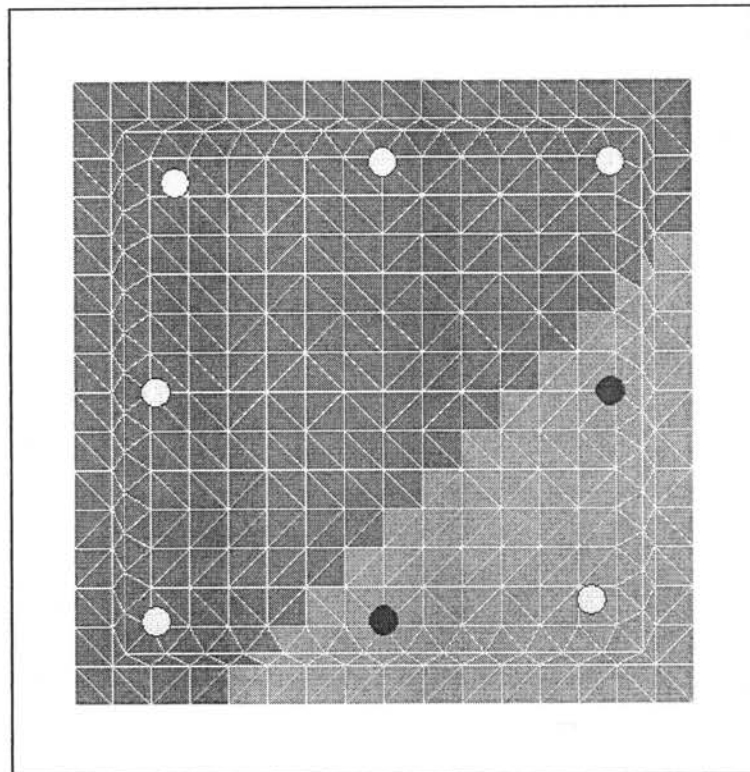
Over Strength Factor: .9772

EI Effective: 5.626×10^6 N-m²

Yield EI Effective: -57.62×10^3 N-m²

Bilinear Harding Slope: -1.024 %

Curvature Ductility: 3.222



XTRACT Analysis Report -

For use only in an academic or research setting.

Section Name: XP30_EMACO

Loading Name: mphl190

Analysis Type: Moment Curvature

caz

NTUA

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Section Details:

X Centroid: -2.360×10^{-16} m

Y Centroid: -1.722×10^{-16} m

Section Area: 90.00×10^{-3} m²

Loading Details:

Constant Load - P: 190.0 kN

Incrementing Loads: Mxx Only

Number of Points: 610

Analysis Strategy: Displacement Control

Analysis Results:

Failing Material: emaco

Failure Strain: 20.00×10^{-3} Compression

Curvature at Initial Load: -2.549×10^{-20} 1/m

Curvature at First Yield: 10.38×10^{-3} 1/m

Ultimate Curvature: .5652 1/m

Moment at First Yield: 62.92 kN-m

Ultimate Moment: 89.70 kN-m

Centroid Strain at Yield: $.6279 \times 10^{-3}$ Tension

Centroid Strain at Ultimate: 61.23×10^{-3} Tension

N.A. at First Yield: 60.48×10^{-3} m

N.A. at Ultimate: .1083 m

Energy per Length: 48.62 kN

Effective Yield Curvature: 13.95×10^{-3} 1/m

Effective Yield Moment: 84.55 kN-m

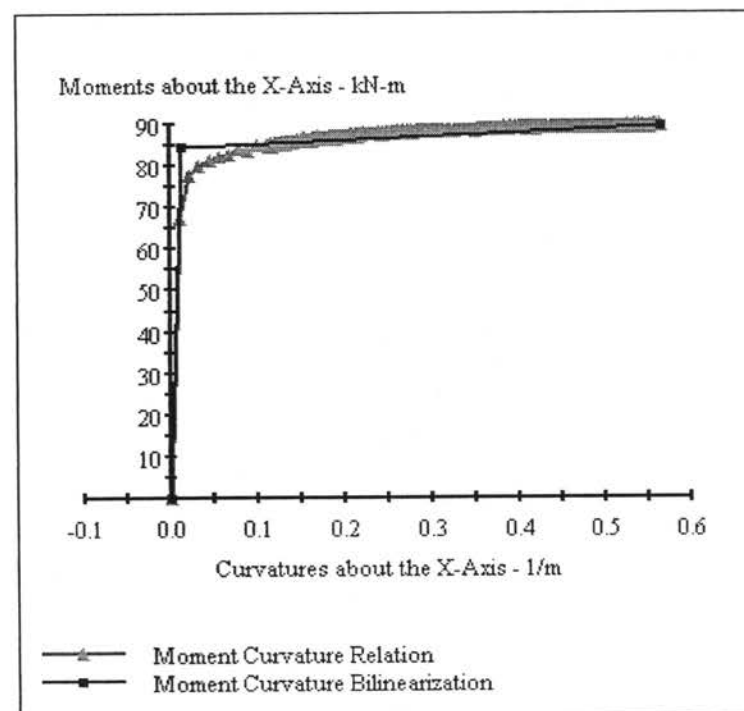
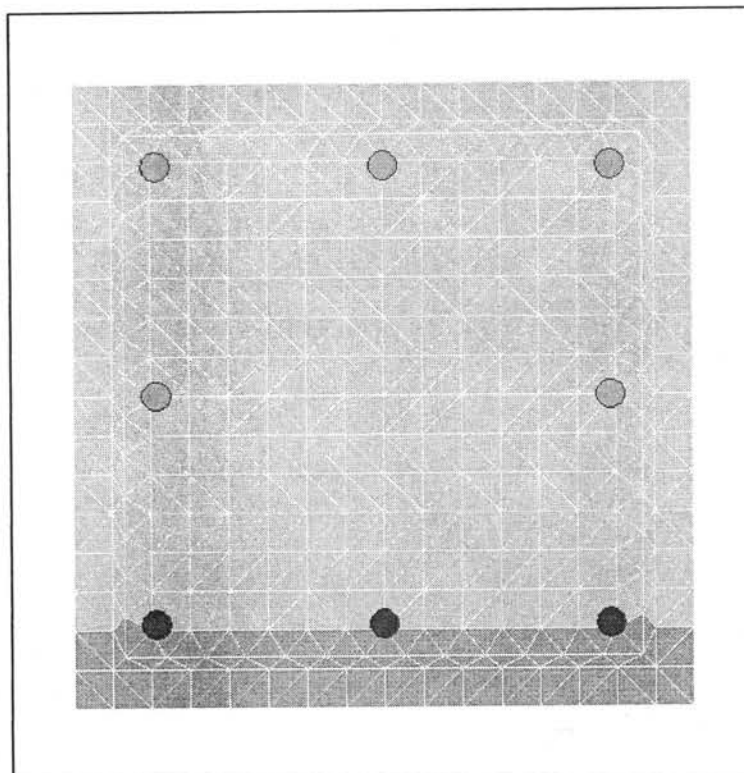
Over Strength Factor: 1.061

EI Effective: 6.060×10^6 N-m²

Yield EI Effective: 9347 N-m²

Bilinear Harding Slope: .1542 %

Curvature Ductility: 40.51



XTRACT Analysis Report -

For use only in an academic or research setting.

Section Name: XP30_EMACO

Loading Name: mphibx190

Analysis Type: Moment Curvature

caz

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Section Details:

X Centroid: -2.360×10^{-16} m

Y Centroid: -1.722×10^{-16} m

Section Area: 90.00×10^{-3} m²

Loading Details:

Constant Load - P: 190.0 kN

Incrementing Loads: Mxx and Myy

Angle of Loading: 45 deg

Number of Points: 610

Analysis Strategy: Displacement Control

Analysis Results:

Failing Material: emaco

Failure Strain: 20.00×10^{-3} Compression

Curvature at Initial Load: $.5877 \times 10^{-19}$ 1/m

Curvature at First Yield: 8.437×10^{-3} 1/m

Ultimate Curvature: $.1905$ 1/m

Moment at First Yield: 57.16 kN-m

Ultimate Moment: 93.66 kN-m

Centroid Strain at Yield: $.4577 \times 10^{-3}$ Tension

Centroid Strain at Ultimate: 18.02×10^{-3} Tension

N.A. at First Yield: 54.24×10^{-3} m

N.A. at Ultimate: 94.57×10^{-3} m

Energy per Length: 16.93 kN

Effective Yield Curvature: 13.38×10^{-3} 1/m

Effective Yield Moment: 90.66 kN-m

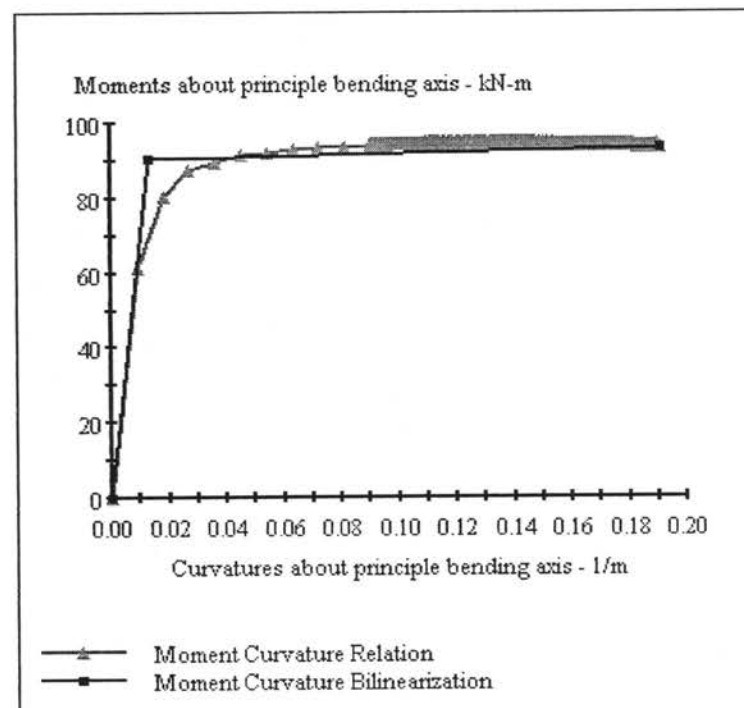
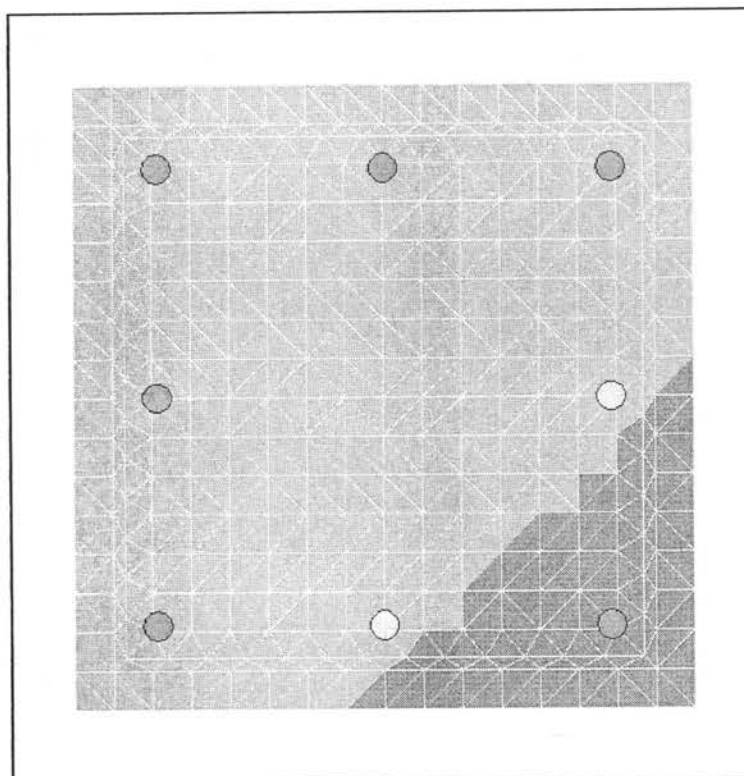
Over Strength Factor: 1.033

EI Effective: 6.774×10^6 N-m²

Yield EI Effective: 16.89×10^3 N-m²

Bilinear Hardening Slope: .2493 %

Curvature Ductility: 14.24



XTRACT Analysis Report -

For use only in an academic or research setting.

Section Name: colC130EMACO
Loading Name: mphil90bx
Analysis Type: Moment Curvature

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Section Details:

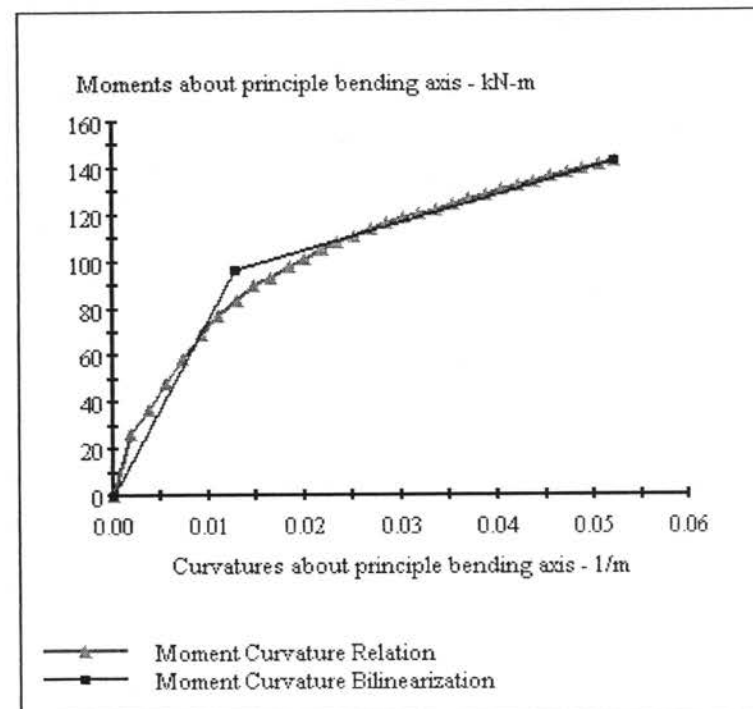
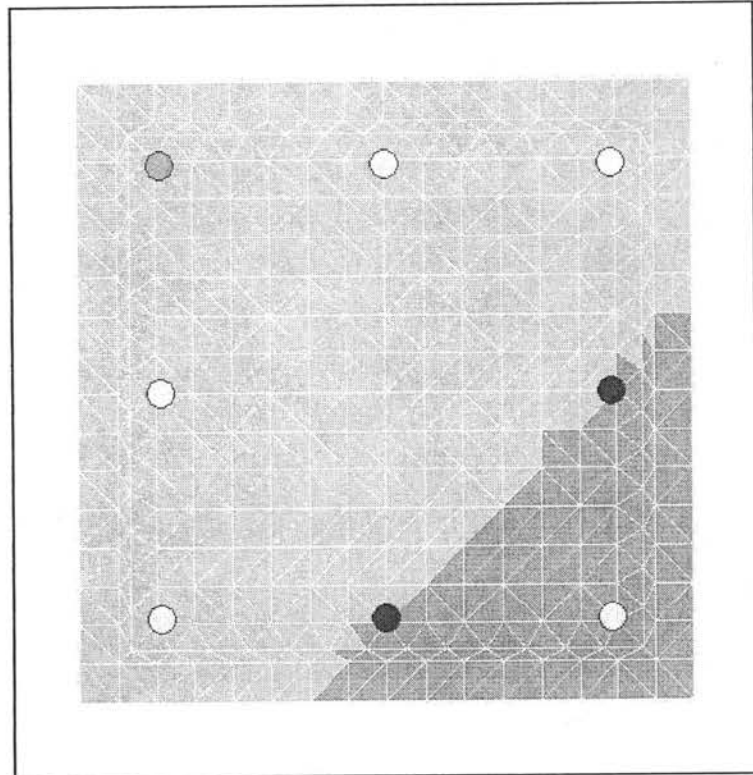
X Centroid: $-.2360\text{E-16 m}$
Y Centroid: $-.1722\text{E-16 m}$
Section Area: 92.05E-3 m^2

Loading Details:

Constant Load - P: 190.0 kN
Incrementing Loads: Mxx and Myy
Angle of Loading: 45 deg
Number of Points: 30
Analysis Strategy: Displacement Control

Analysis Results:

Failing Material: C130
Failure Strain: 15.00E-3 Tension
Curvature at Initial Load: $.5877\text{E-19 1/m}$
Curvature at First Yield: 9.213E-3 1/m
Ultimate Curvature: 52.21E-3 1/m
Moment at First Yield: 69.13 kN-m
Ultimate Moment: 143.4 kN-m
Centroid Strain at Yield: $.4681\text{E-3 Tension}$
Centroid Strain at Ultimate: 3.938E-3 Tension
N.A. at First Yield: 50.81E-3 m
N.A. at Ultimate: 75.43E-3 m
Energy per Length: 5.340 kN
Effective Yield Curvature: 12.86E-3 1/m
Effective Yield Moment: 96.50 kN-m
Over Strength Factor: 1.486
EI Effective: 7.504E+6 N-m^2
Yield EI Effective: 1.192E+6 N-m^2
Bilinear Harding Slope: 15.88 %
Curvature Ductility: 4.060



XTRACT Analysis Report -

For use only in an academic or research setting.

Section Name: colC130EMACO

Loading Name: mph190bx

Analysis Type: Moment Curvature

caz

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Mxx (kN-m)	Myy (kN-m)	M45 (kN-m)	Kxx (1/m)	Kyy (1/m)	K45 (1/m)
0	0	0	-.2549E-20	.8566E-19	.5877E-19
18.71	18.71	26.46	1.303E-3	1.303E-3	1.843E-3
26.15	26.18	37.00	2.607E-3	2.607E-3	3.687E-3
33.97	34.00	48.06	3.910E-3	3.910E-3	5.530E-3
41.42	41.37	58.54	5.214E-3	5.214E-3	7.373E-3
48.90	48.90	69.15	6.517E-3	6.517E-3	9.216E-3
54.33	54.36	76.86	7.820E-3	7.820E-3	11.06E-3
59.22	59.17	83.71	9.124E-3	9.124E-3	12.90E-3
63.60	63.59	89.93	10.43E-3	10.43E-3	14.75E-3
66.21	66.24	93.66	11.73E-3	11.73E-3	16.59E-3
69.34	69.34	98.06	13.03E-3	13.03E-3	18.43E-3
71.67	71.71	101.4	14.23E-3	14.23E-3	20.12E-3
74.33	74.39	105.2	15.42E-3	15.42E-3	21.81E-3
76.58	76.66	108.4	16.62E-3	16.62E-3	23.50E-3
78.38	78.43	110.9	17.81E-3	17.81E-3	25.19E-3
80.68	80.71	114.1	19.00E-3	19.00E-3	26.88E-3
82.40	82.41	116.5	20.20E-3	20.20E-3	28.57E-3
83.96	83.96	118.7	21.39E-3	21.39E-3	30.25E-3
85.09	85.08	120.3	22.59E-3	22.59E-3	31.94E-3
86.56	86.56	122.4	23.78E-3	23.78E-3	33.63E-3
88.14	88.15	124.7	24.98E-3	24.98E-3	35.32E-3
89.62	89.64	126.8	26.17E-3	26.17E-3	37.01E-3
91.13	91.15	128.9	27.36E-3	27.36E-3	38.70E-3
92.44	92.45	130.7	28.56E-3	28.56E-3	40.39E-3
93.55	93.57	132.3	29.75E-3	29.75E-3	42.08E-3
95.03	95.05	134.4	30.95E-3	30.95E-3	43.77E-3
96.36	96.38	136.3	32.14E-3	32.14E-3	45.45E-3
97.54	97.56	138.0	33.34E-3	33.34E-3	47.14E-3
98.83	98.86	139.8	34.53E-3	34.53E-3	48.83E-3
100.0	100.0	141.5	35.72E-3	35.72E-3	50.52E-3
101.4	101.4	143.4	36.92E-3	36.92E-3	52.21E-3