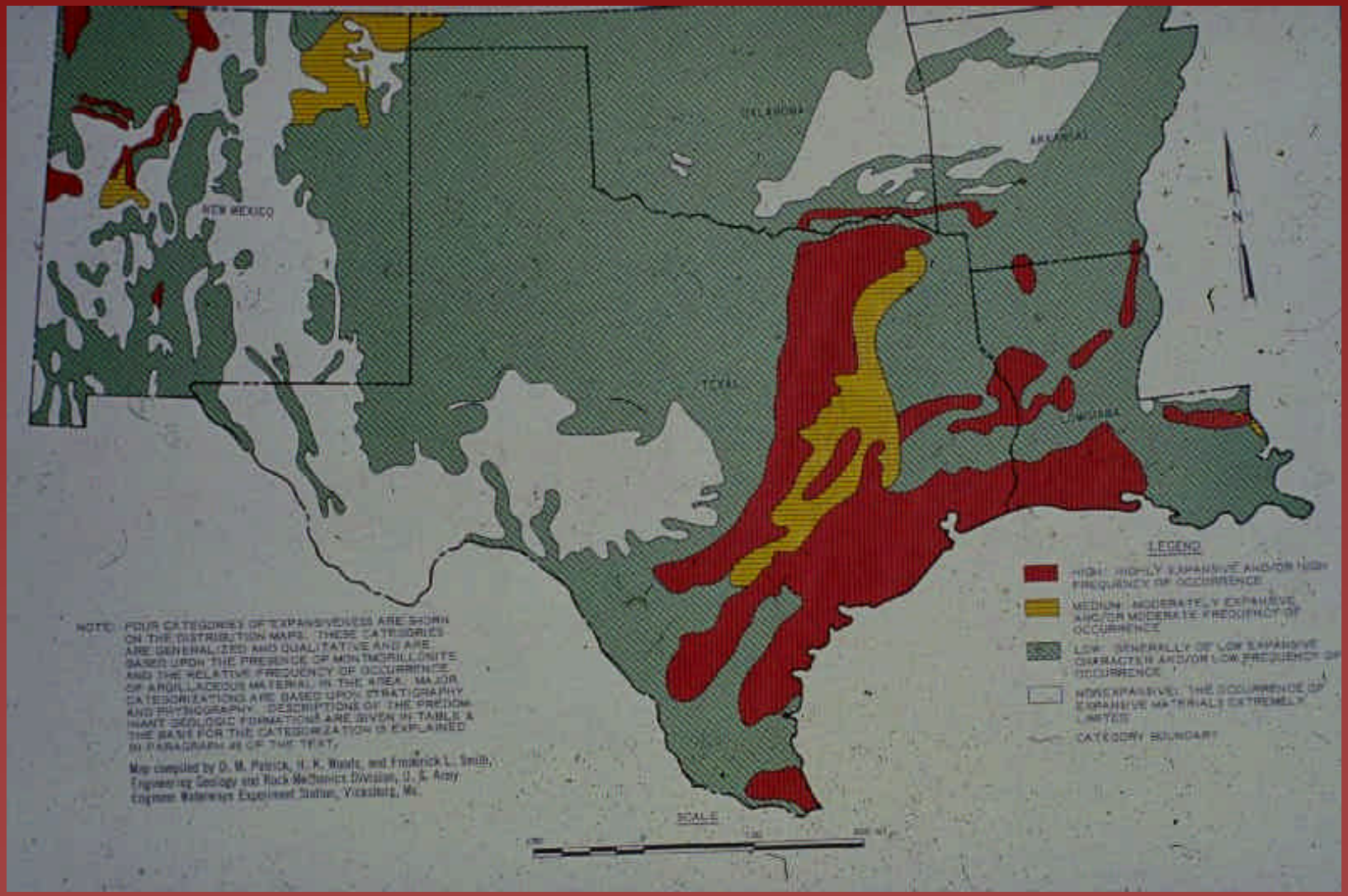
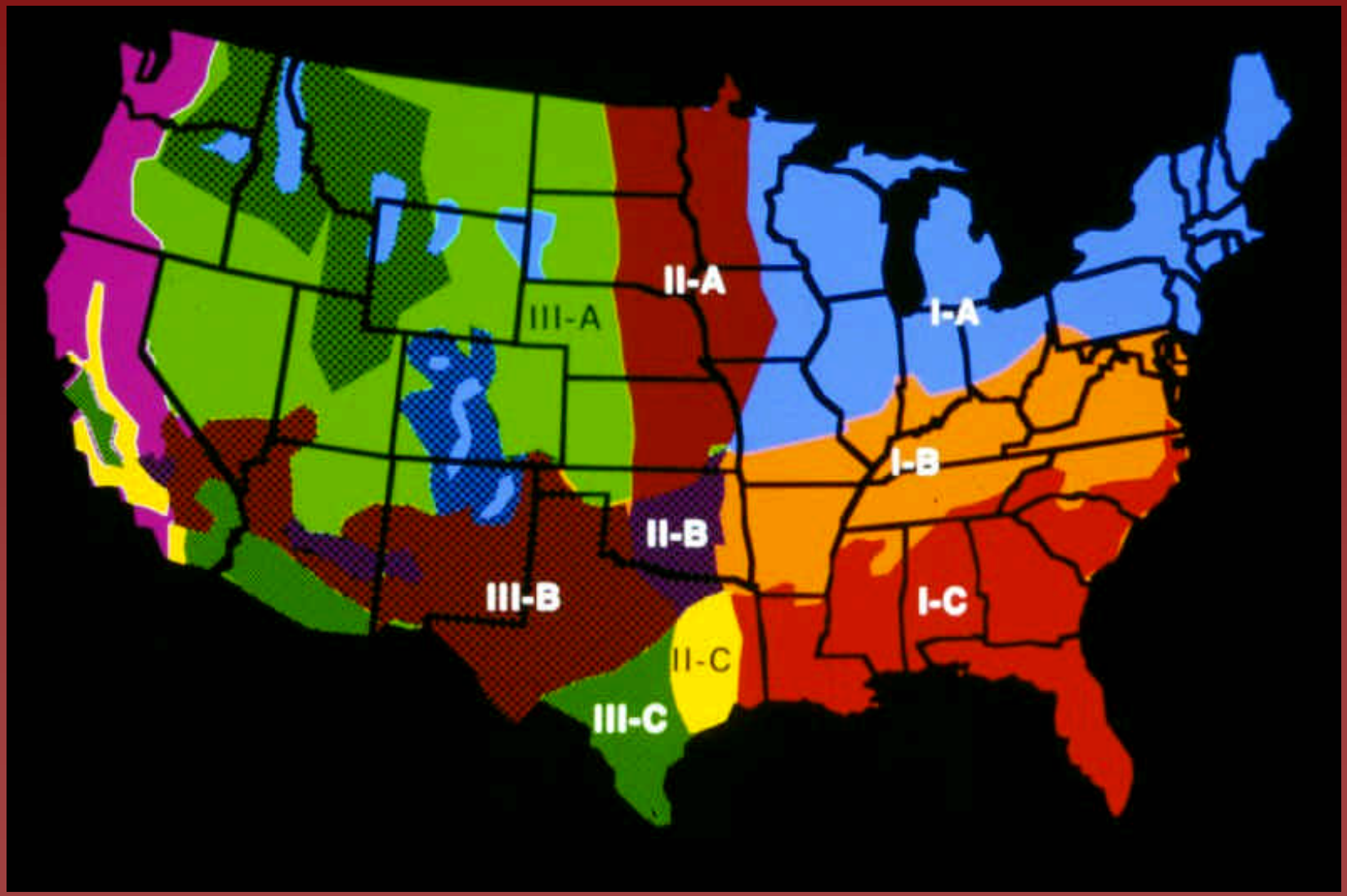
HOW TO DESIGN?

TYPICAL CONTOURS FOR RESIDENTIAL SLAB EXPERIENCING CENTER LIFT OR EDGE DRYING CONDITIONS IN ARLINGTON, TEXAS (Tucker and Peer, 1977)

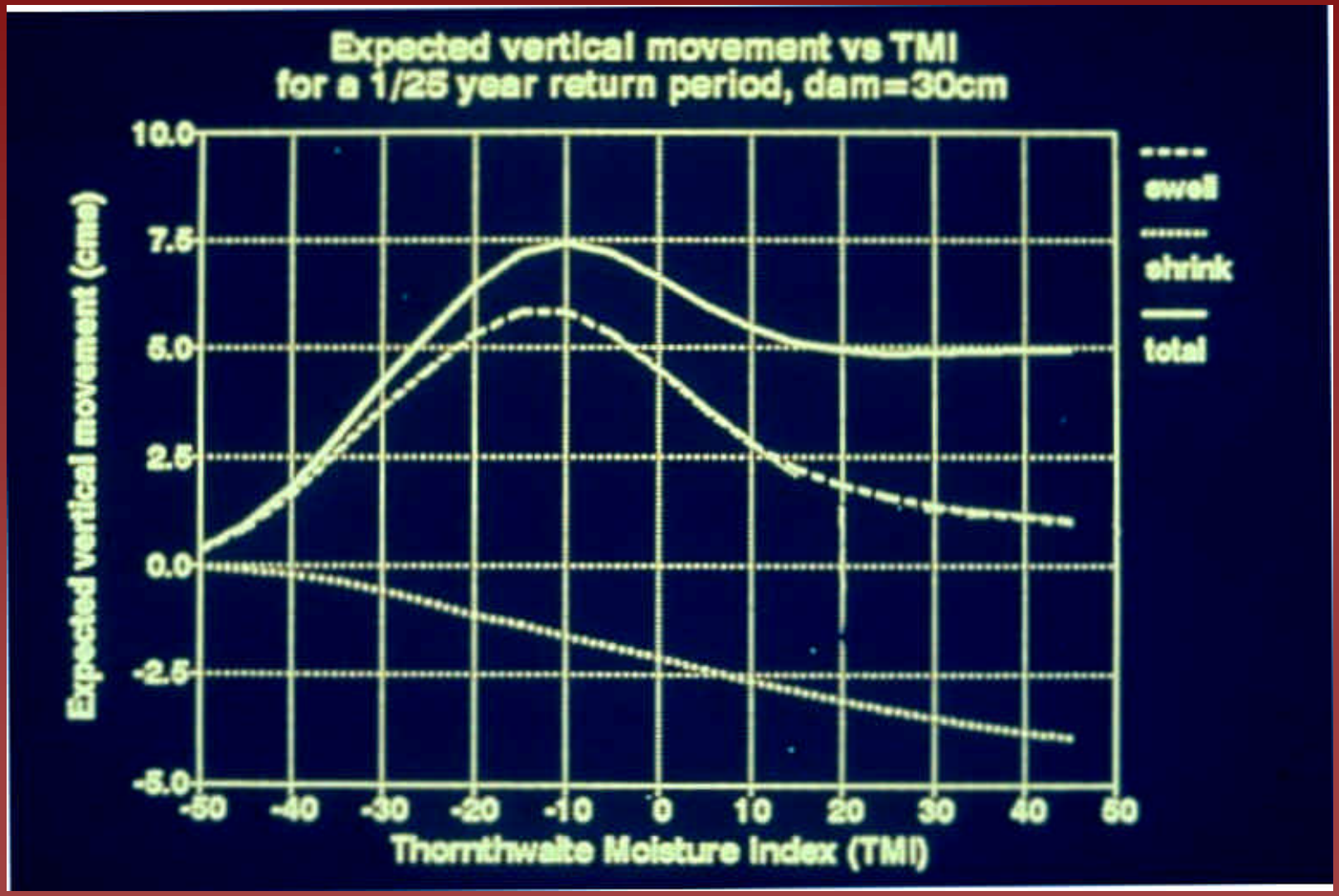
DISTRIBUTION OF EXPANSIVE SOILS



WIDE VARIETY OF CLIMATE



SAME SOIL -- DIFFERENT CLIMATE

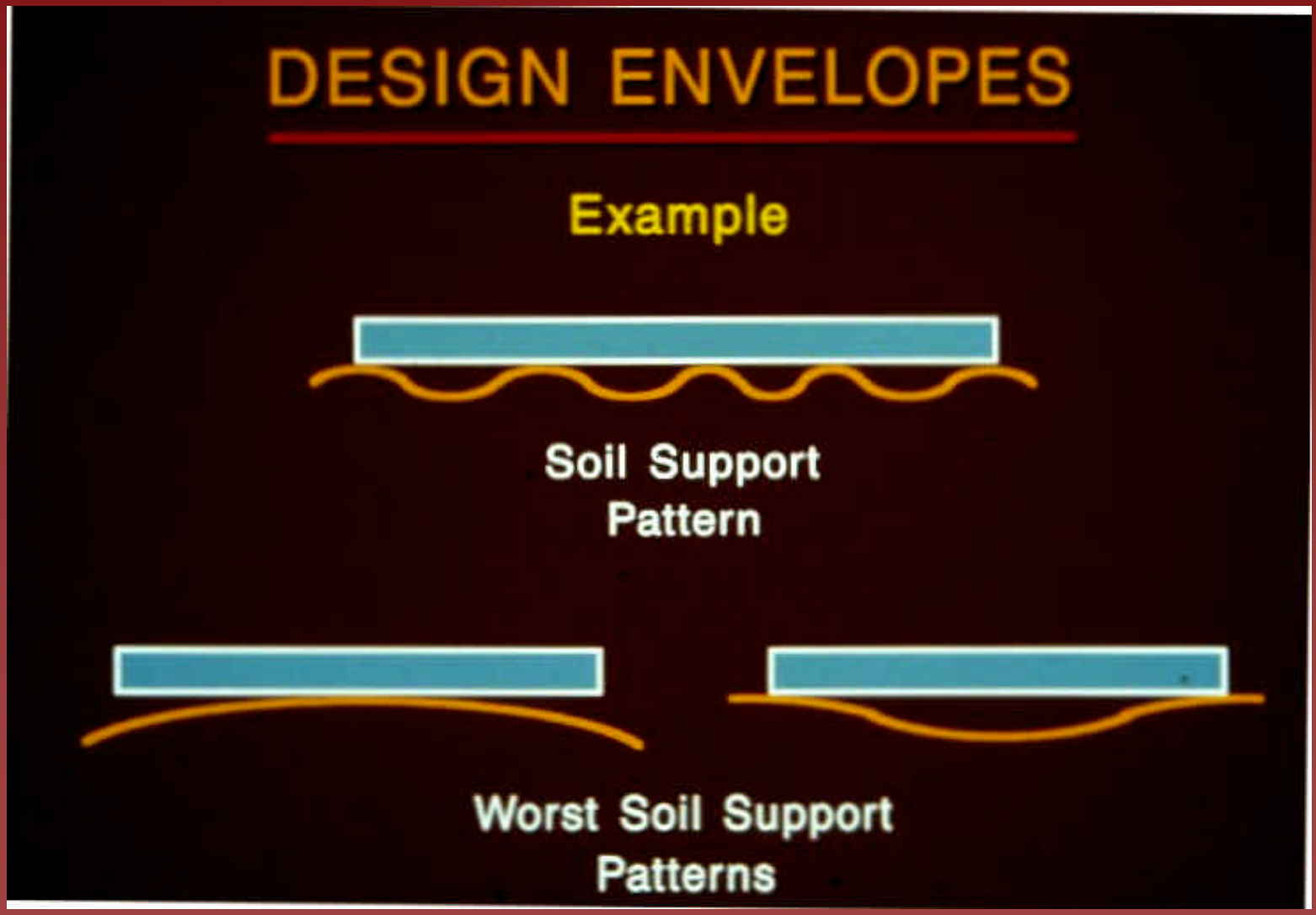


RESIDENCE COMPLICATIONS

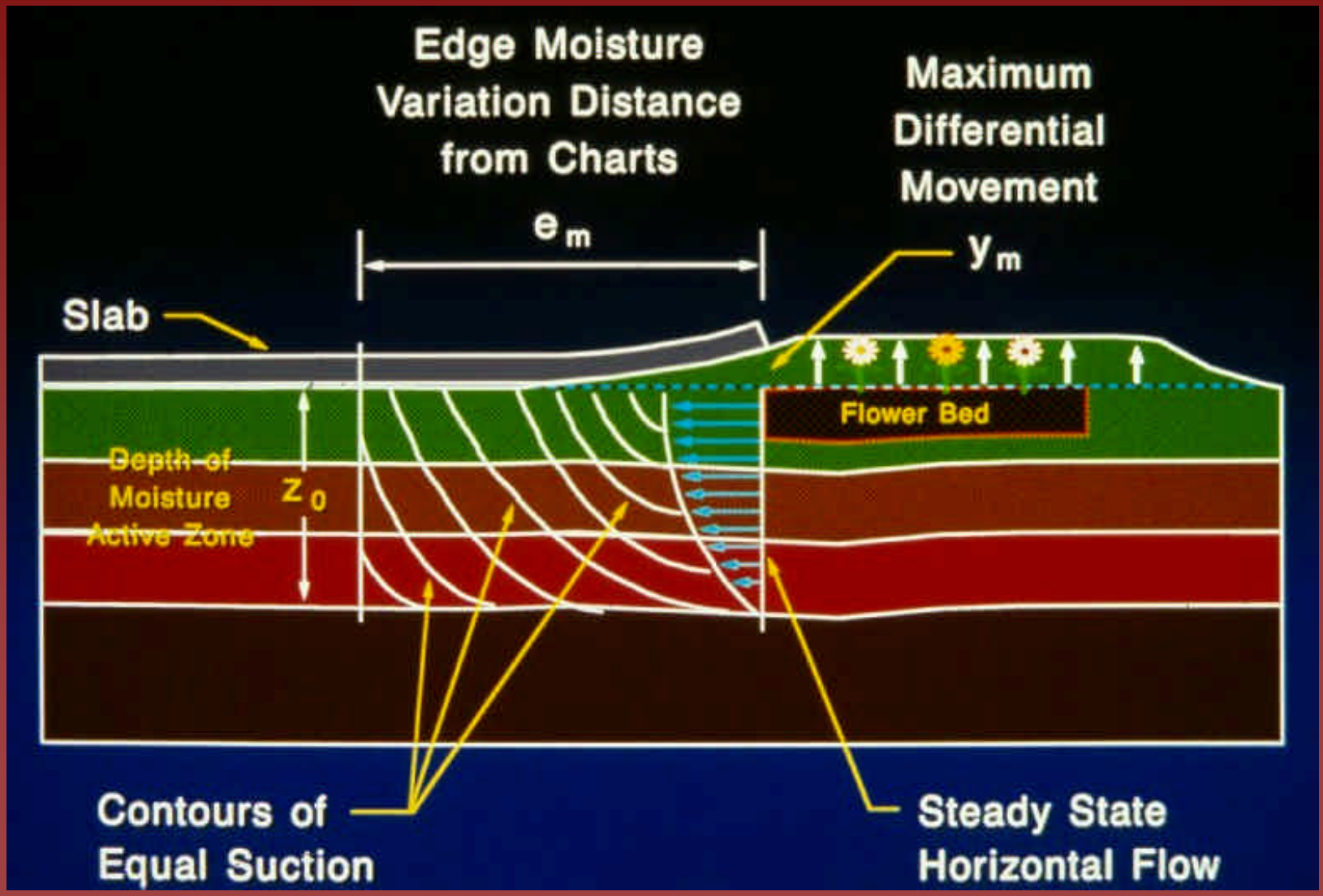
SITE CONDITIONS

- Rainfall and evaporation
- Tree root zones
- Flower beds, ponds
- Vertical, horizontal barriers

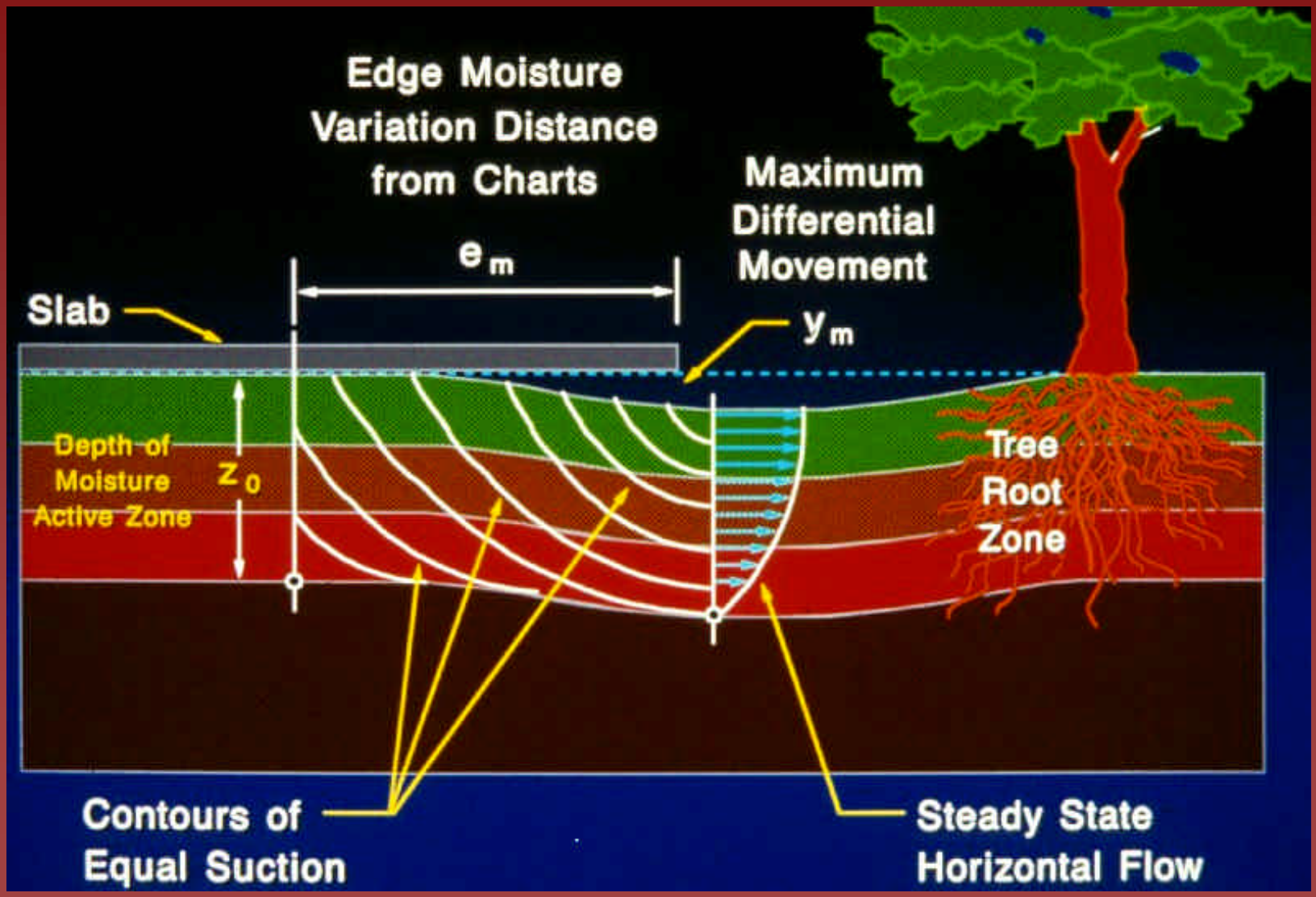
DESIGN NEEDS ENVELOPES



EDGE LIFT


Edge Moisture
Variation Distance
from Charts
e_m
Maximum
Differential
Movement
y_m
Slab
Flower Bed
Depth of
Moisture
Active Zone
z_0
Contours of
Equal Suction
Steady State
Horizontal Flow

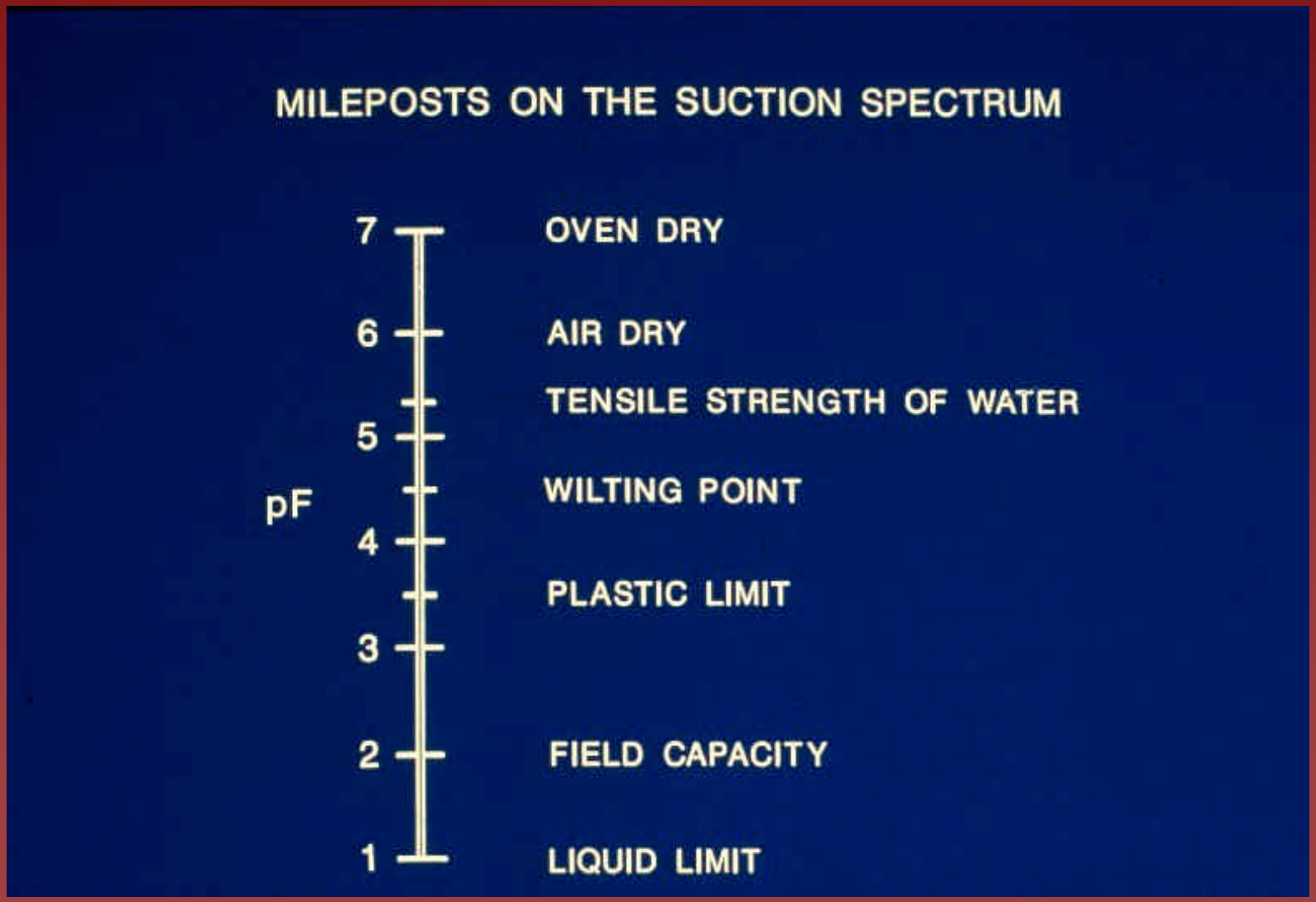
EDGE DRYING


Edge Moisture
Variation Distance
from Charts
e_m
Maximum
Differential
Movement
y_m
Slab
Depth of
Moisture
Active Zone
z_0
Tree
Root
Zone
Contours of
Equal Suction
Steady State
Horizontal Flow

DESIGN AIDS

- SOIL MOVEMENT
- SOIL MOVEMENT TABLES
- SLAB DEFLECTION AND STRESSES
- SOIL VOLUME CHANGE
- SOIL MOISTURE VARIATION DISTANCE
- VERTICAL BARRIERS

SOIL SUCTION



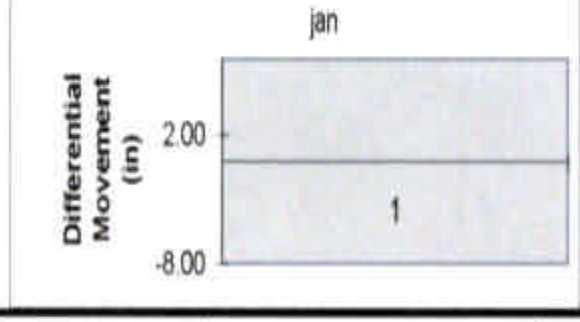
EXAMPLE: VOLFLO-2

GIVEN VALUES:

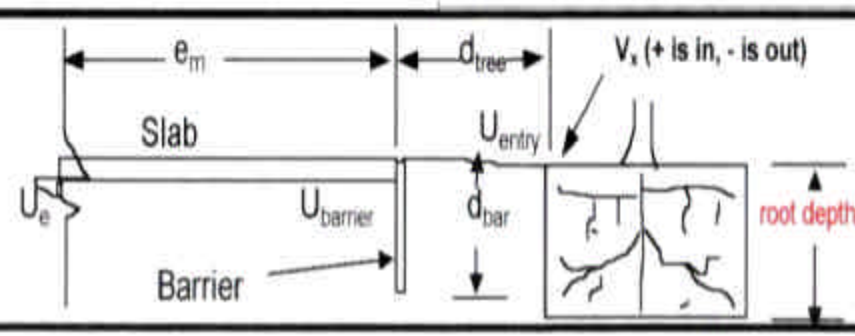
- U_{WET} = 2.50 pF
- U_{DRY} = 4.56 pF
- Z_m = 28.08 ft
- $U_{EQUIL.}$ = 3.31 pF
- U_O = 1.03 pF
- n = 1 cycle/year

SOIL MOVEMENT

7.00	Month of Construction =	jan
7.00	Month to calc. Vol. Chg. =	jan
	Input d_{bar} =	4.00 ft
	Input d_{tree} =	2.00 ft
Total Shrink for jan =		0.00 in
	Edge =	0.00 in
	Center =	0.00 in



d_{tree} is the distance the tree is away from the slab.



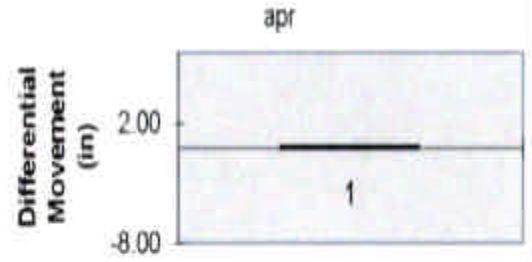
e_m = 320.0 cm (center lift)

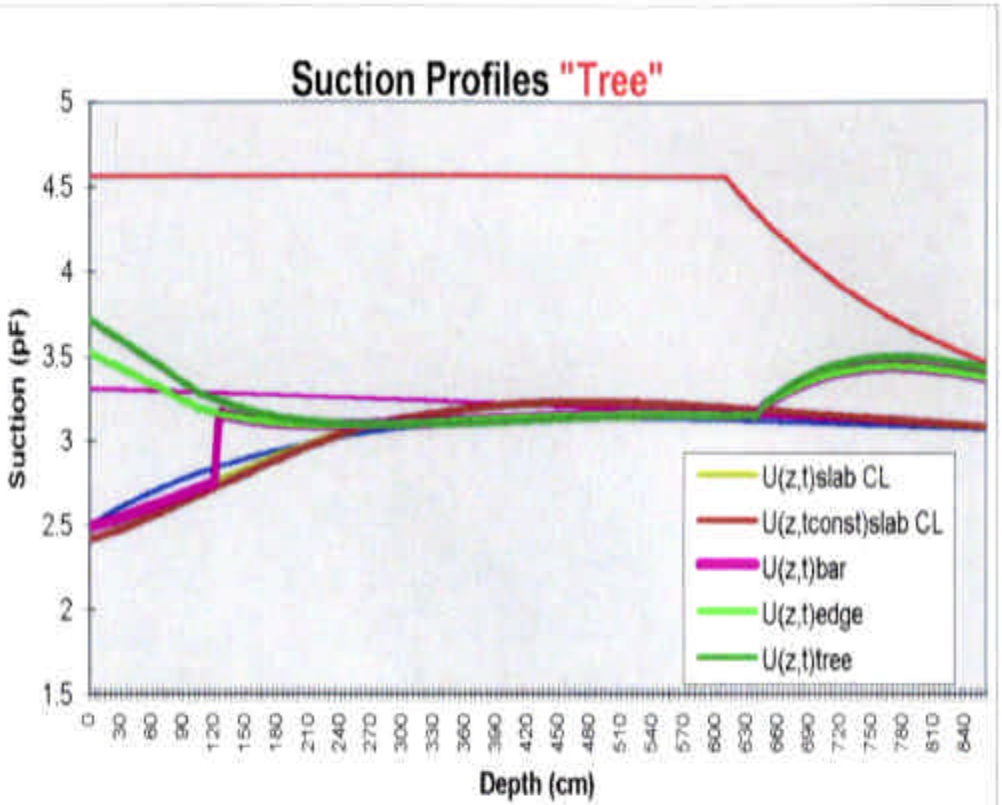
e_m = 198.1 cm (edge lift)

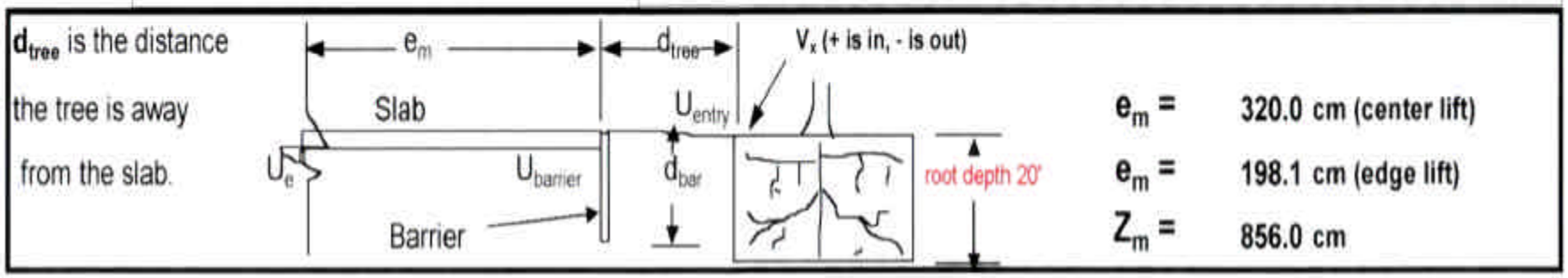
Z_m = 856.0 cm

SOIL MOVEMENT

Time in Mo.			
	Driest Month =		jun
7.00	Month of Construction =		jan
10.00	Month to calc. Vol. Chg. =		apr
	Input d_{bar} =	4.00	ft
	Input d_{tree} =	2.00	ft
Total Swell for apr =		0.03	in
	Edge =	-0.03	in
	Center =	-0.06	in

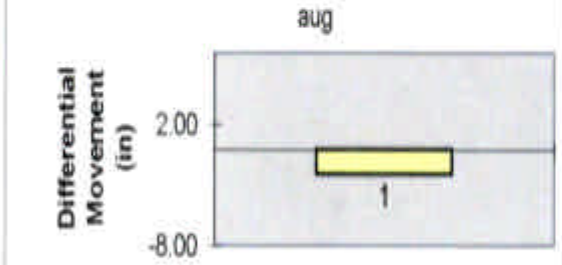


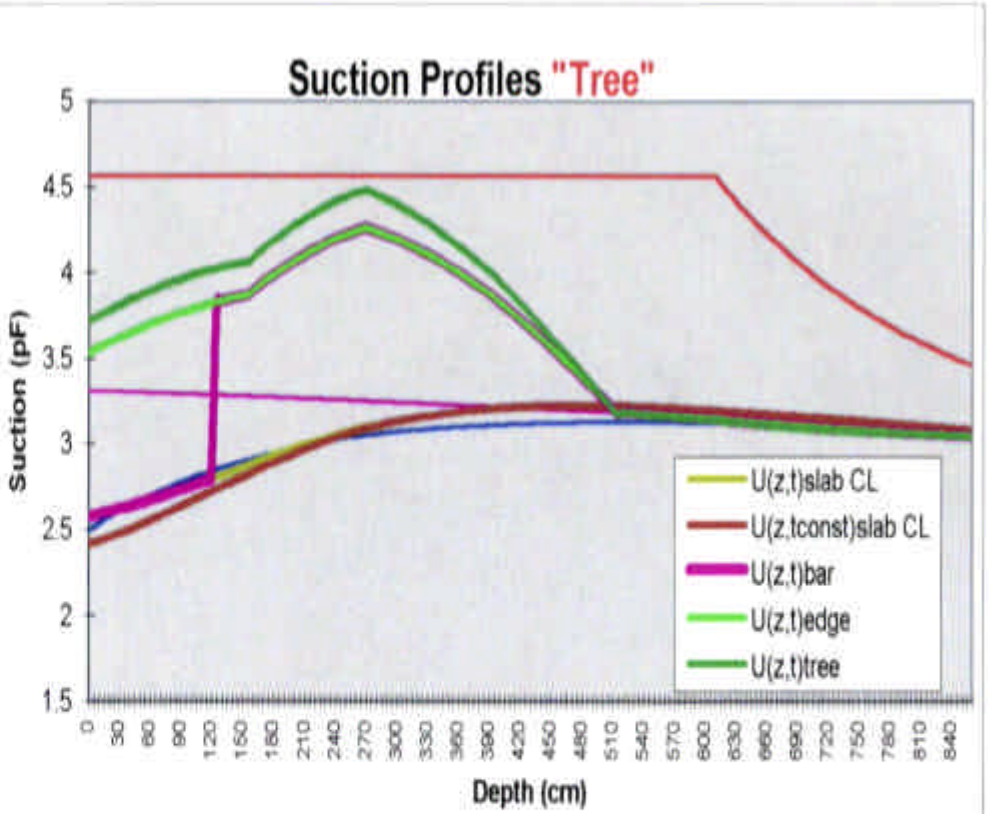




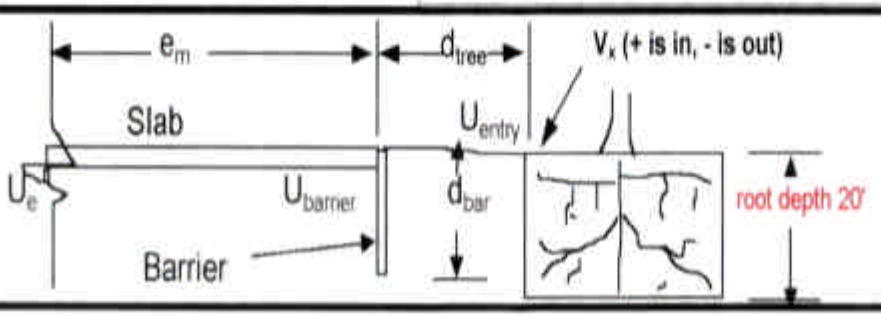
SOIL MOVEMENT

Time in Mo.			
	Driest Month =		jun
7.00	Month of Construction =		jan
14.00	Month to calc. Vol. Chg. =		aug
	Input d_{bar} =	4.00	ft
	Input d_{tree} =	2.00	ft
Total Shrink for aug =		2.00	in
	Edge =	-2.13	in
	Center =	-0.13	in





d_{tree} is the distance the tree is away from the slab.



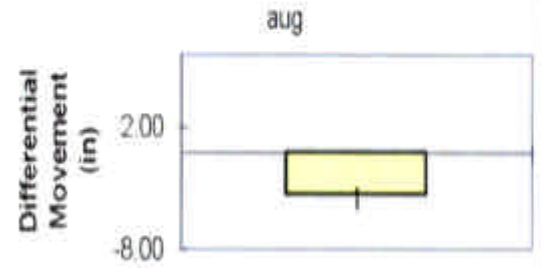
e_m = 320.0 cm (center lift)

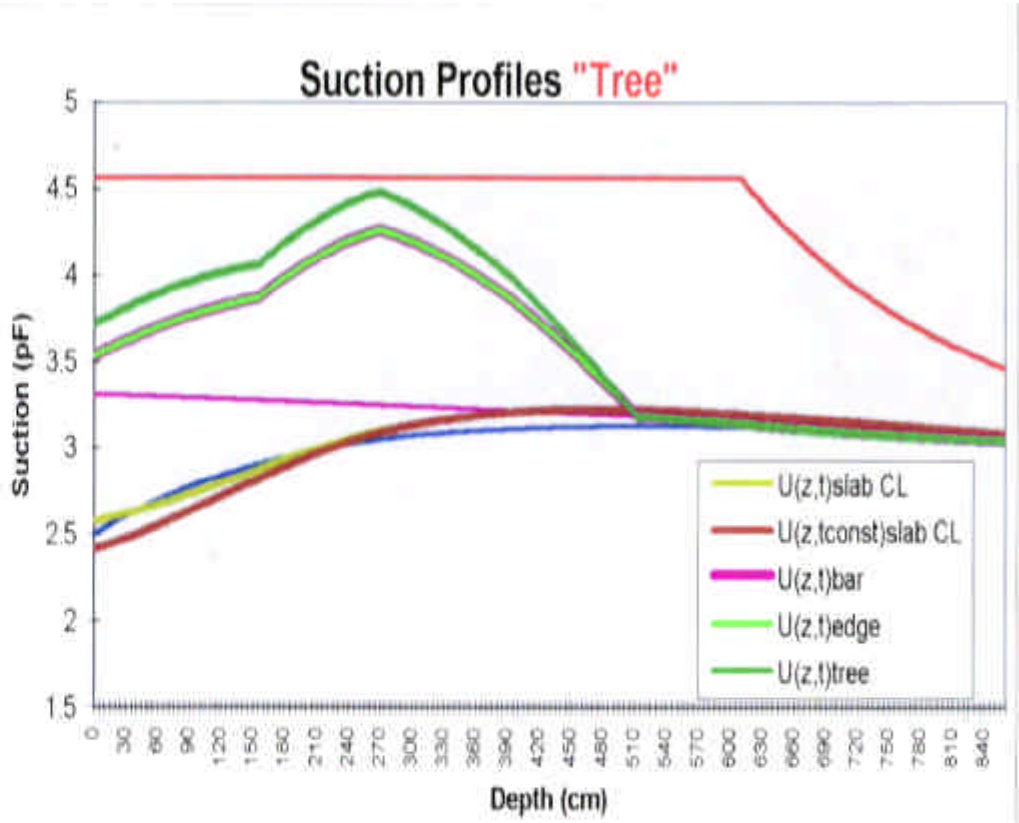
e_m = 198.1 cm (edge lift)

Z_m = 856.0 cm

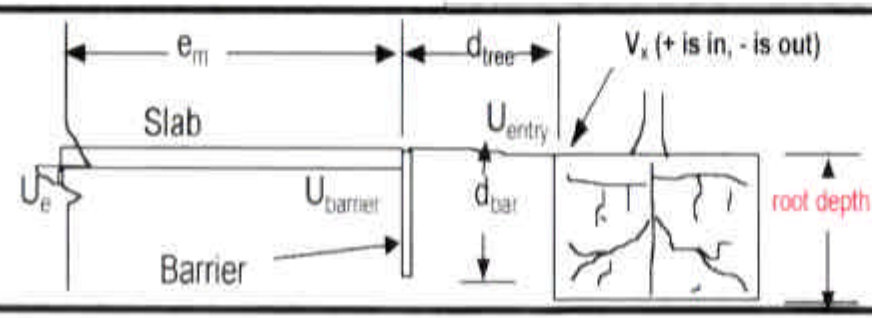
SOIL MOVEMENT

Time in Mo.			
	Driest Month =	jun	
7.00	Month of Construction =	jan	
14.00	Month to calc. Vol. Chg. =	aug	
	Input d_{bar} =	0.00	ft
	Input d_{tree} =	2.00	ft
Total Shrink for aug =		3.42	in
	Edge =	-3.55	in
	Center =	-0.13	in





d_{tree} is the distance the tree is away from the slab.



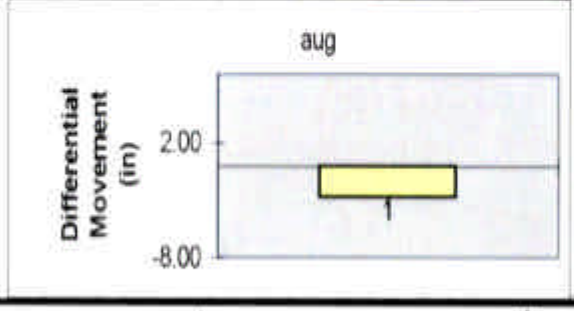
e_m = 320.0 cm (center lift)

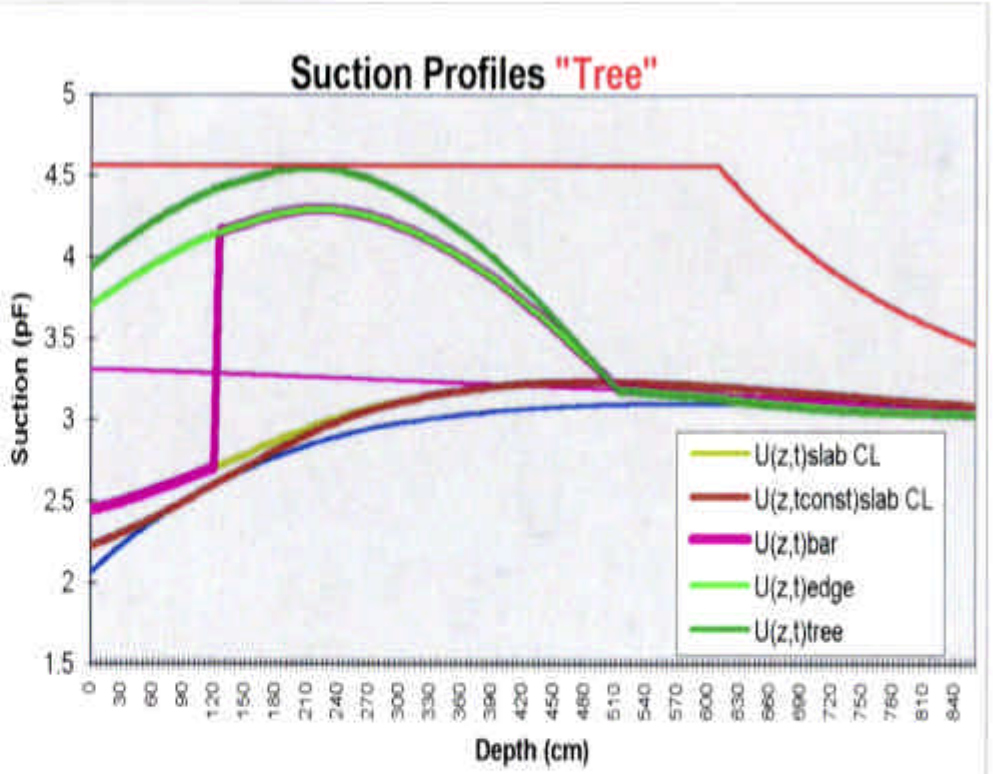
e_m = 198.1 cm (edge lift)

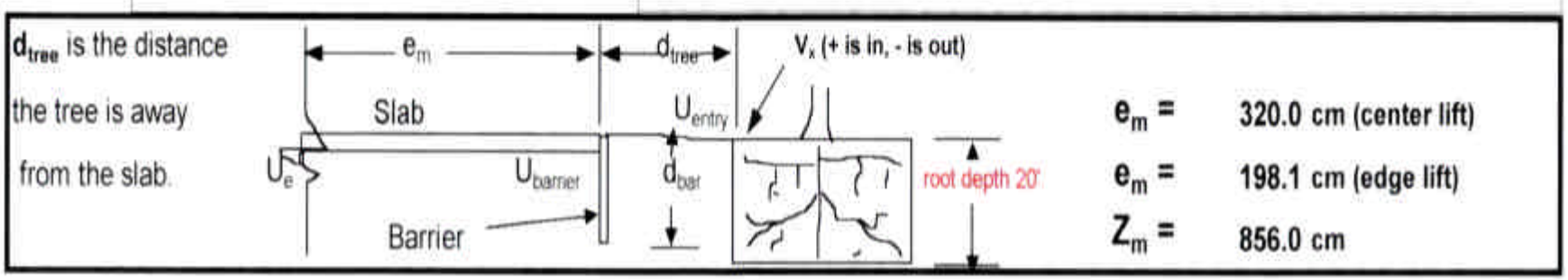
Z_m = 856.0 cm

SOIL MOVEMENT

Time in Mo.			
	Driest Month =		jun
7.00	Month of Construction =		jan
14.00	Month to calc. Vol. Chg. =		aug
	Input d_{bar} =	4.00	ft
	Input d_{tree} =	2.00	ft
Total Shrink for aug =		2.63	in
	Edge =	-2.81	in
	Center =	-0.18	in







SOIL MOVEMENT TABLES

Design Differential Soil Movement, y_m, Guide Number for Slab Design

Measured Suction pF at Depth, z_m, m	y_m Guide Numbers						
	Controlling Surface Suction, pF						
	2.5	**2.7**	**3.0**	**3.5**	**4.0**	**4.2**	**4.5**
2.7	+3.2	0	-4.1	-13.6	-25.7	-31.3	-40.0
3.0	+9.6	+5.1	0	-7.5	-18.2	-23.1	-31.3
3.3	+17.7	+12.1	+5.1	-2.6	-11.5	-15.8	-23.1
3.6	+27.1	+20.7	+12.1	+1.6	-5.7	-9.4	-15.8
3.9	+38.1	+30.8	+20.7	+7.3	-1.3	-4.1	-9.4
4.2	+50.4	+42.1	+30.8	+14.8	+3.2	0	-4.1
4.5	+63.6	+54.7	+42.1	+23.9	+9.6	+5.1	0

Note: The positive sign indicates heave and the negative sign indicates shrinkage.

SOIL MOVEMENT TABLES

Design Differential Soil Movement, y_m, Guide Number for Slab Design: Lawn Irrigation

Measured Suction pF at Depth, z_m, m	y_m Guide Numbers							
	Controlling Surface Suction Due to Lawn Watering							
	pF – units				With 4 ft. Deep Moisture Barrier pF -- units			
	2.5	**2.7**	**3.0**	**3.5**	**2.5**	**2.7**	**3.0**	**3.5**
2.7	3.2	0	0	0	0.1	0	0	0
3.0	9.6	5.1	0	0	0.1	0.1	0	0
3.3	17.7	12.1	5.1	0	0.1	0.1	0.1	0
3.6	27.1	20.7	12.1	1.6	1.3	0.5	0.1	0.1
3.9	38.1	30.8	20.7	7.3	3.8	1.9	0.5	0.1
4.2	50.4	42.1	30.8	14.8	7.7	4.9	1.9	0.1
4.5	63.6	54.7	42.1	23.9	12.4	9.1	4.9	0.8

SOIL MOVEMENT TABLES

Design Differential Soil Movement, y_m, Guide Number for Slab Design: Flower Bed Case (4 ft Deep Flower Bed Moisture)

Measured Suction pF at Depth, z_m, m	y_m Guide Numbers						
	Controlling Surface Suction Due to Flower Bed Watering						
	pF – units			With 4 ft. Deep Moisture Barrier pF -- units			
	2.5	**3.0**	**3.5**	**2.5**	**2.7**	**3.0**	**3.5**
2.7	3.2	0	0	0	0	0	0
3.0	13.1	0	0	0	0	0	0
3.3	27.3	7.0	0	3.7	1.0	0	0
3.6	48.7	14.2	1.6	11.6	6.2	1.1	0
3.9	69.5	35.1	10.2	22.5	15.2	6.4	0
4.2	90.3	56.0	21.5	35.1	26.6	15.3	2.4
4.5	111.0	76.7	42.3	49.0	39.7	26.6	9.1

SOIL MOVEMENT TABLES

Design Differential Soil Movement, y_m, Guide Number for Slab Design: Tree Drying Case (Without Moisture Barrier)

Depth of Tree Root Zone, ft	y_m Guide Numbers						
	Measured Equilibrium Suction at Depth, z_m pF -- units						
	2.7	**3.0**	**3.3**	**3.6**	**3.9**	**4.2**	**4.5**
4	-79.1	-60.1	-43.2	-28.4	-15.6	-0.1	0.0
10	-169.6	-146.3	-124.9	-82.8	-42.6♦	-9.7♠	0.0
15	-244.7	-213.6	-182.5	-108.1♥	-42.6♦	-9.7♠	0.0
20	-333.4	-292.9	-252.5	-108.1♥	-42.6♦	-9.7♠	0.0

♥Movement active zone, z_A = 11.5 ft.
♦Movement active zone, z_A = 7.5 ft.
♠Movement active zone, z_A = 3.5 ft.

SOIL MOVEMENT TABLES

Design Differential Soil Movement, y_m, Guide Number for Slab Design: Tree Drying Case (With Moisture Barrier)

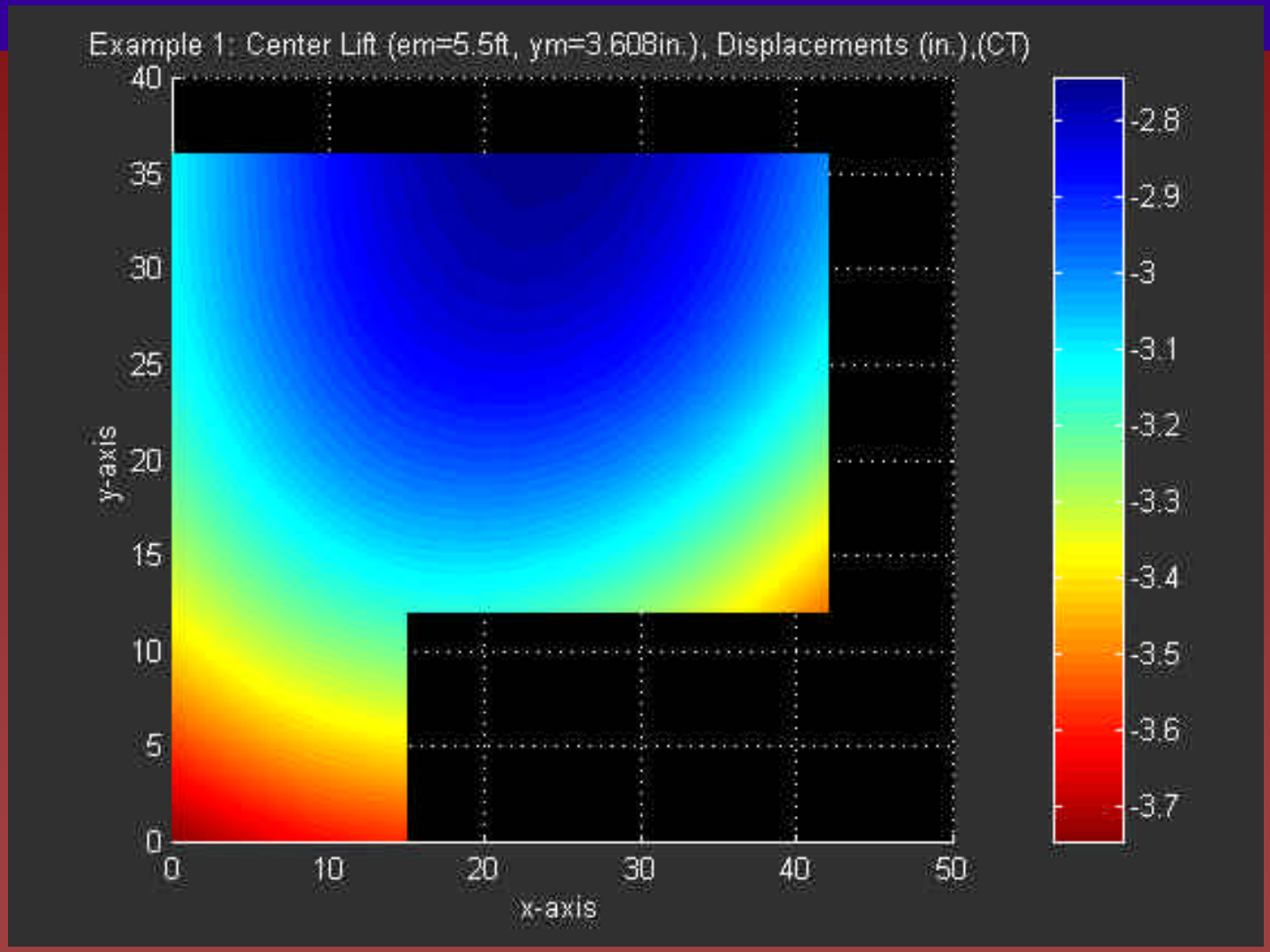
Depth of Tree Root Zone, ft	y_m Guide Numbers						
	Measured Equilibrium Suction at Depth, z_m (With 4 ft Deep Moisture Barrier) pF -- units						
	2.7	**3.0**	**3.3**	**3.6**	**3.9**	**4.2**	**4.5**
4	-36.5	-25.2	-15.8	-8.1	-2.6	0.0	0.0
10	-116.3	-102.4	-88.4	-53.1	-21.5♦	0.0	0.0
15	-193.5	-170.5	-147.5	-78.5♥	-21.5♦	0.0	0.0
20	-278.2	-246.1	-214.2	-78.5♥	-21.5♦	0.0	0.0

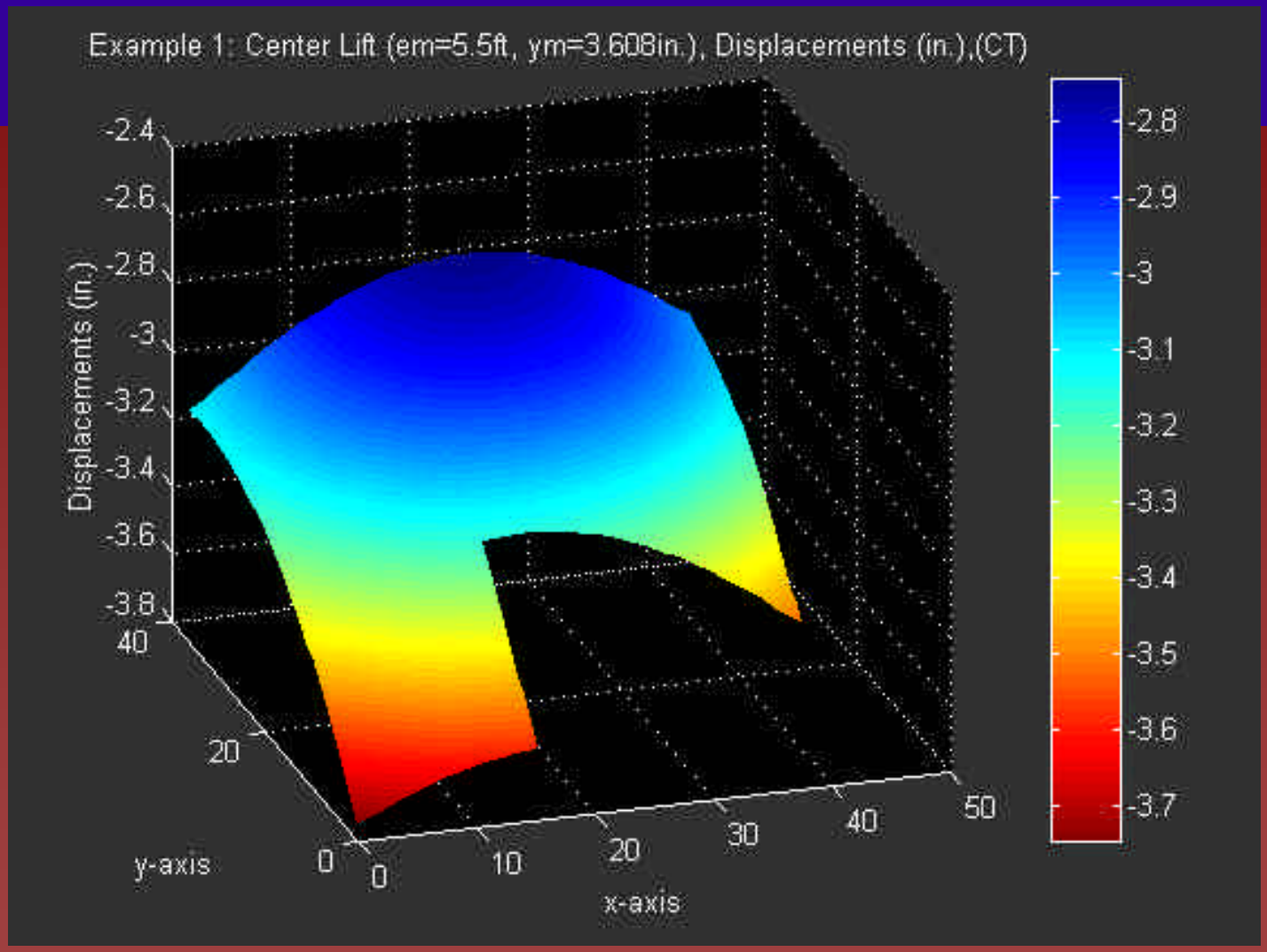
♥Movement active zone, z_A = 11.5 ft.
♦Movement active zone, z_A = 7.5 ft.

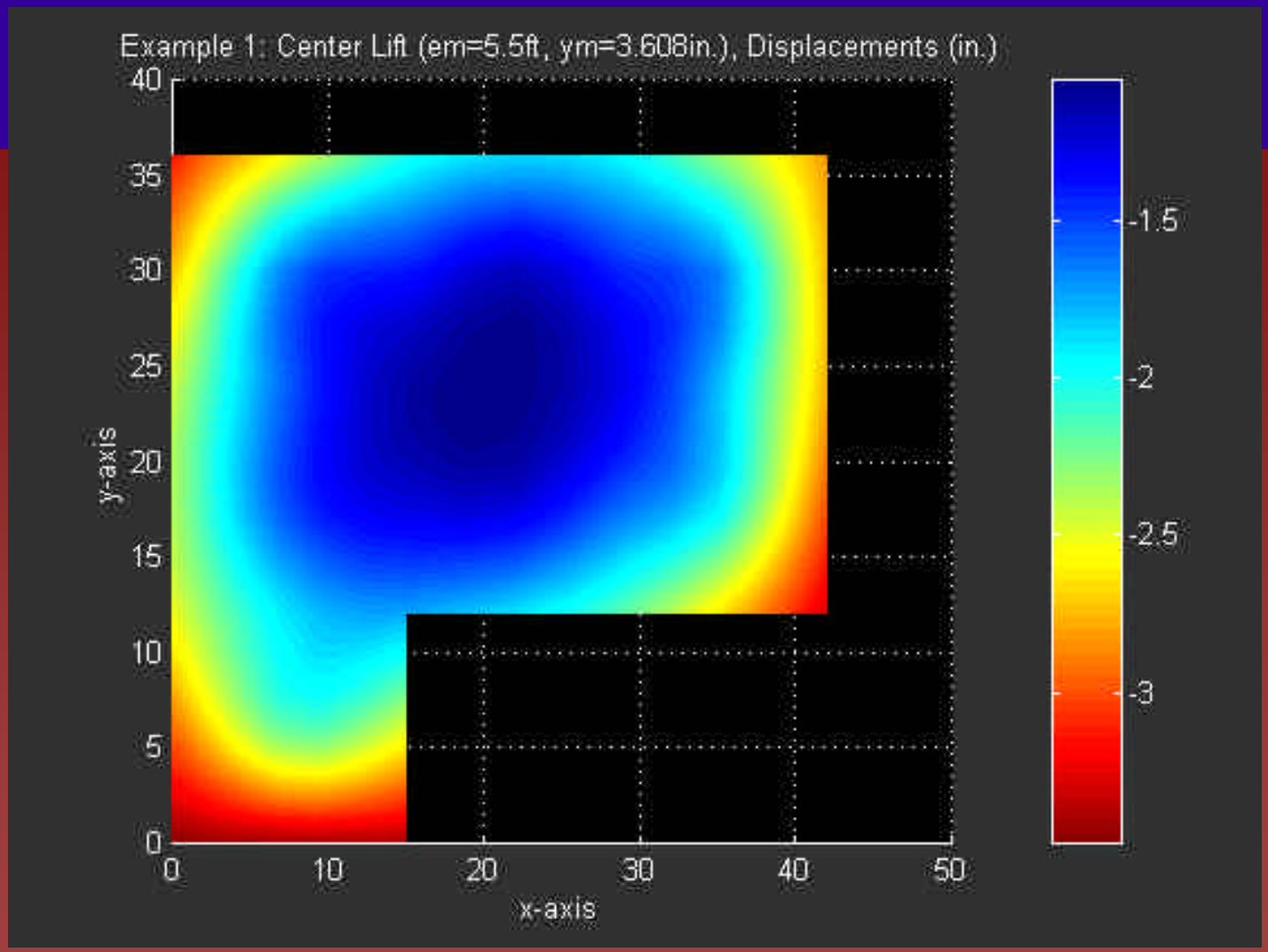
SLAB DEFLECTIONS AND STRESSES

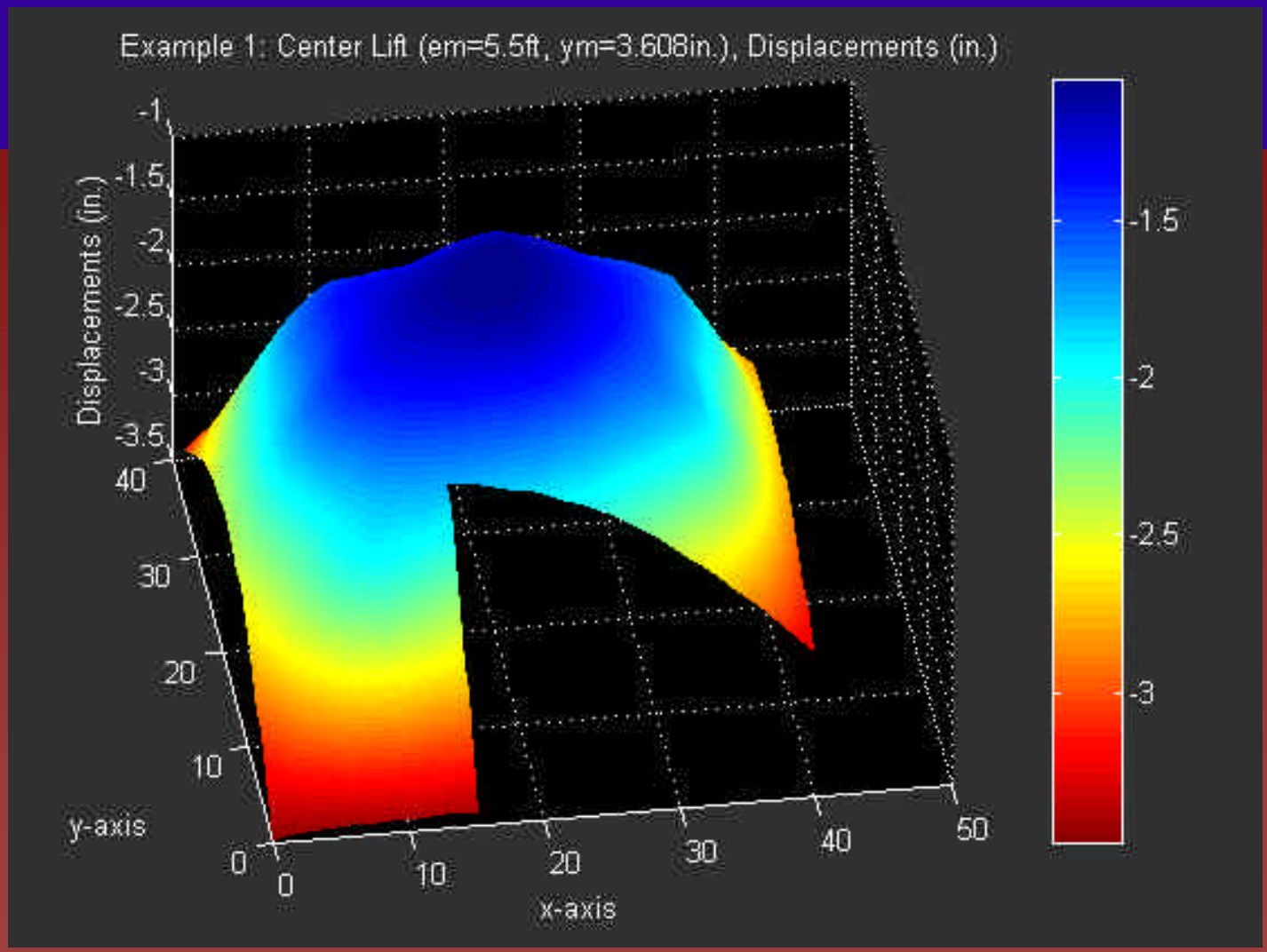
EXAMPLE NO. 1
P.T.I. DESIGN MANUAL

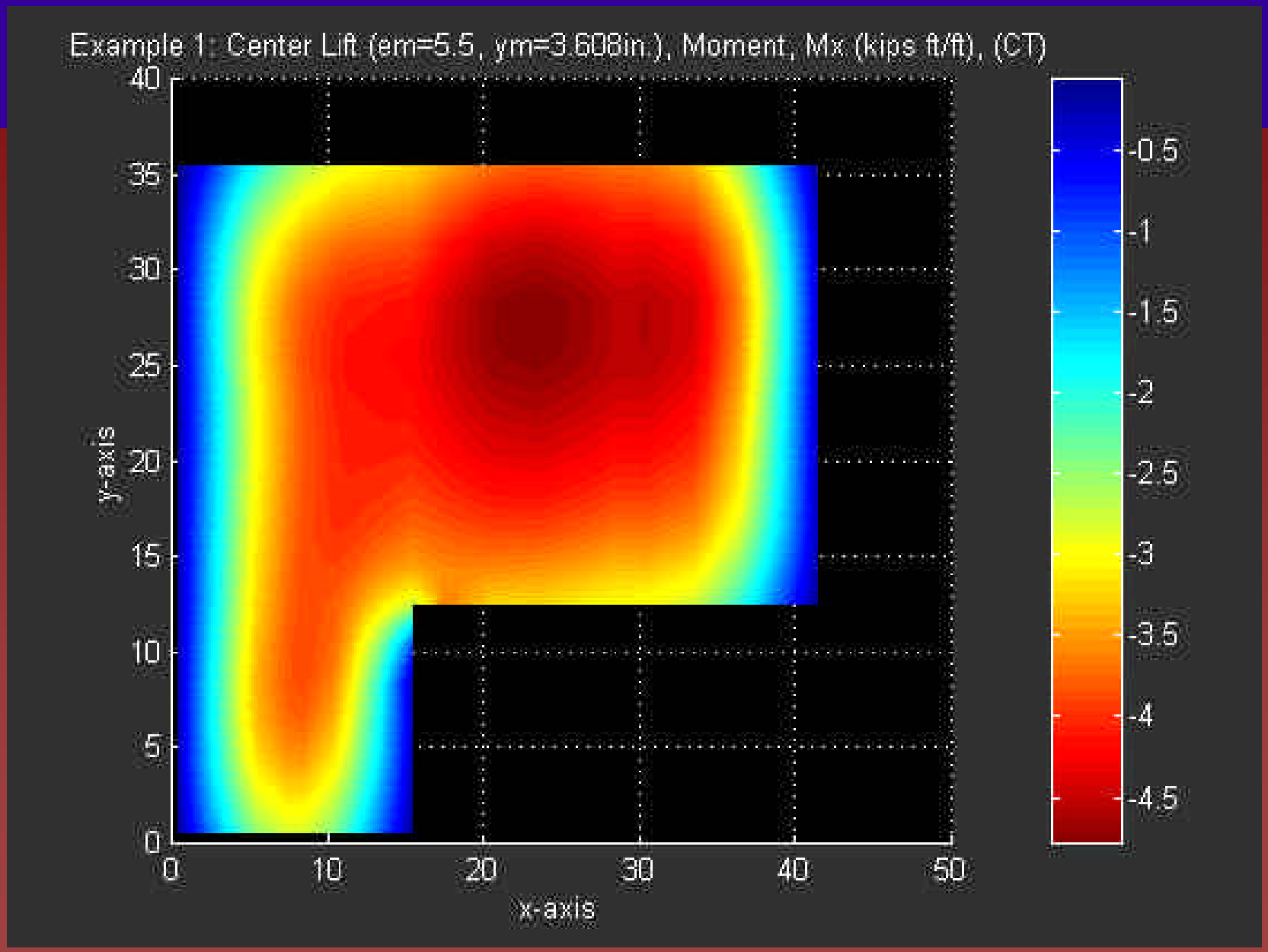
FLAT SLAB
RIBBED SLAB

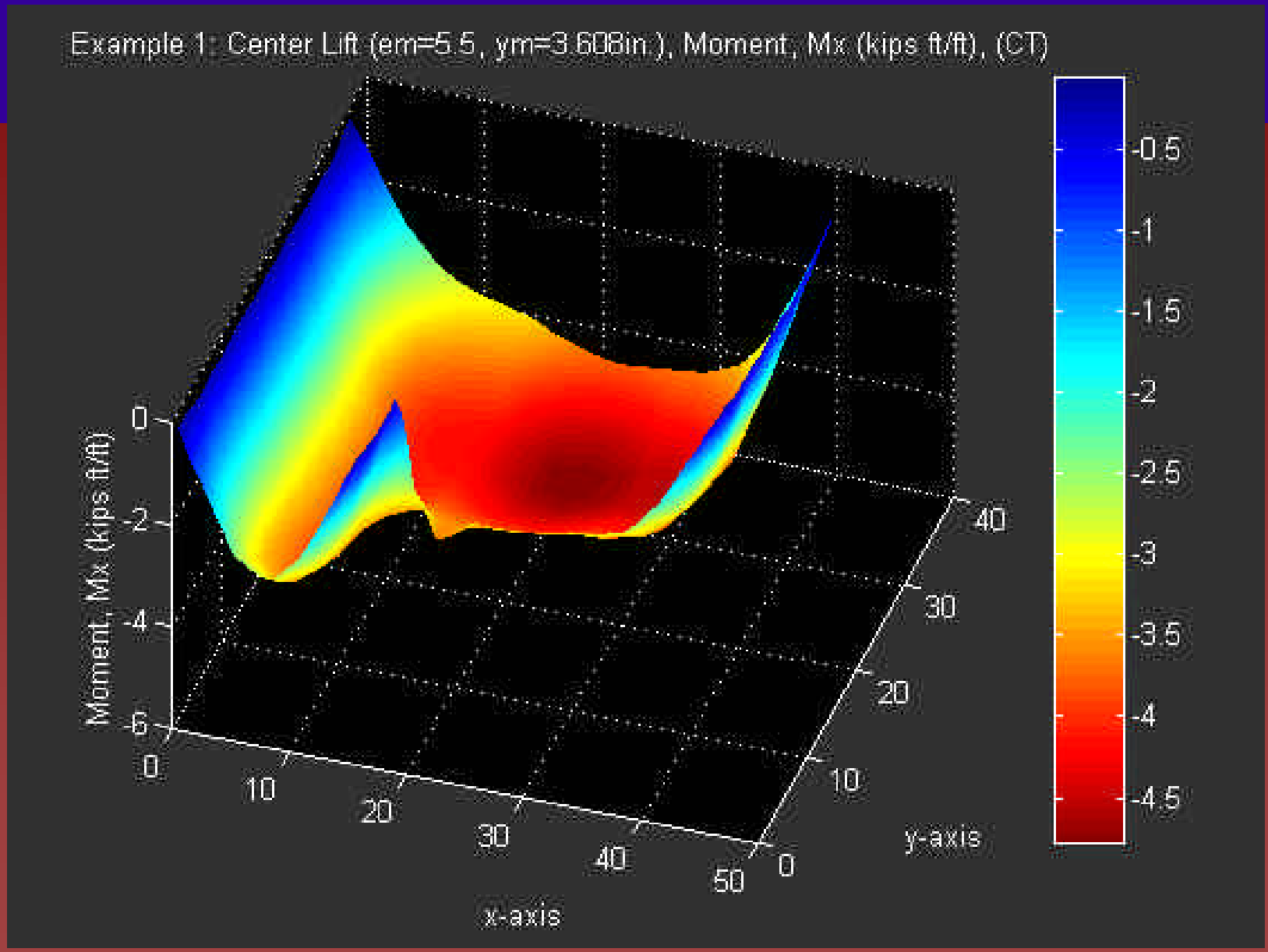

Example 1: Center Lift (em=5.5ft, ym=3.608in.), Displacements (in.),(CT)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
-2.8
-2.9
-3
-3.1
-3.2
-3.3
-3.4
-3.5
-3.6
-3.7

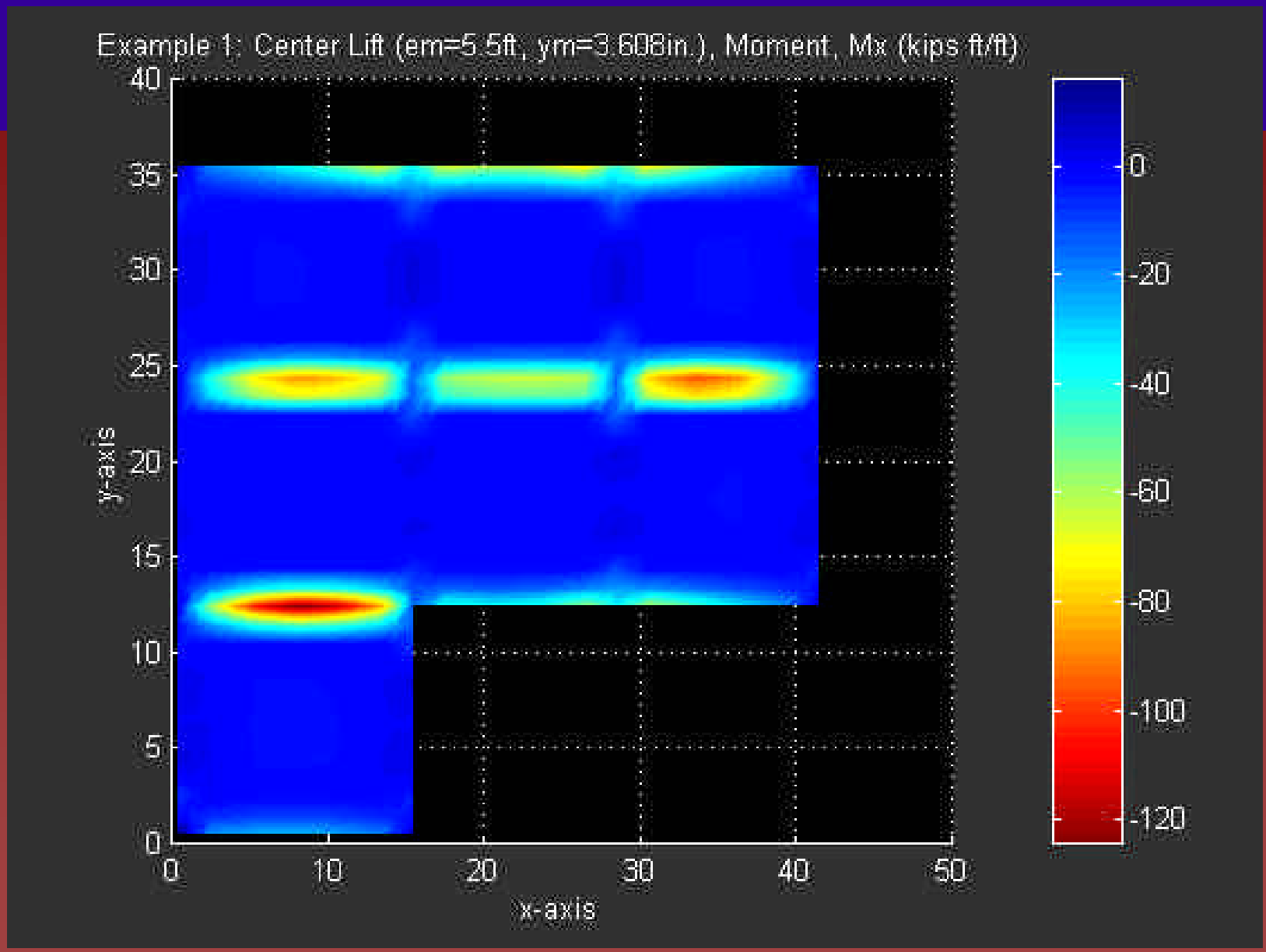

Example 1: Center Lift (em=5.5ft, ym=3.608in.), Displacements (in.),(CT)
Displacements (in.)
-2.4
-2.6
-2.8
-3
-3.2
-3.4
-3.6
-3.8
40
20
0
y-axis
0
10
20
30
40
50
x-axis
-2.8
-2.9
-3
-3.1
-3.2
-3.3
-3.4
-3.5
-3.6
-3.7

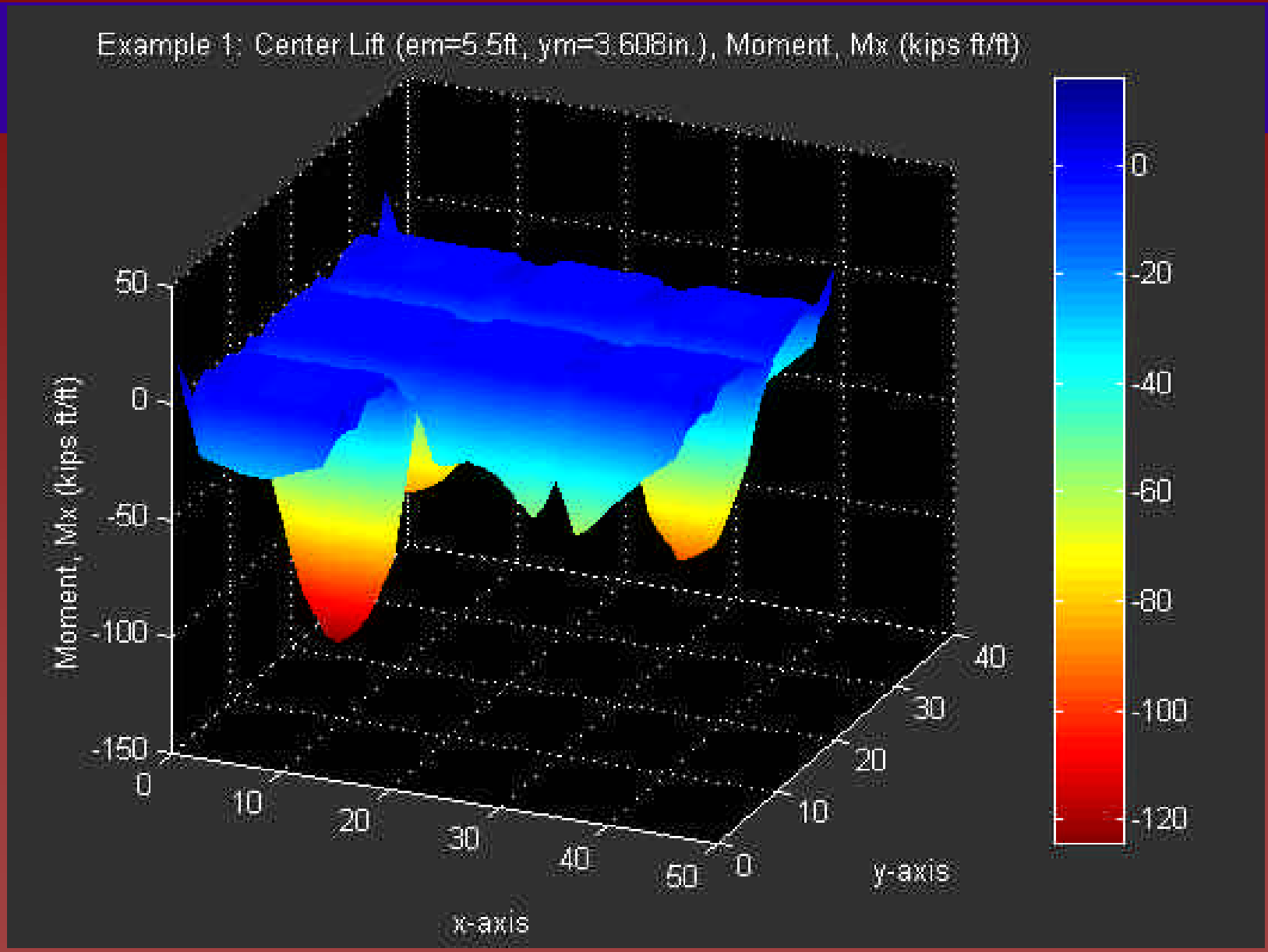

Example 1: Center Lift (em=5.5ft, ym=3.608in.), Displacements (in.)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
-1.5
-2
-2.5
-3

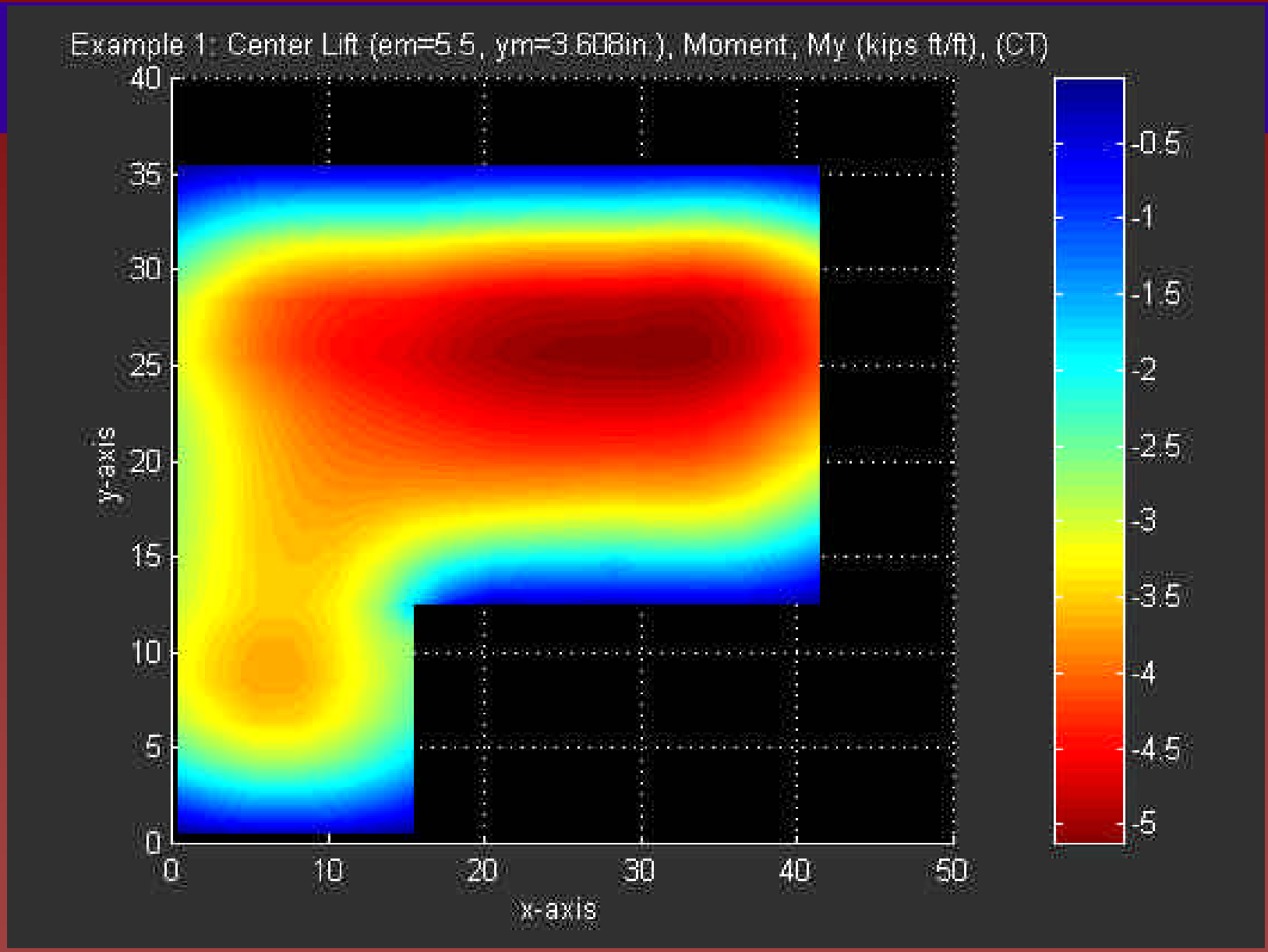

Example 1: Center Lift (em=5.5ft, ym=3.608in.), Displacements (in.)
Displacements (in.)
-1
-1.5
-2
-2.5
-3
-3.5
y-axis
0
10
20
30
40
x-axis
0
10
20
30
40
50
-1.5
-2
-2.5
-3

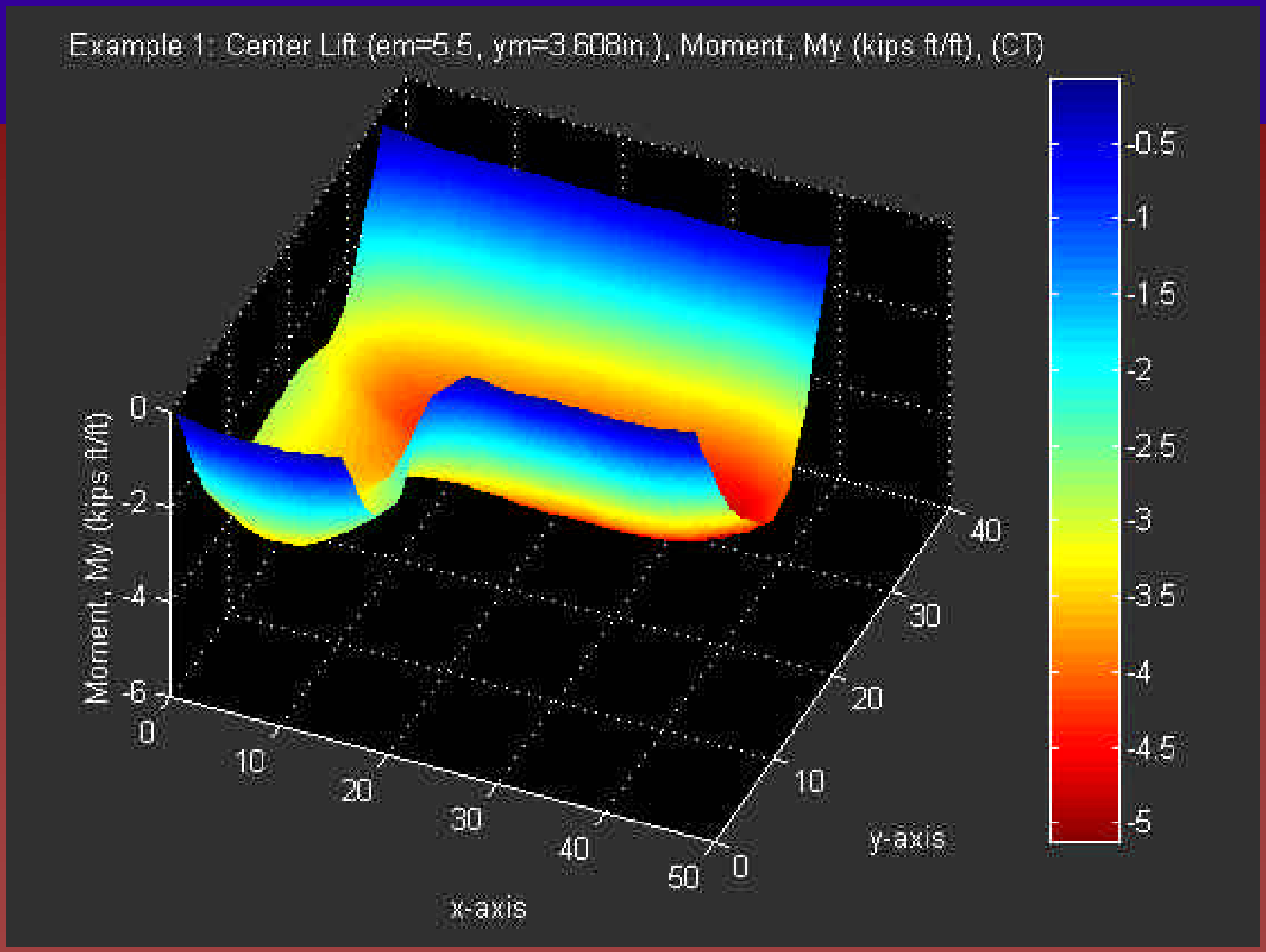

Example 1: Center Lift (em=5.5, ym=3.608in.), Moment, Mx (kips ft/ft), (CT)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5

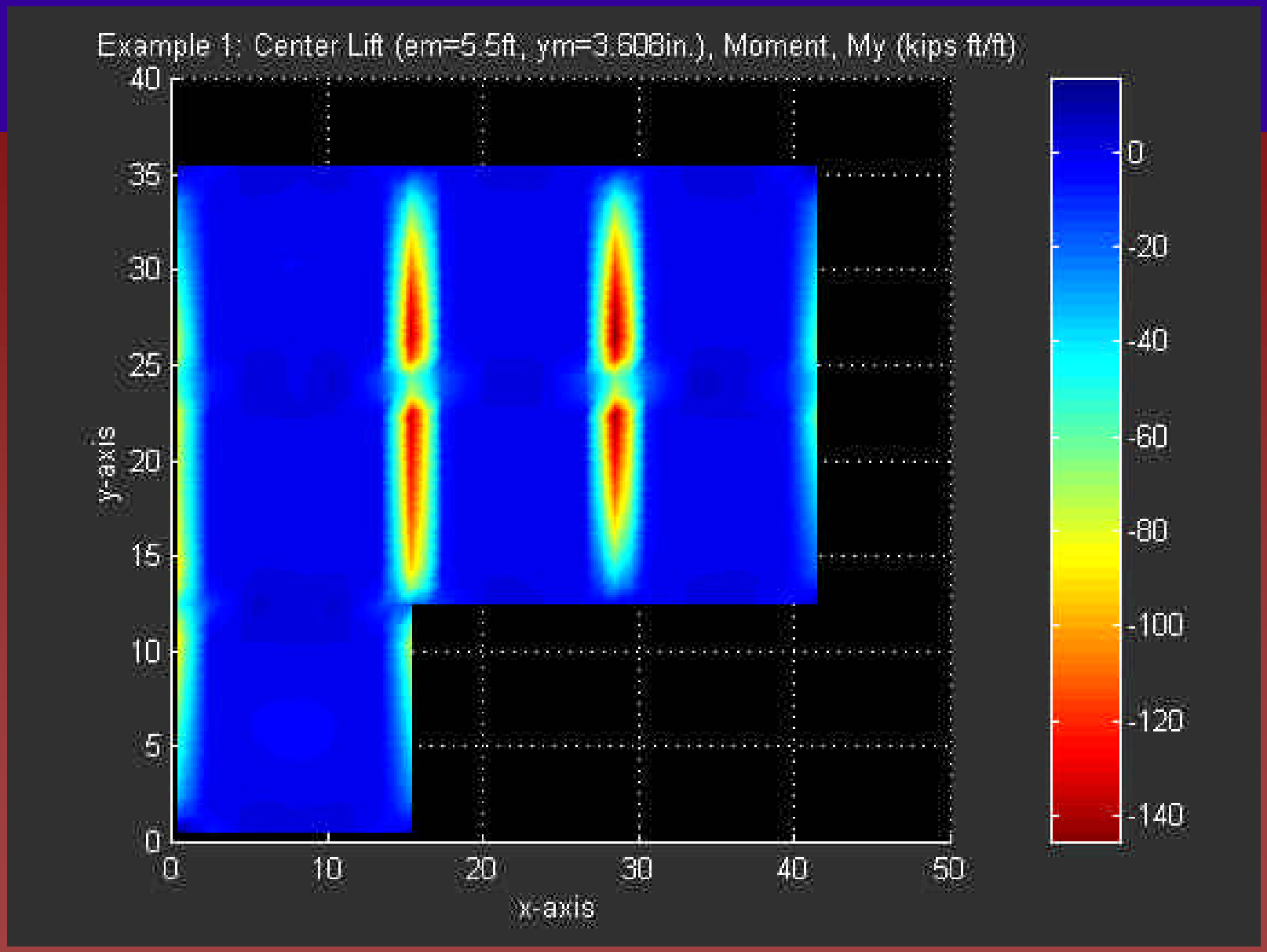

Example 1: Center Lift (em=5.5, ym=3.608in.), Moment, Mx (kips ft/ft), (CT)
Moment, Mx (kips ft/ft)
0
-2
-4
-6
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5

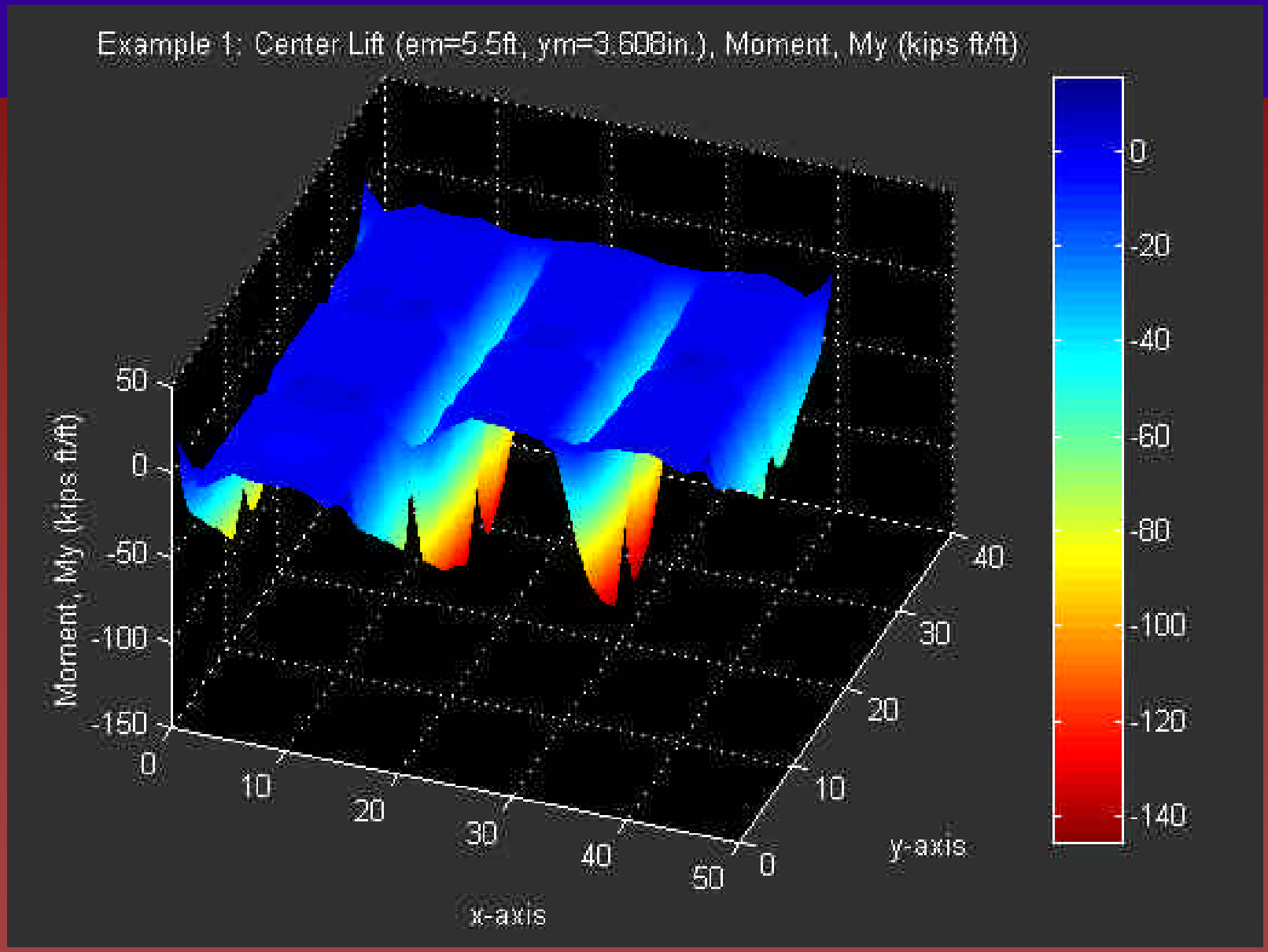

Example 1: Center Lift (em=5.5ft, ym=3.608in.), Moment, Mx (kips ft/ft)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
0
-20
-40
-60
-80
-100
-120

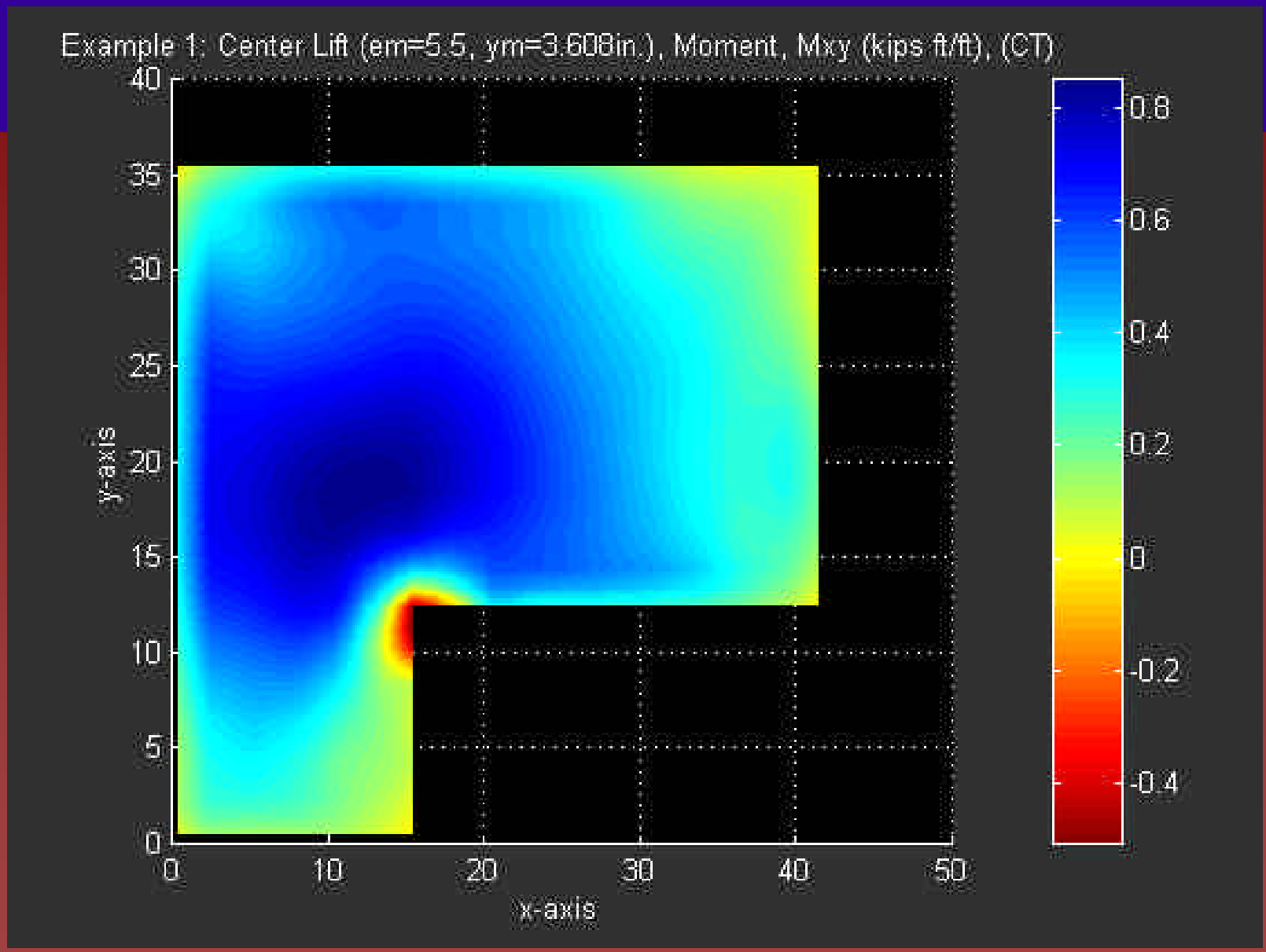

Example 1: Center Lift (em=5.5ft, ym=3.608in.), Moment, Mx (kips ft/ft)
Moment, Mx (kips ft/ft)
50
0
-50
-100
-150
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
0
-20
-40
-60
-80
-100
-120

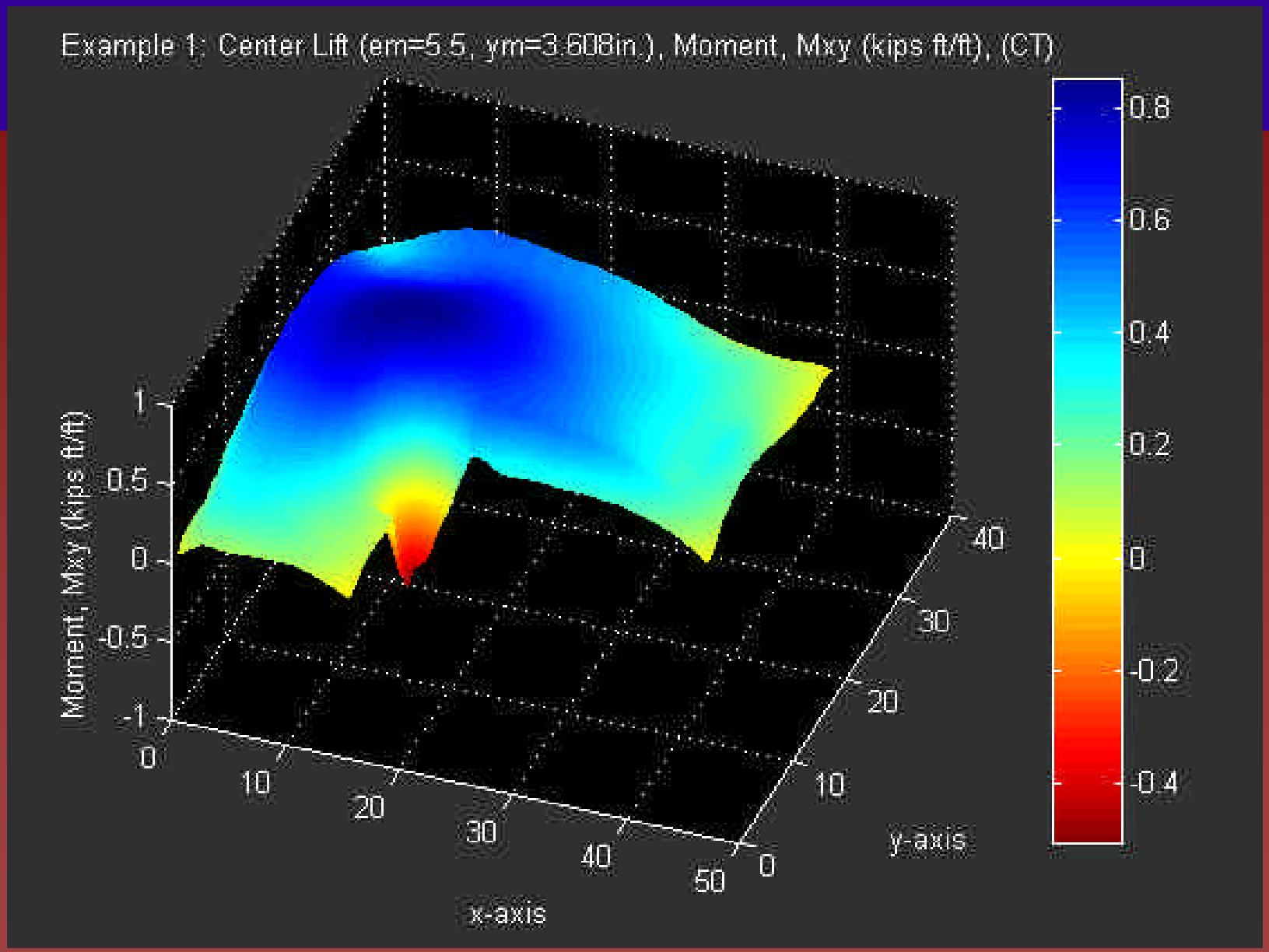

Example 1: Center Lift (em=5.5, ym=3.608in.), Moment, My (kips ft/ft), (CT)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5

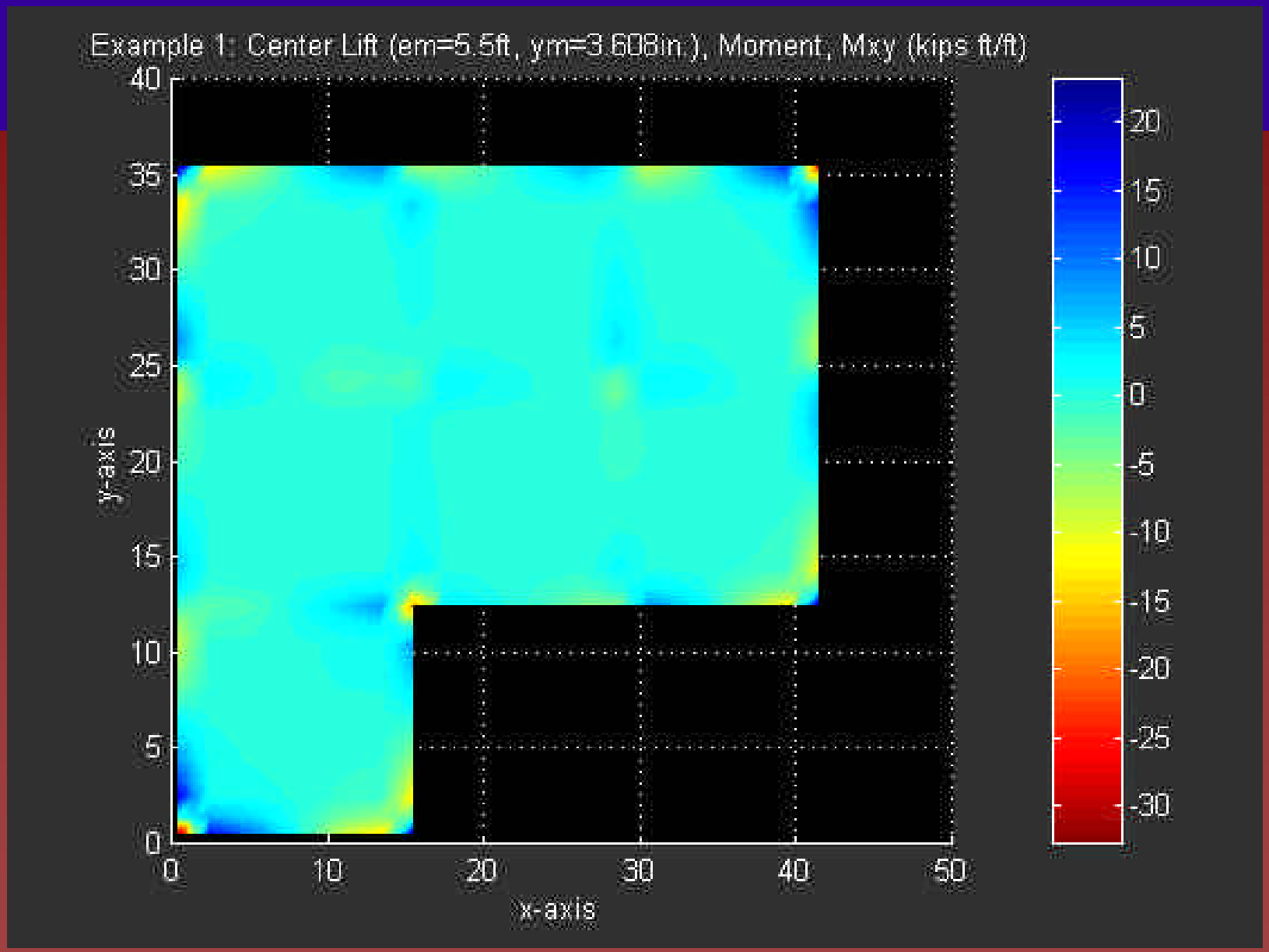

Example 1: Center Lift (em=5.5, ym=3.608in.), Moment, My (kips ft/ft), (CT)
Moment, My (kips ft/ft)
0
-2
-4
-6
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5

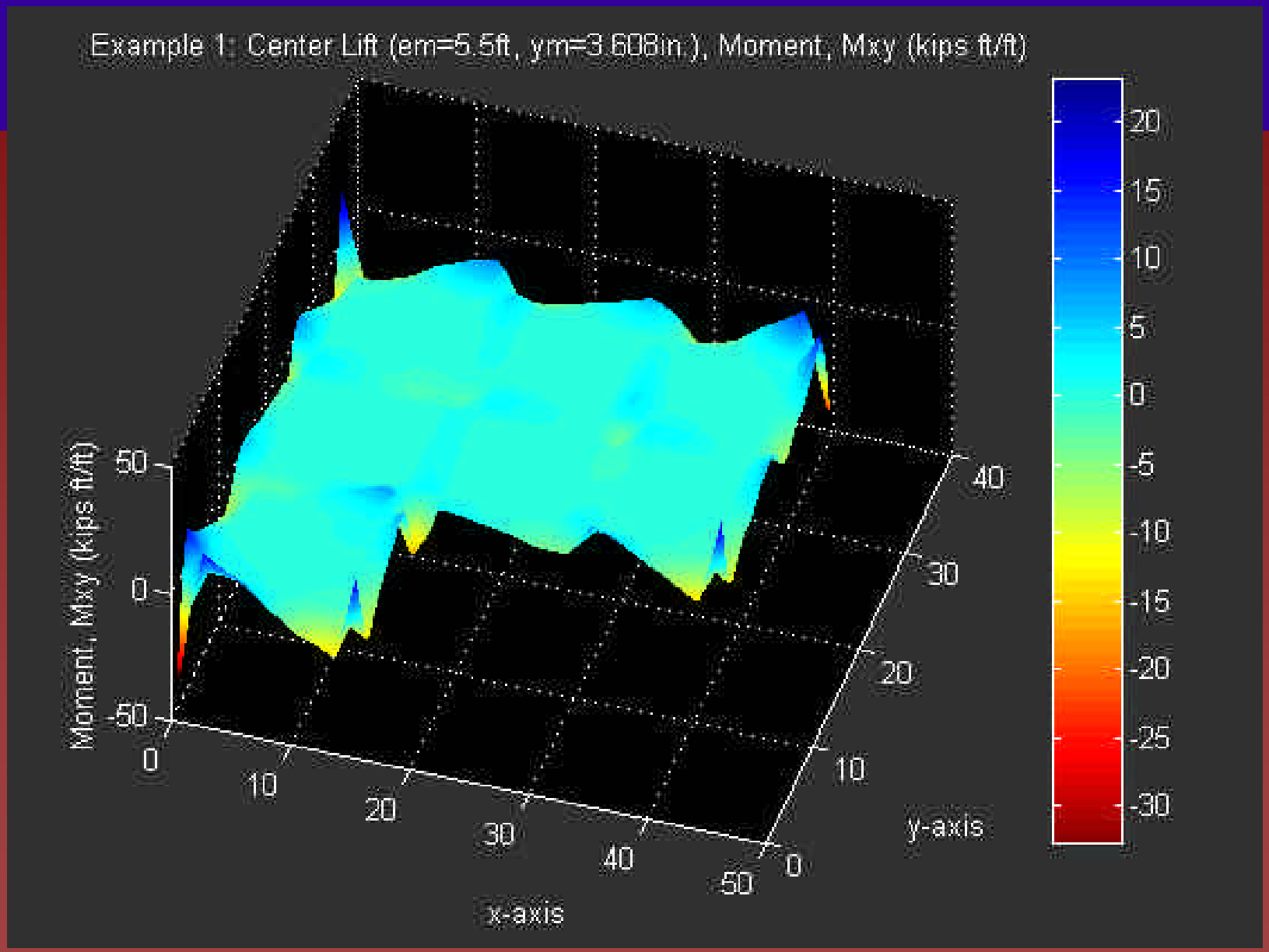

Example 1: Center Lift (em=5.5ft, ym=3.608in.), Moment, My (kips ft/ft)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
0
-20
-40
-60
-80
-100
-120
-140

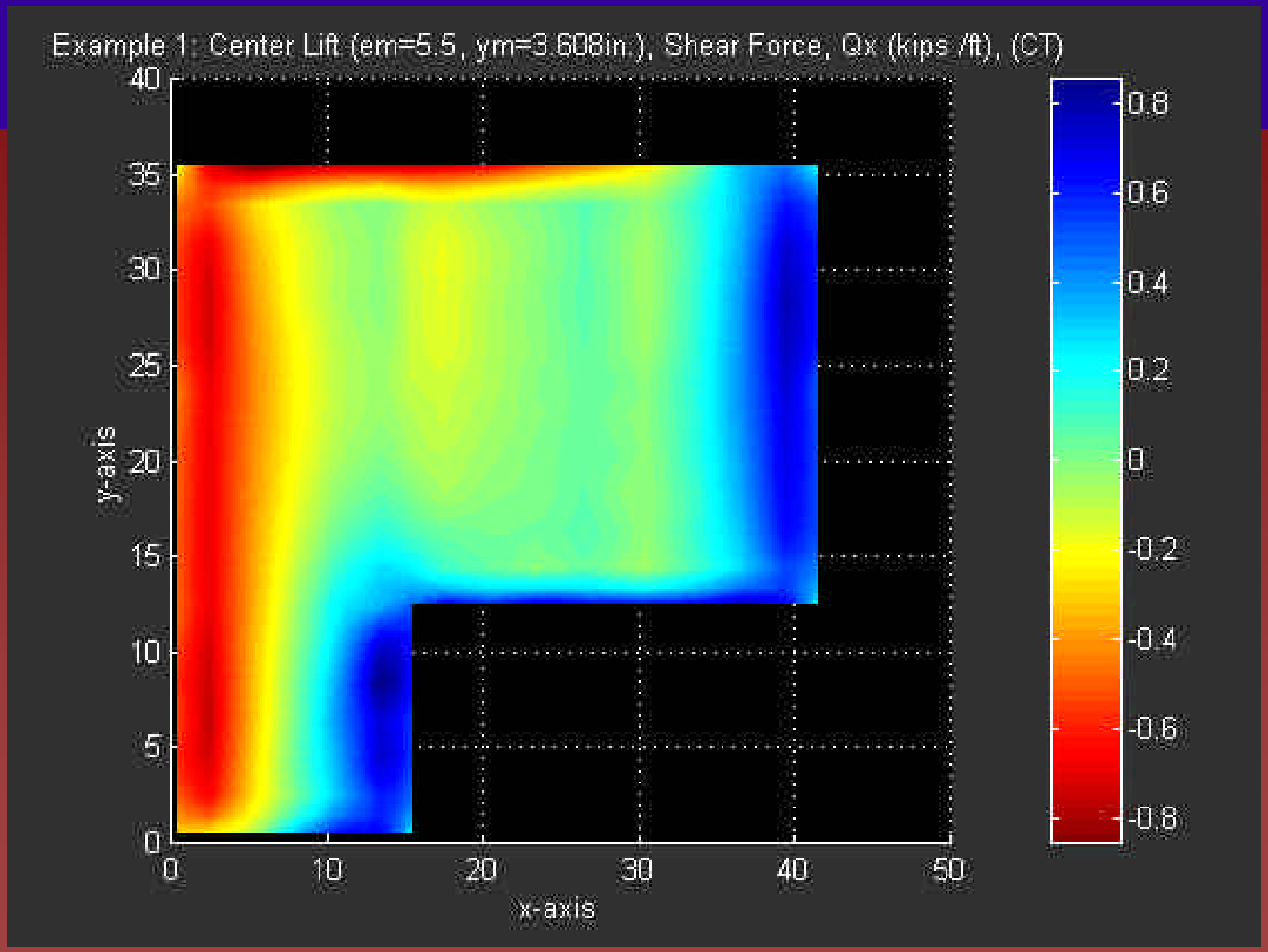

Example 1: Center Lift (em=5.5ft, ym=3.608in.), Moment, My (kips ft/ft)
Moment, My (kips ft/ft)
50
0
-50
-100
-150
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
0
-20
-40
-60
-80
-100
-120
-140

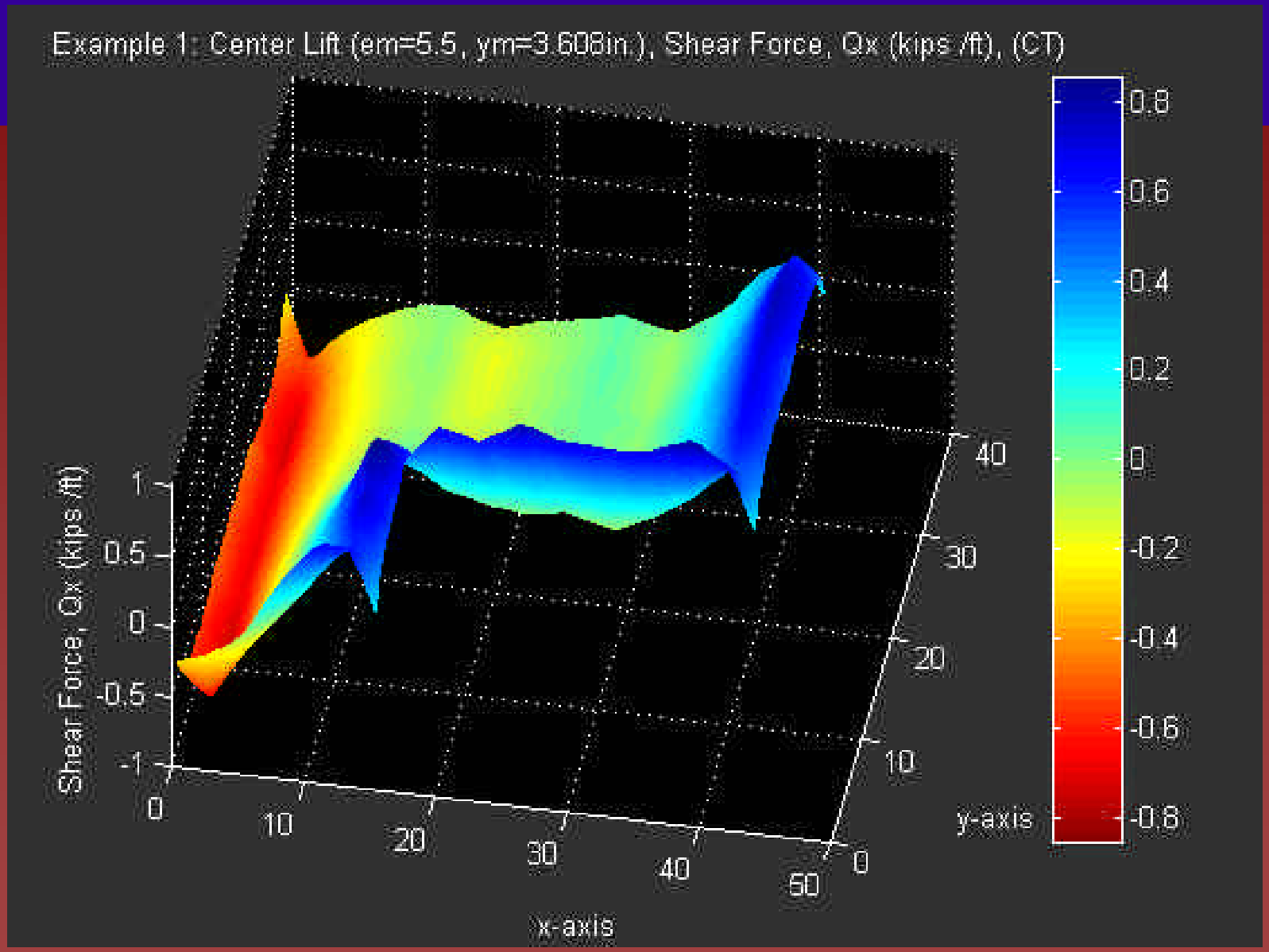

Example 1: Center Lift (em=5.5, ym=3.608in.), Moment, Mxy (kips ft/ft), (CT)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
0.8
0.6
0.4
0.2
0
-0.2
-0.4

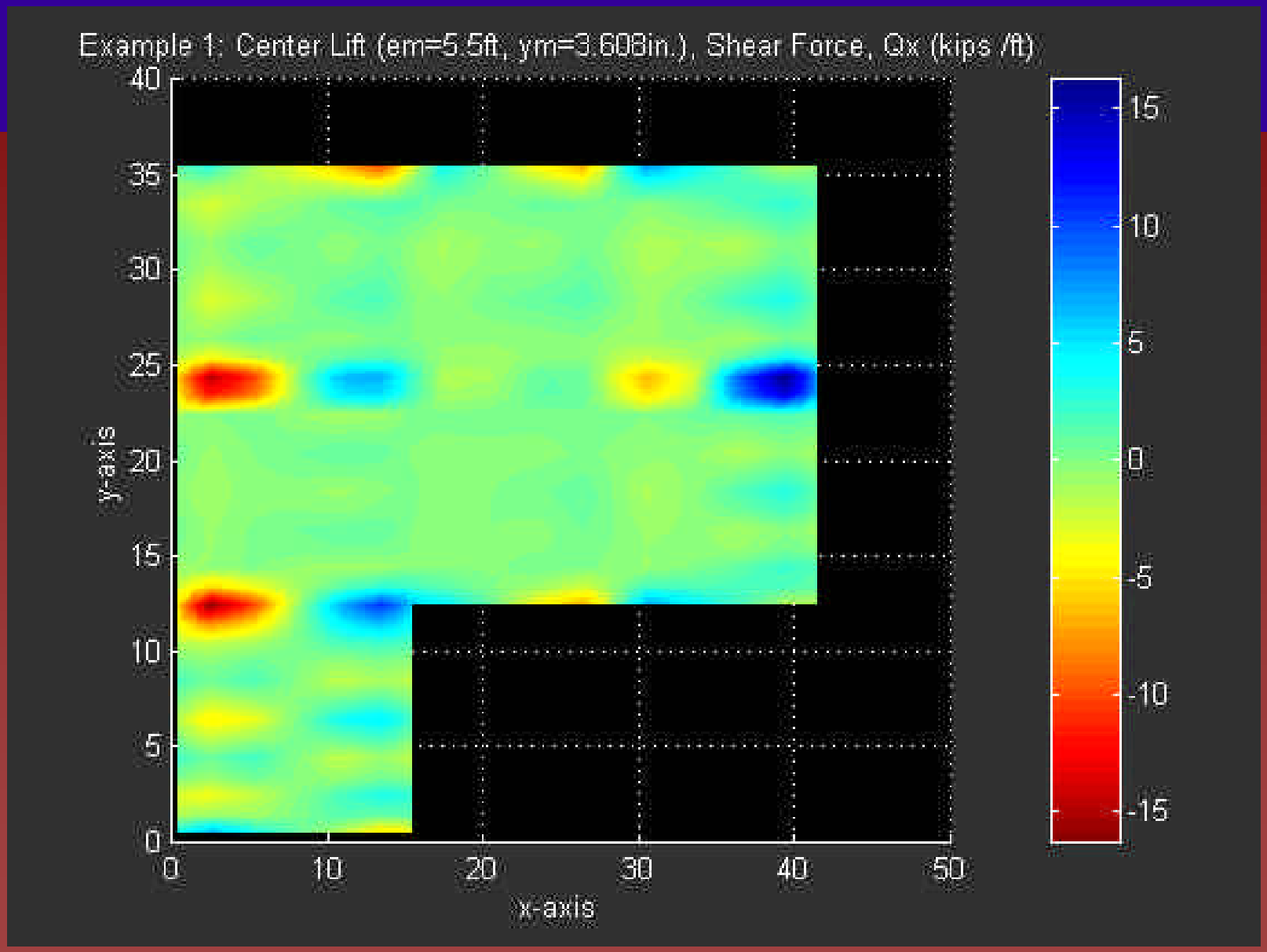

Example 1: Center Lift (em=5.5, ym=3.608in.), Moment, Mxy (kips ft/ft), (CT)
Moment, Mxy (kips ft/ft)
1
0.5
0
-0.5
-1
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
0.8
0.6
0.4
0.2
0
-0.2
-0.4

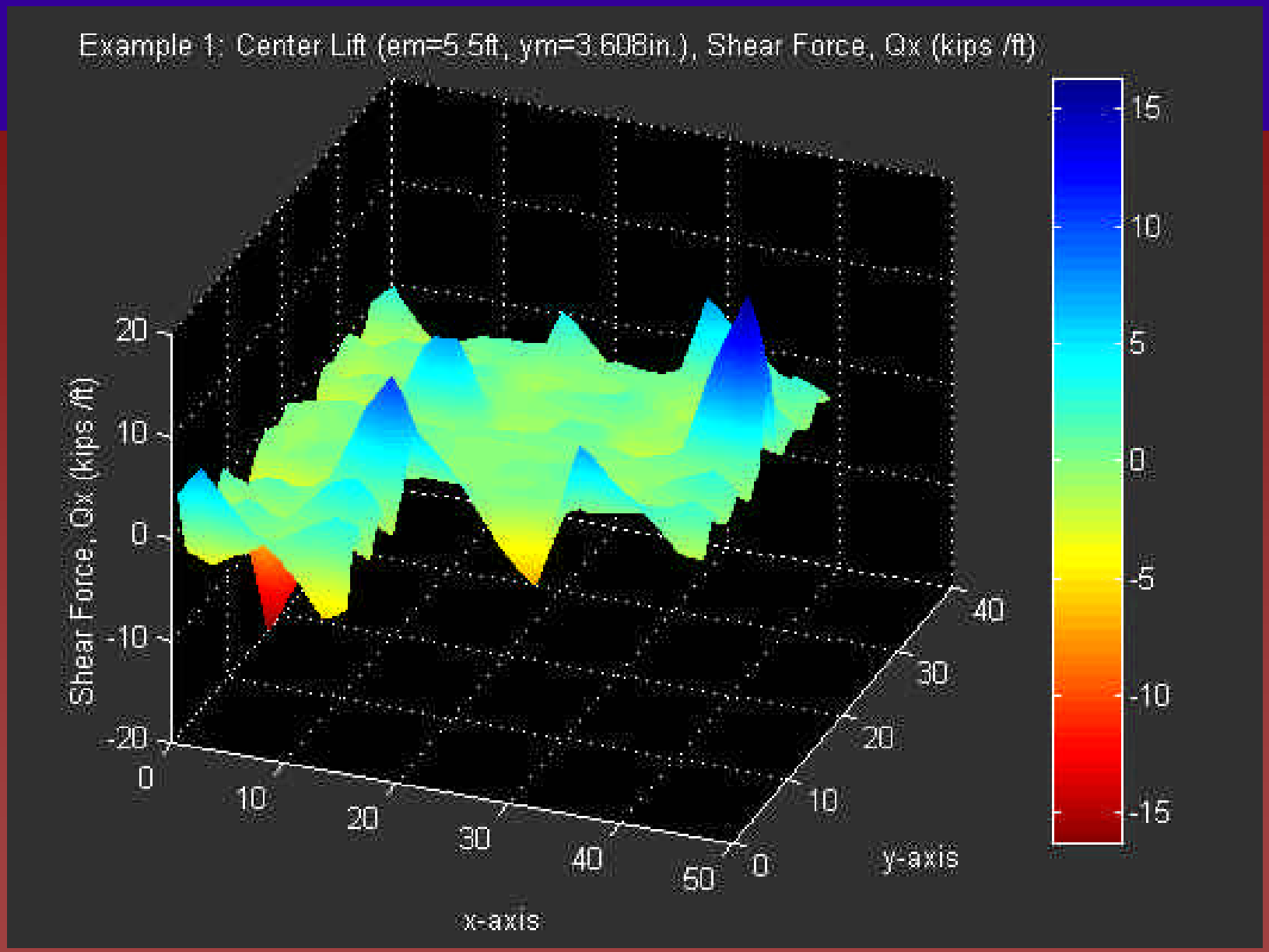

Example 1: Center Lift (em=5.5ft, ym=3.608in.), Moment, Mxy (kips ft/ft)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
20
15
10
5
0
-5
-10
-15
-20
-25
-30

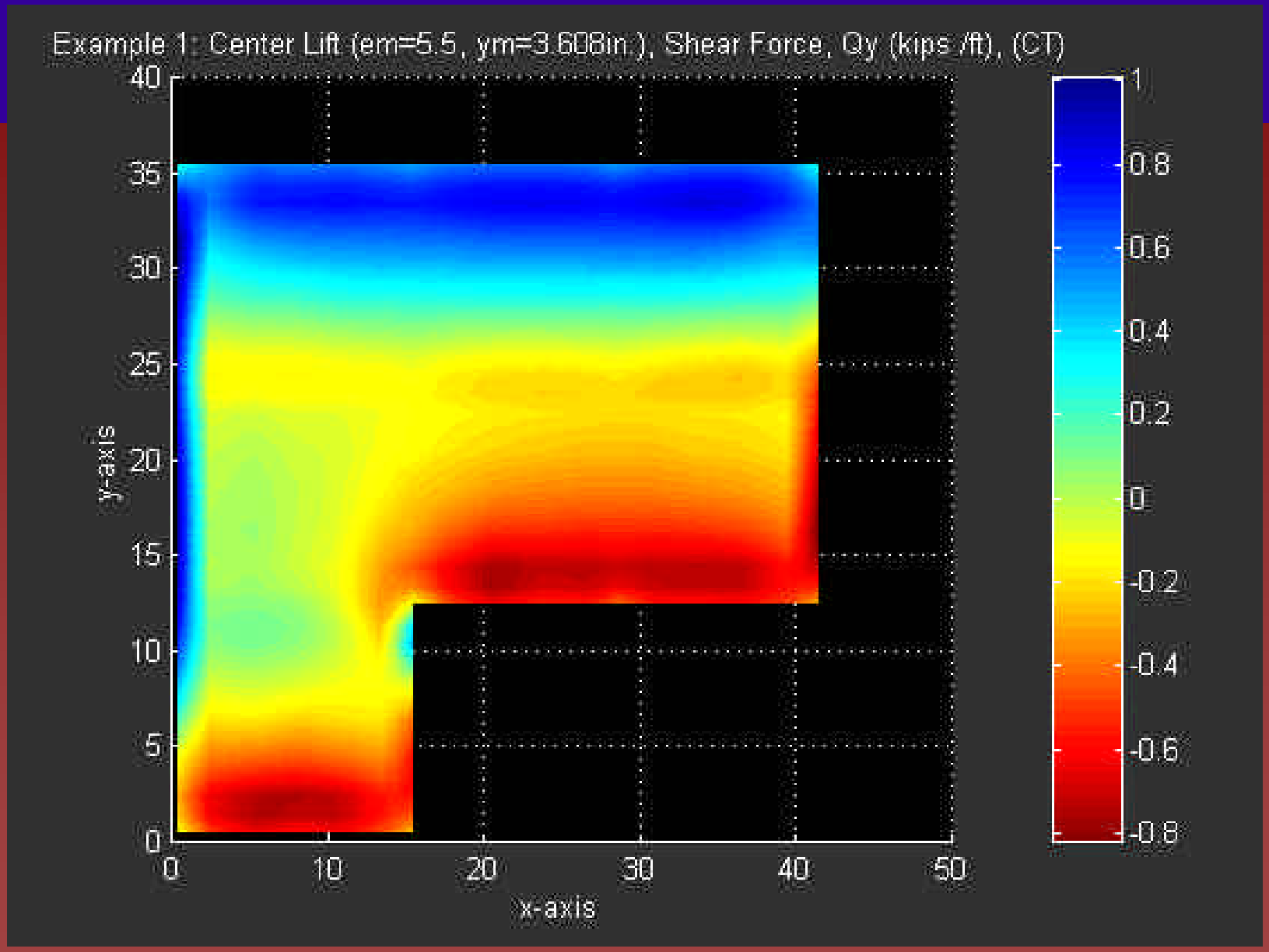

Example 1: Center Lift (em=5.5ft, ym=3.608in.), Moment, Mxy (kips ft/ft)
Moment, Mxy (kips ft/ft)
50
0
-50
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
20
15
10
5
0
-5
-10
-15
-20
-25
-30

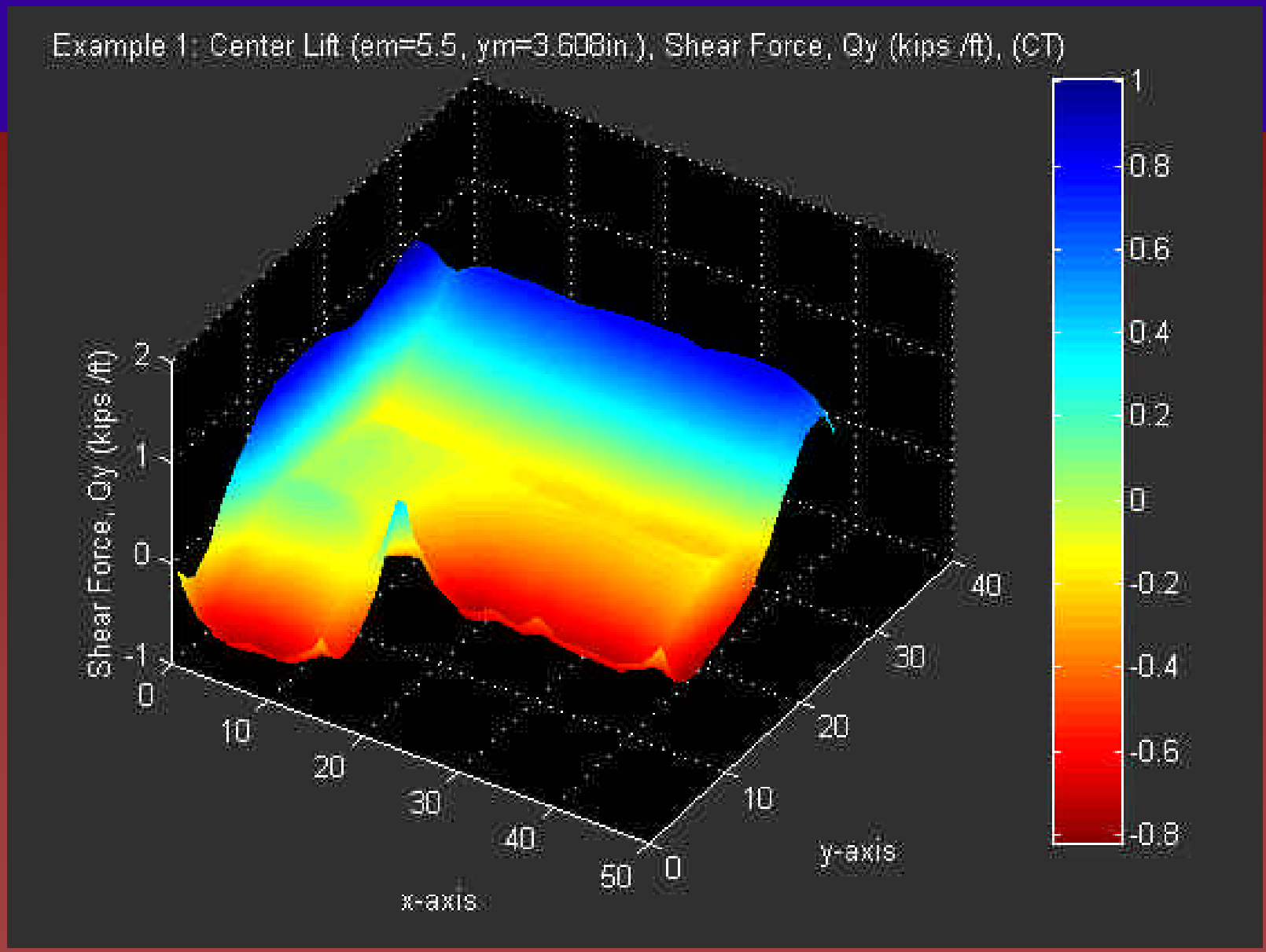

Example 1: Center Lift (em=5.5, ym=3.608in.), Shear Force, Qx (kips /ft), (CT)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8

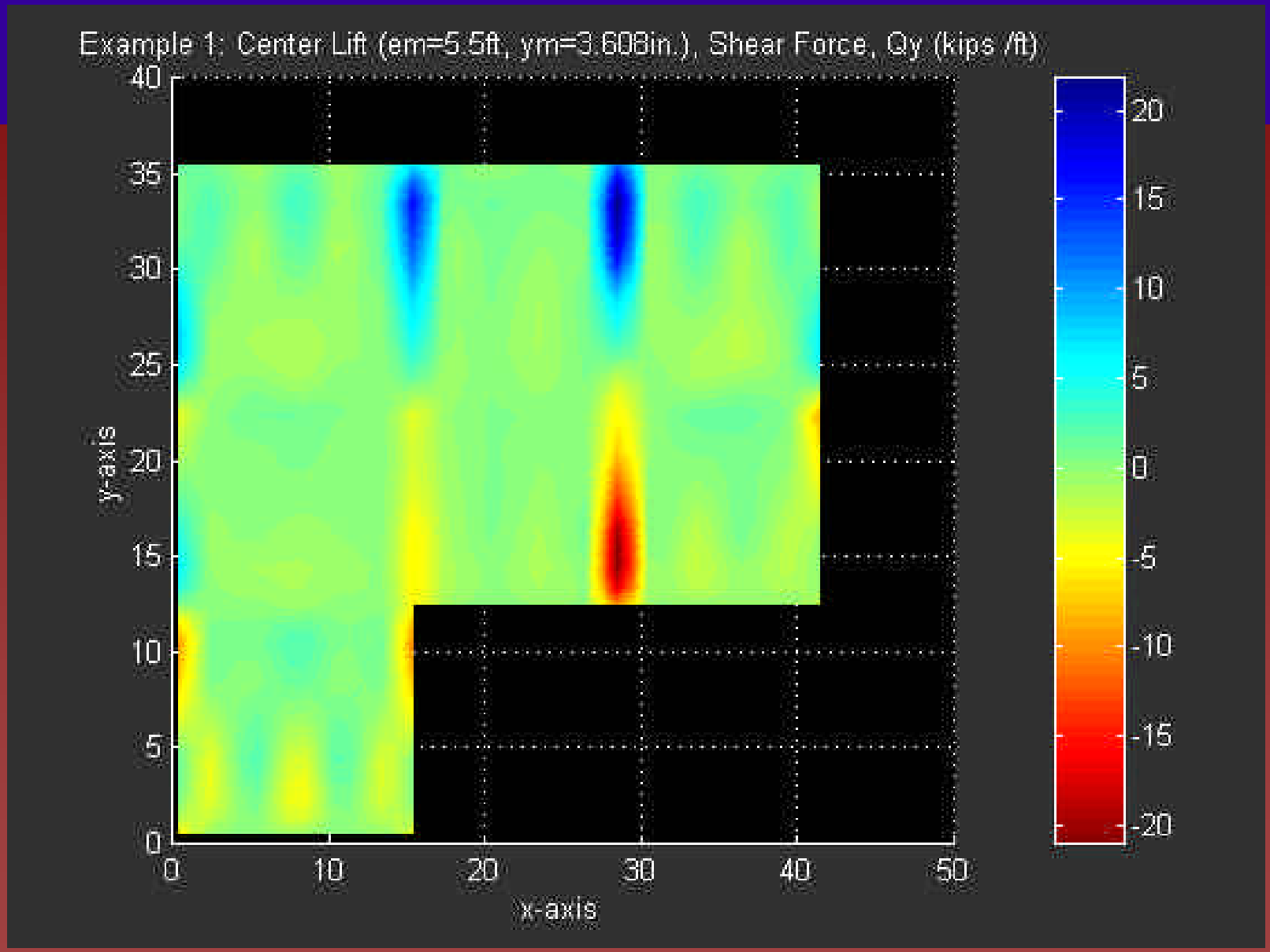

Example 1: Center Lift (em=5.5, ym=3.608in.), Shear Force, Qx (kips /ft), (CT)
Shear Force, Qx (kips /ft)
1
0.5
0
-0.5
-1
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8

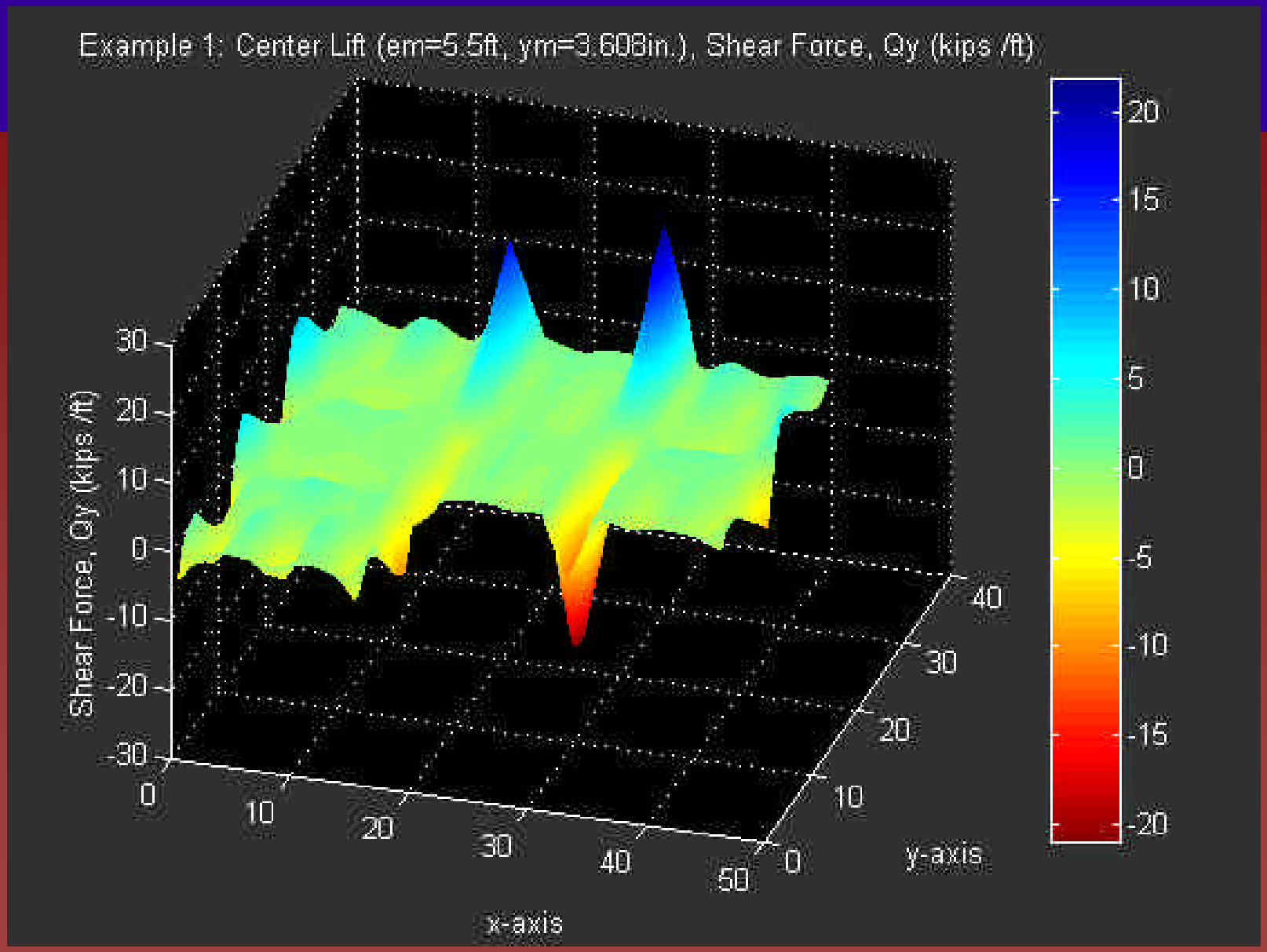

Example 1: Center Lift (em=5.5ft, ym=3.608in.), Shear Force, Qx (kips /ft)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
15
10
5
0
-5
-10
-15

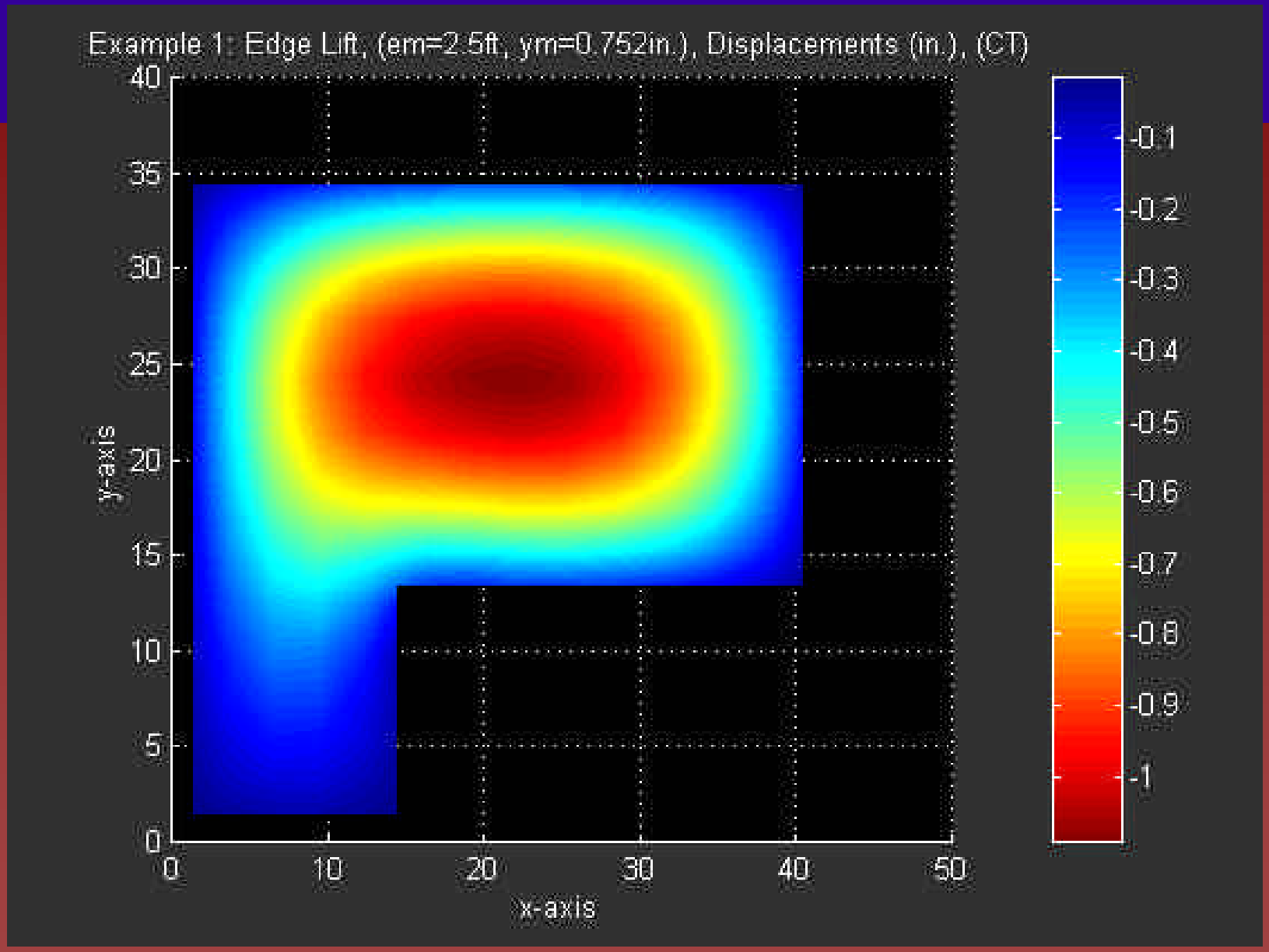

Example 1: Center Lift (em=5.5ft, ym=3.608in.), Shear Force, Qx (kips /ft)
Shear Force, Qx (kips /ft)
20
10
0
-10
-20
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
15
10
5
0
-5
-10
-15

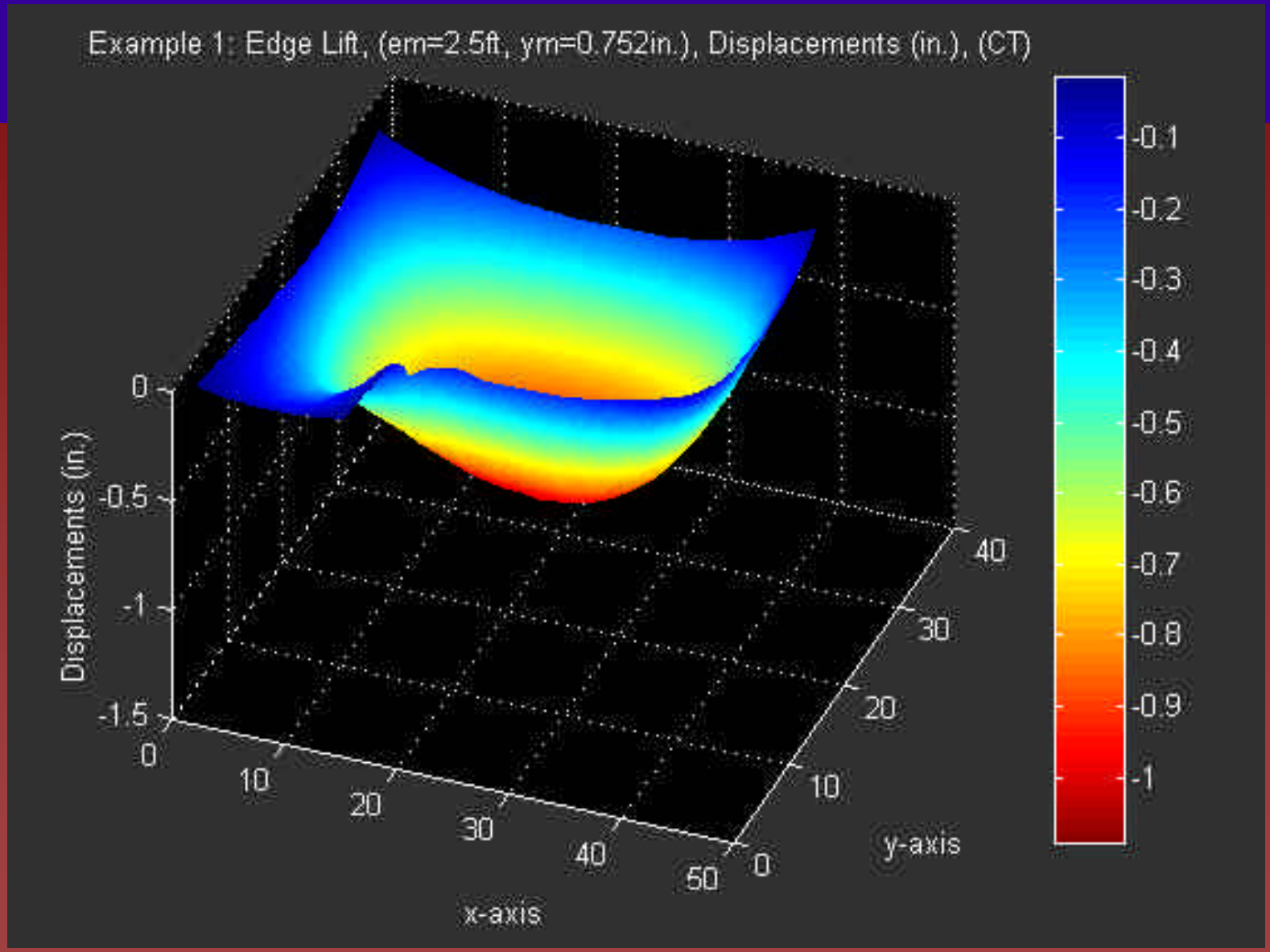

Example 1: Center Lift (em=5.5, ym=3.608in.), Shear Force, Qy (kips/ft), (CT)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8

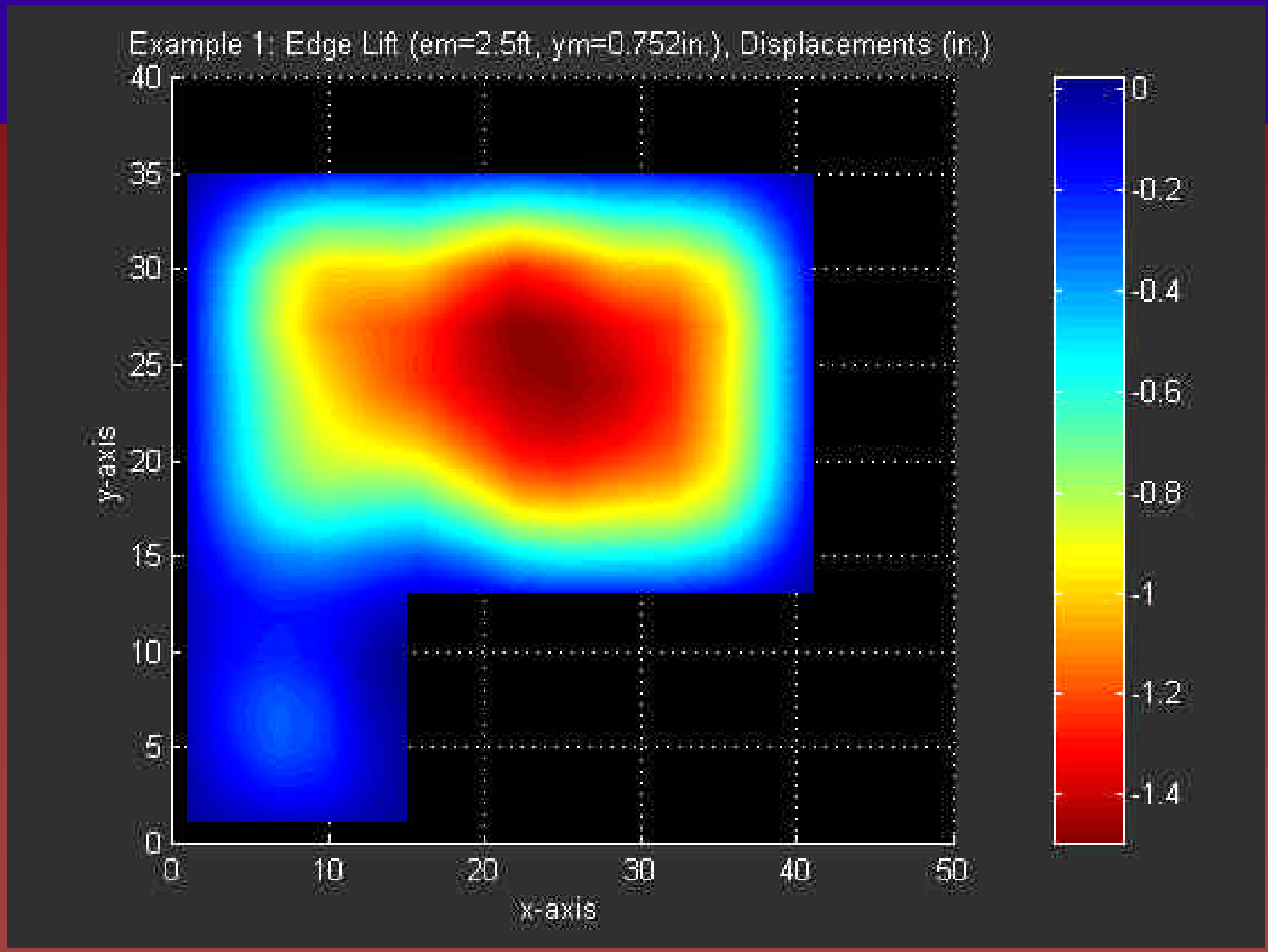

Example 1: Center Lift (em=5.5, ym=3.608in.), Shear Force, Qy (kips /ft), (CT)
Shear Force, Qy (kips /ft)
2
1
0
-1
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8

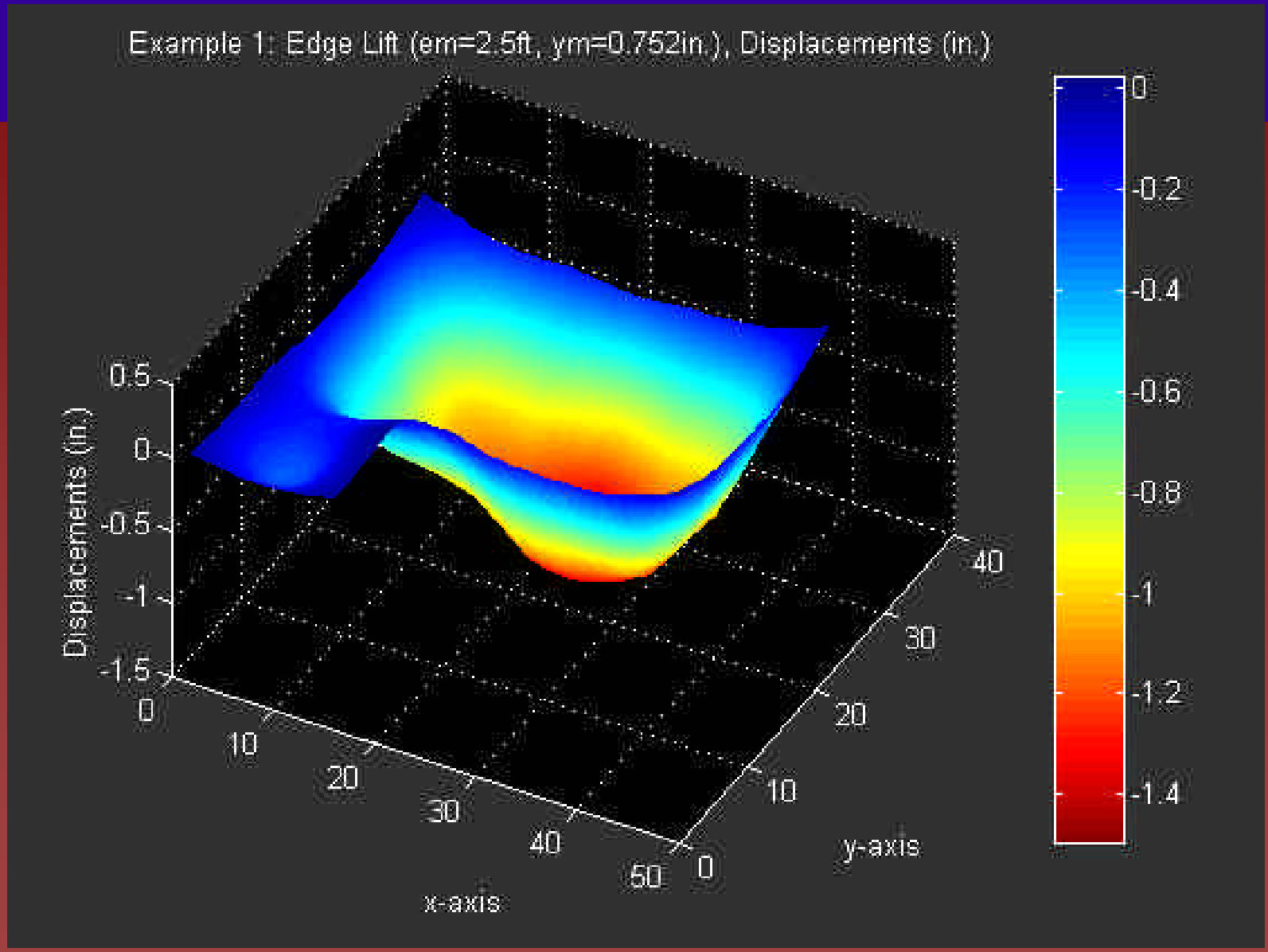

Example 1: Center Lift (em=5.5ft, ym=3.60Bin.), Shear Force, Qy (kips /ft)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
20
15
10
5
0
-5
-10
-15
-20

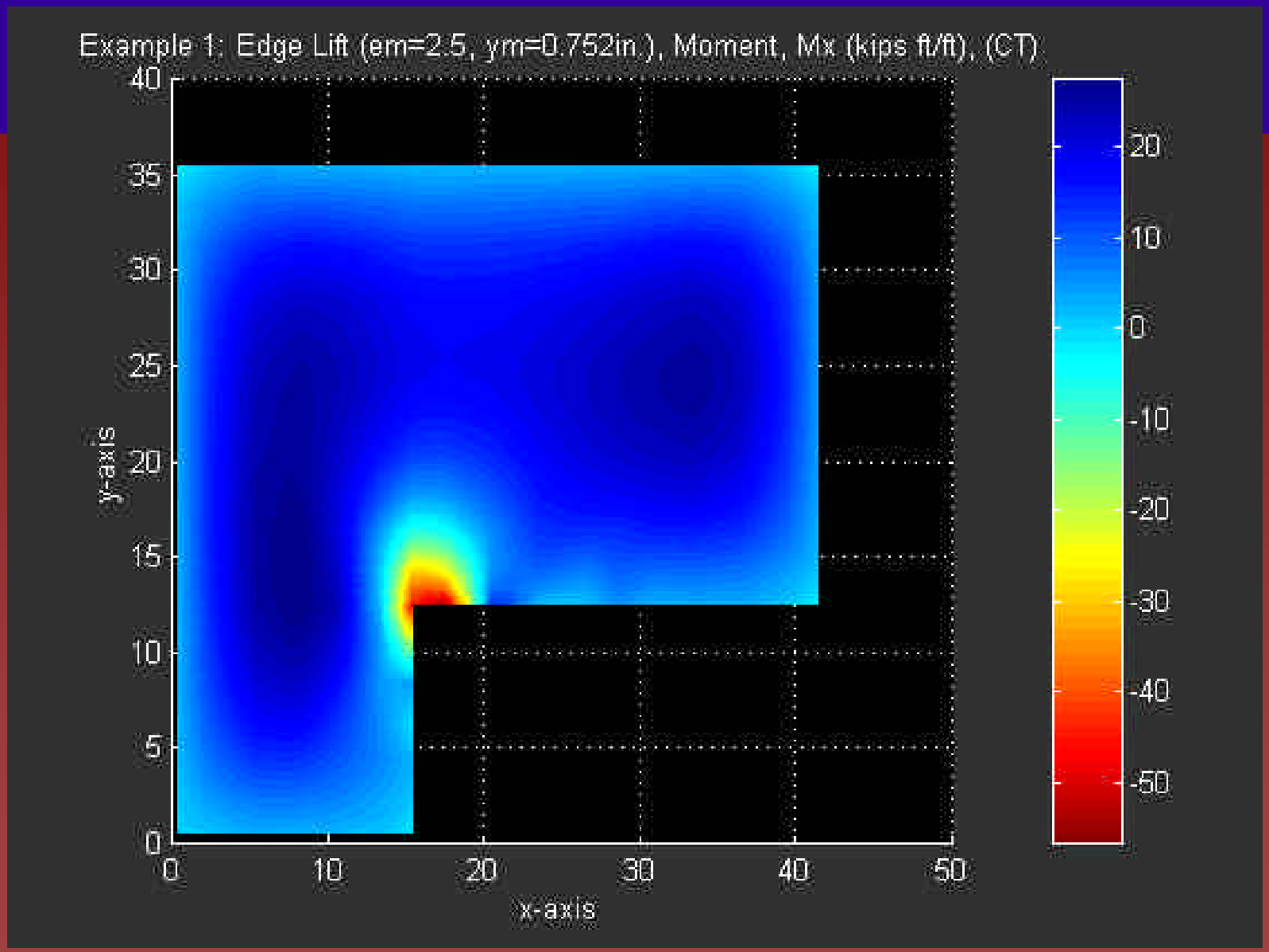

Example 1: Center Lift (em=5.5ft, ym=3.608in.), Shear Force, Qy (kips /ft)
Shear Force, Qy (kips /ft)
30
20
10
0
-10
-20
-30
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
20
15
10
5
0
-5
-10
-15
-20

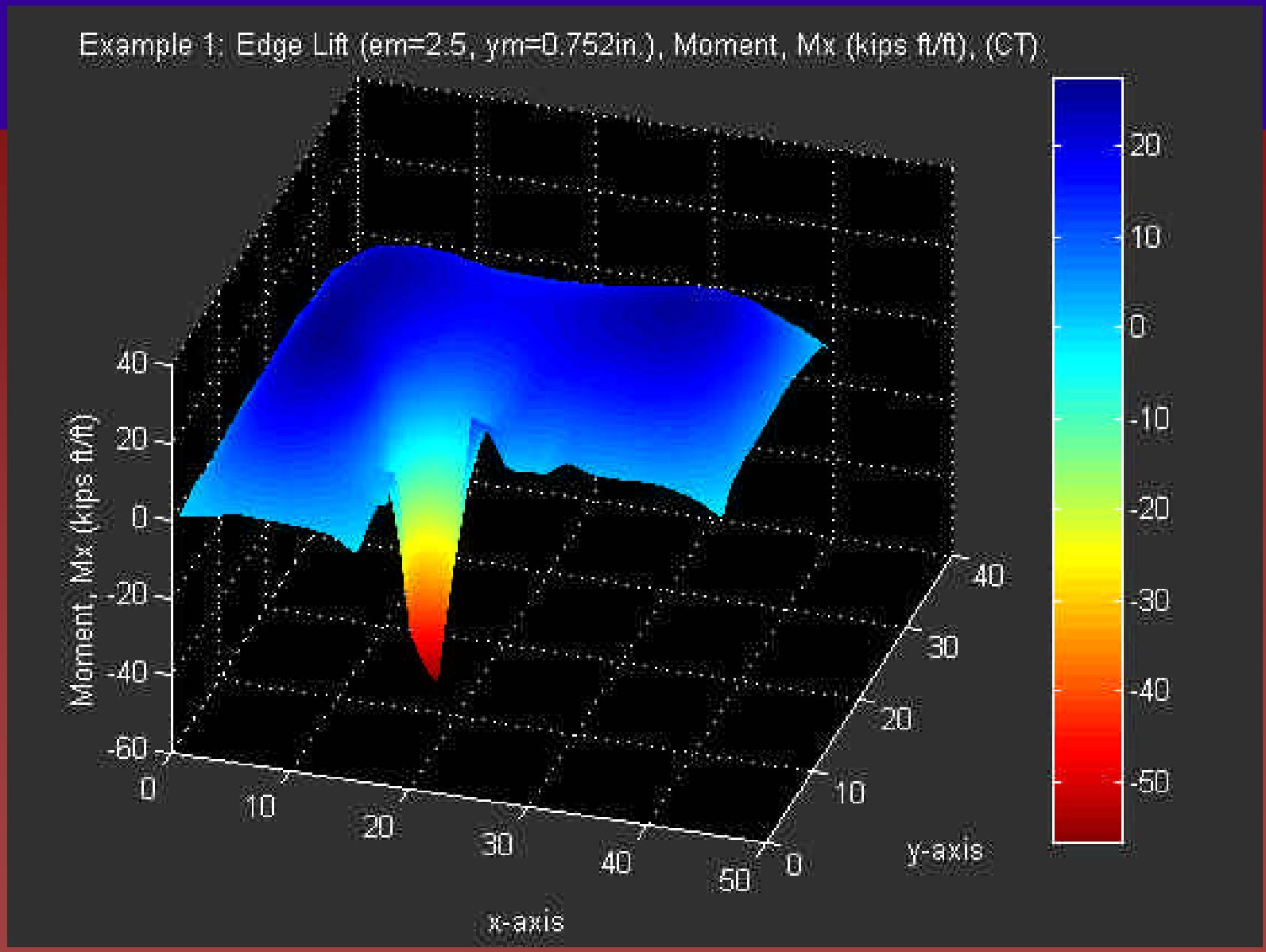

Example 1: Edge Lift, (em=2.5ft, ym=0.752in.), Displacements (in.), (CT)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1

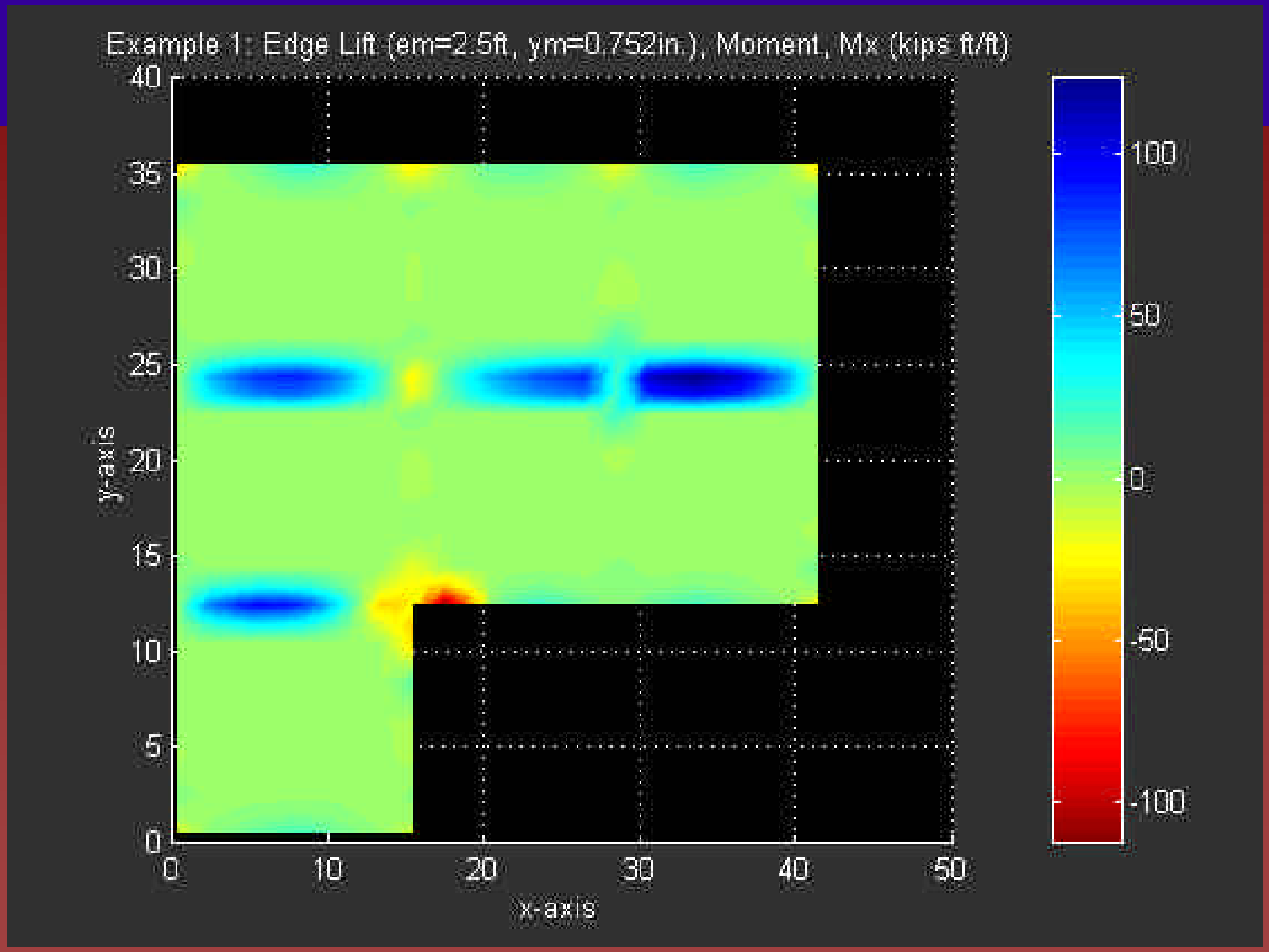

Example 1: Edge Lift, (em=2.5ft, ym=0.752in.), Displacements (in.), (CT)
Displacements (in.)
0
-0.5
-1
-1.5
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1

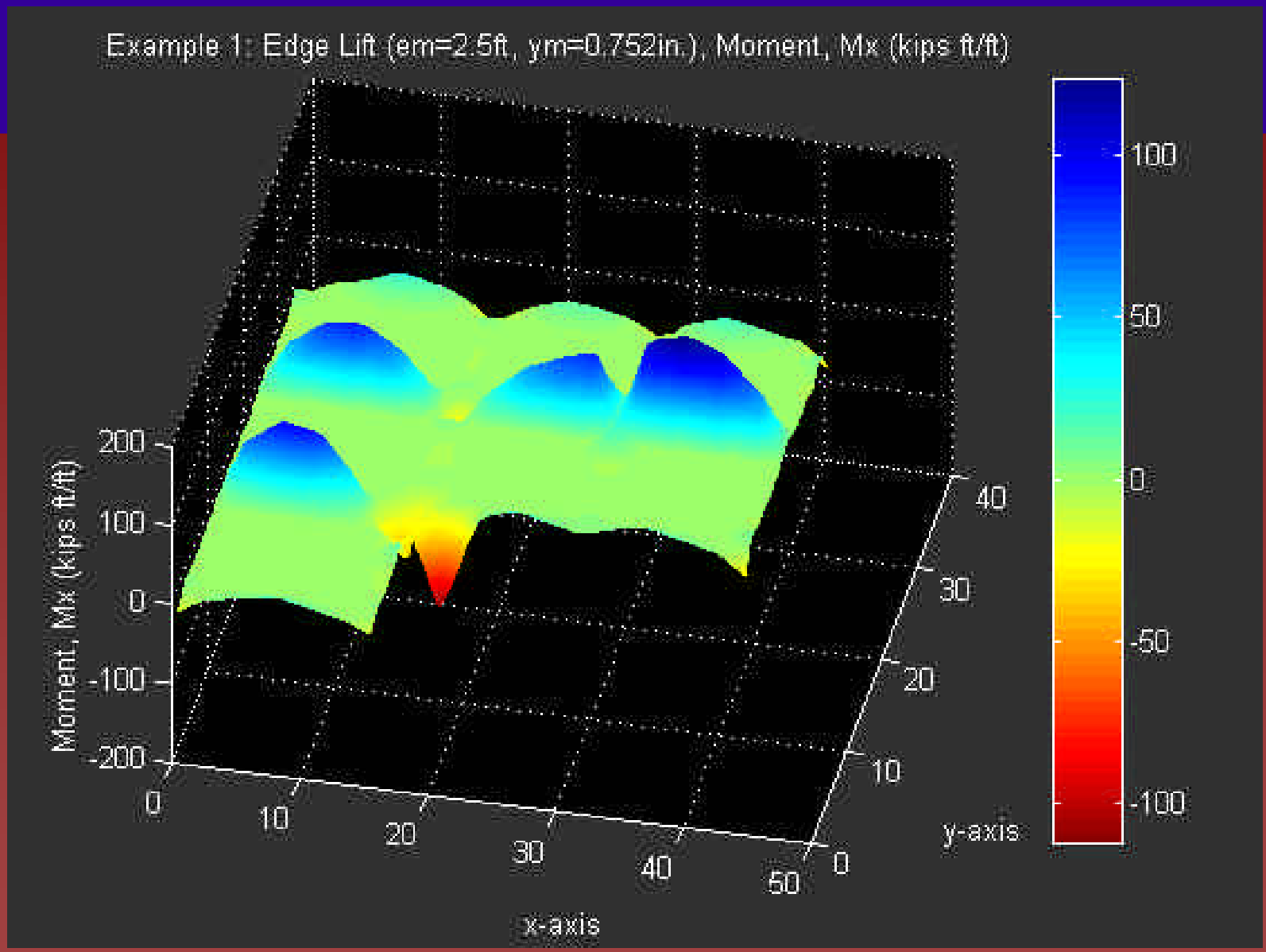

Example 1: Edge Lift (em=2.5ft, ym=0.752in.), Displacements (in.)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4

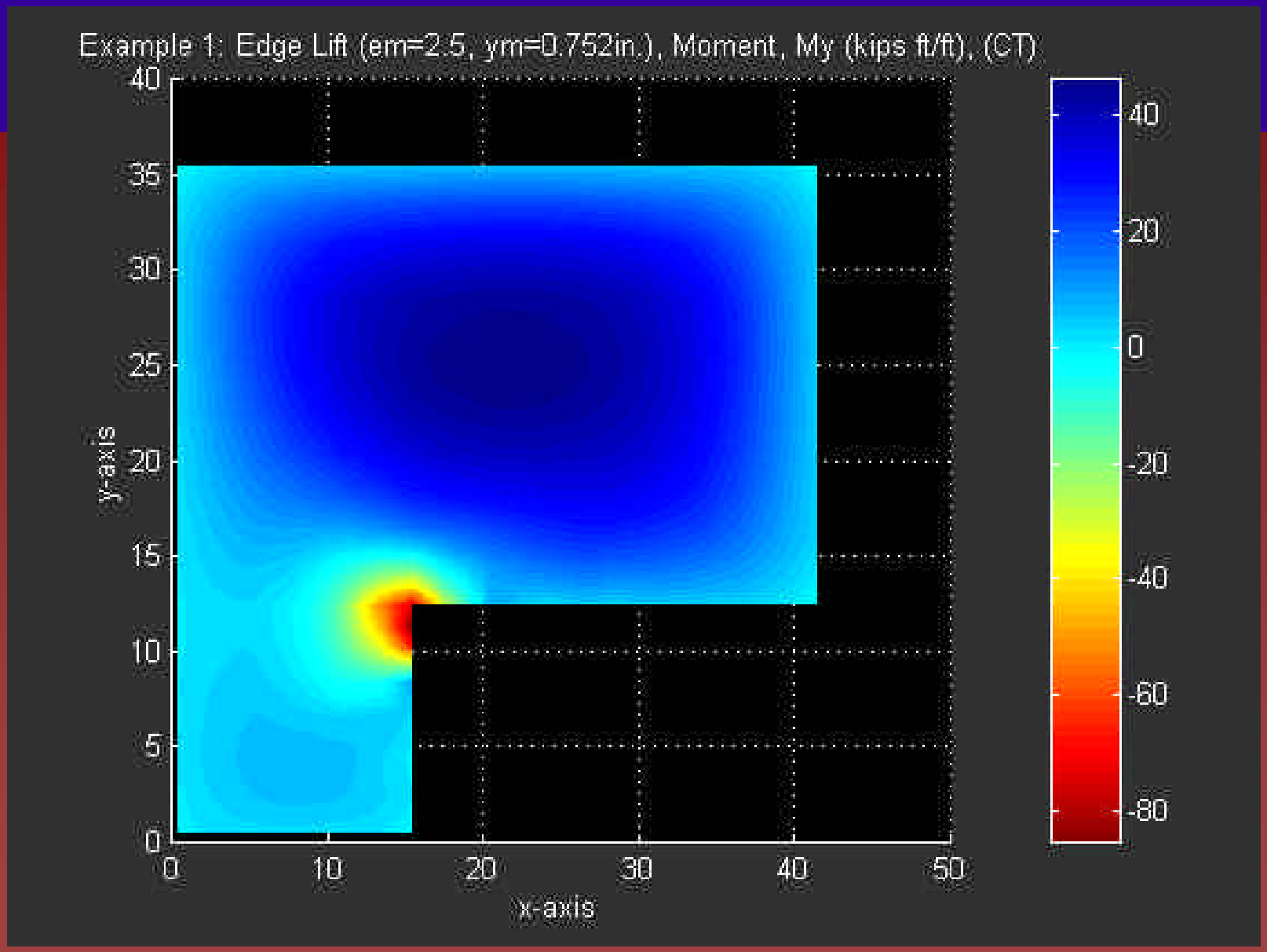

Example 1: Edge Lift (em=2.5ft, ym=0.752in.), Displacements (in.)
Displacements (in.)
0.5
0
-0.5
-1
-1.5
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4

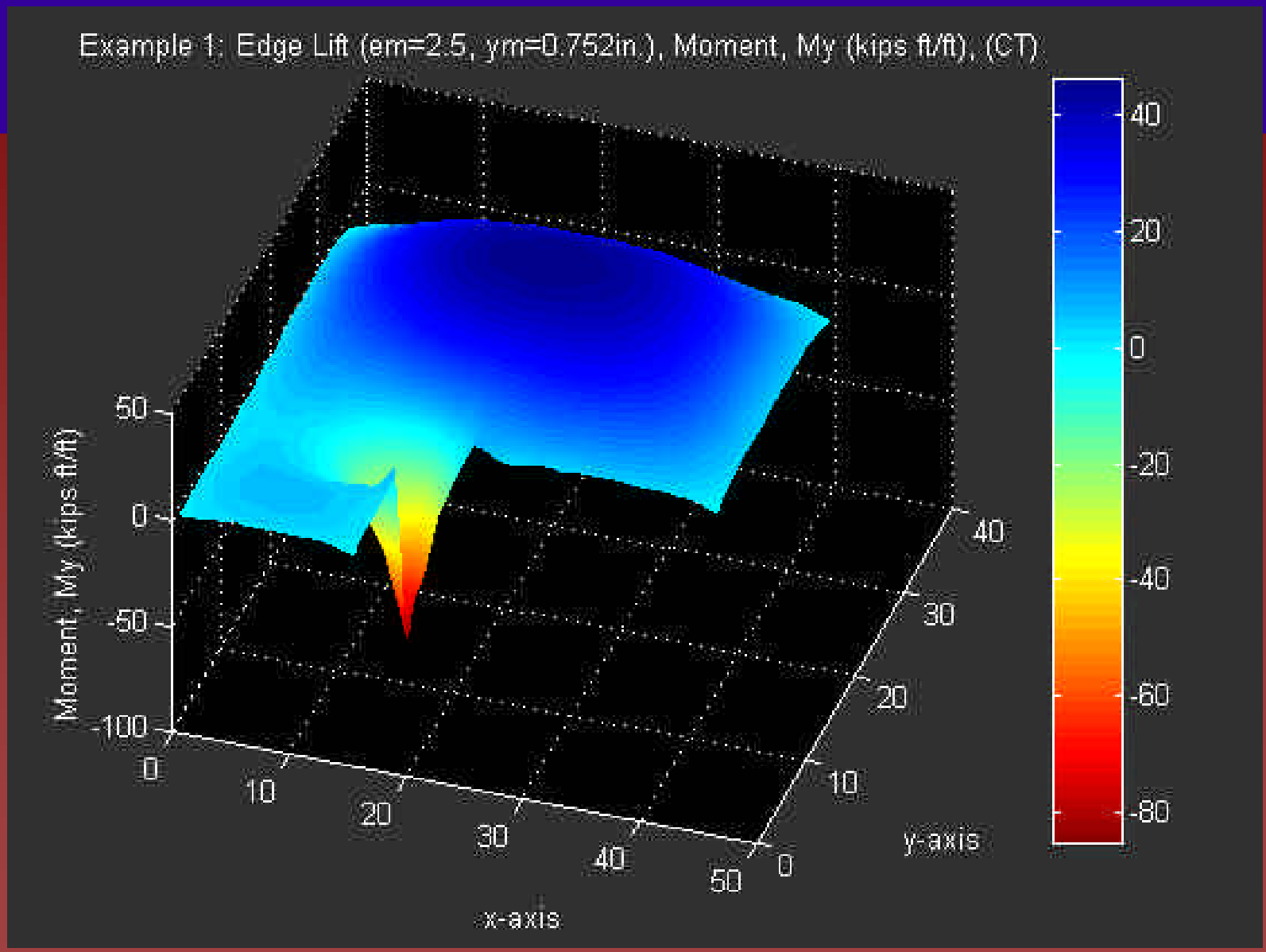

Example 1: Edge Lift (em=2.5, ym=0.752in.), Moment, Mx (kips ft/ft), (CT)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
20
10
0
-10
-20
-30
-40
-50

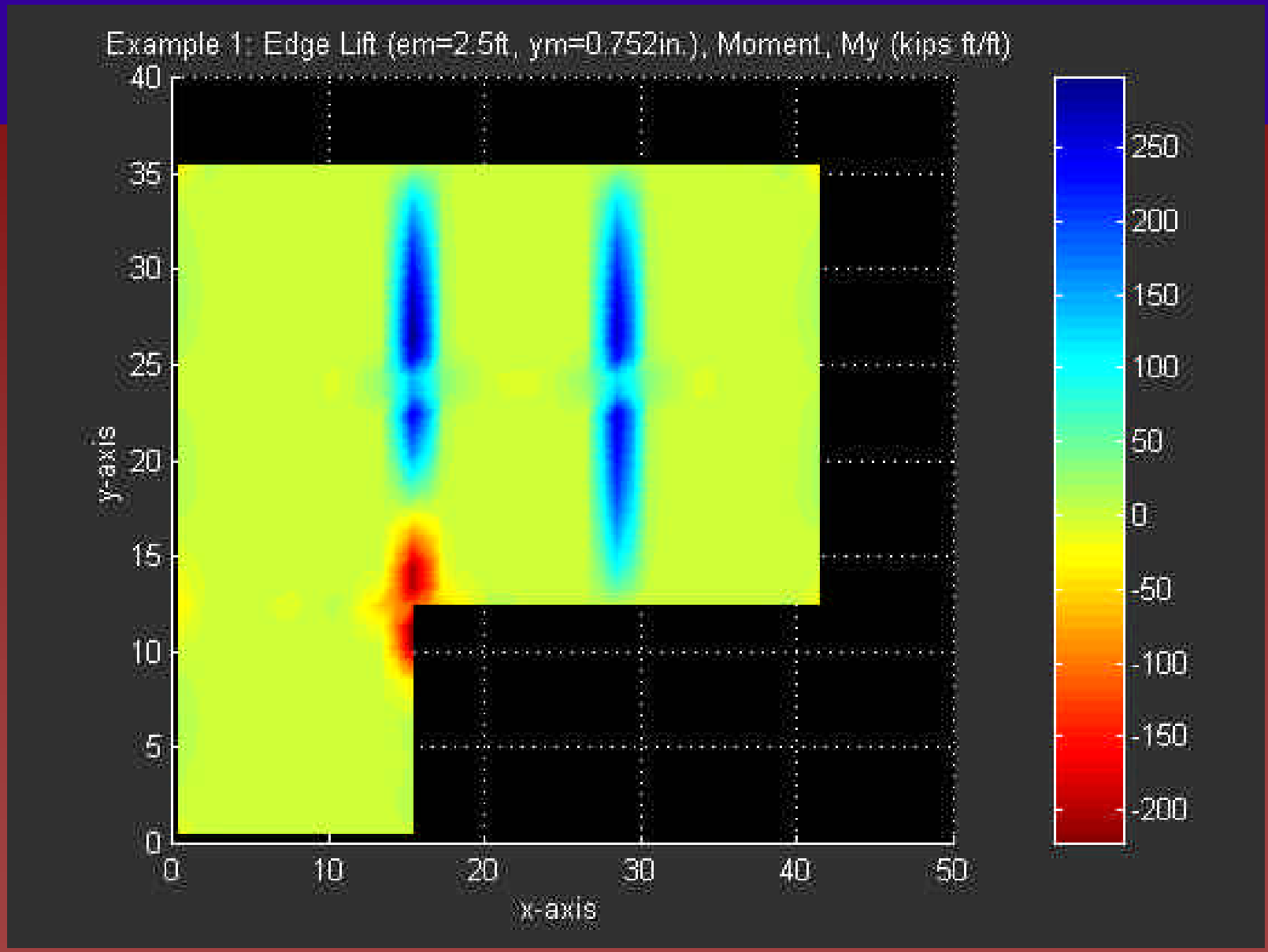

Example 1: Edge Lift (em=2.5, ym=0.752in.), Moment, Mx (kips ft/ft), (CT)
Moment, Mx (kips ft/ft)
40
20
0
-20
-40
-60
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
20
10
0
-10
-20
-30
-40
-50

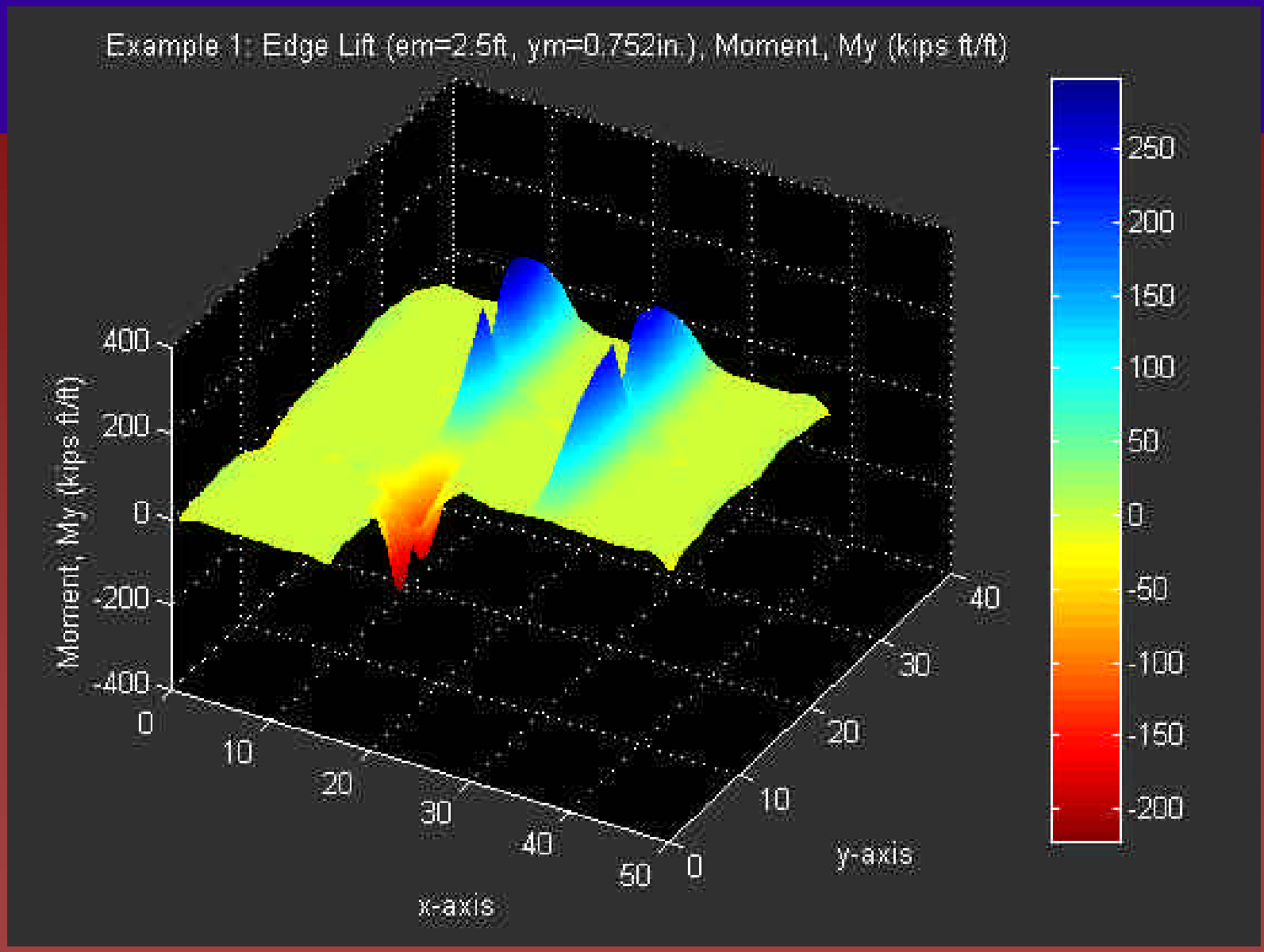

Example 1: Edge Lift (em=2.5ft, ym=0.752in.), Moment, Mx (kips ft/ft)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
100
50
0
-50
-100

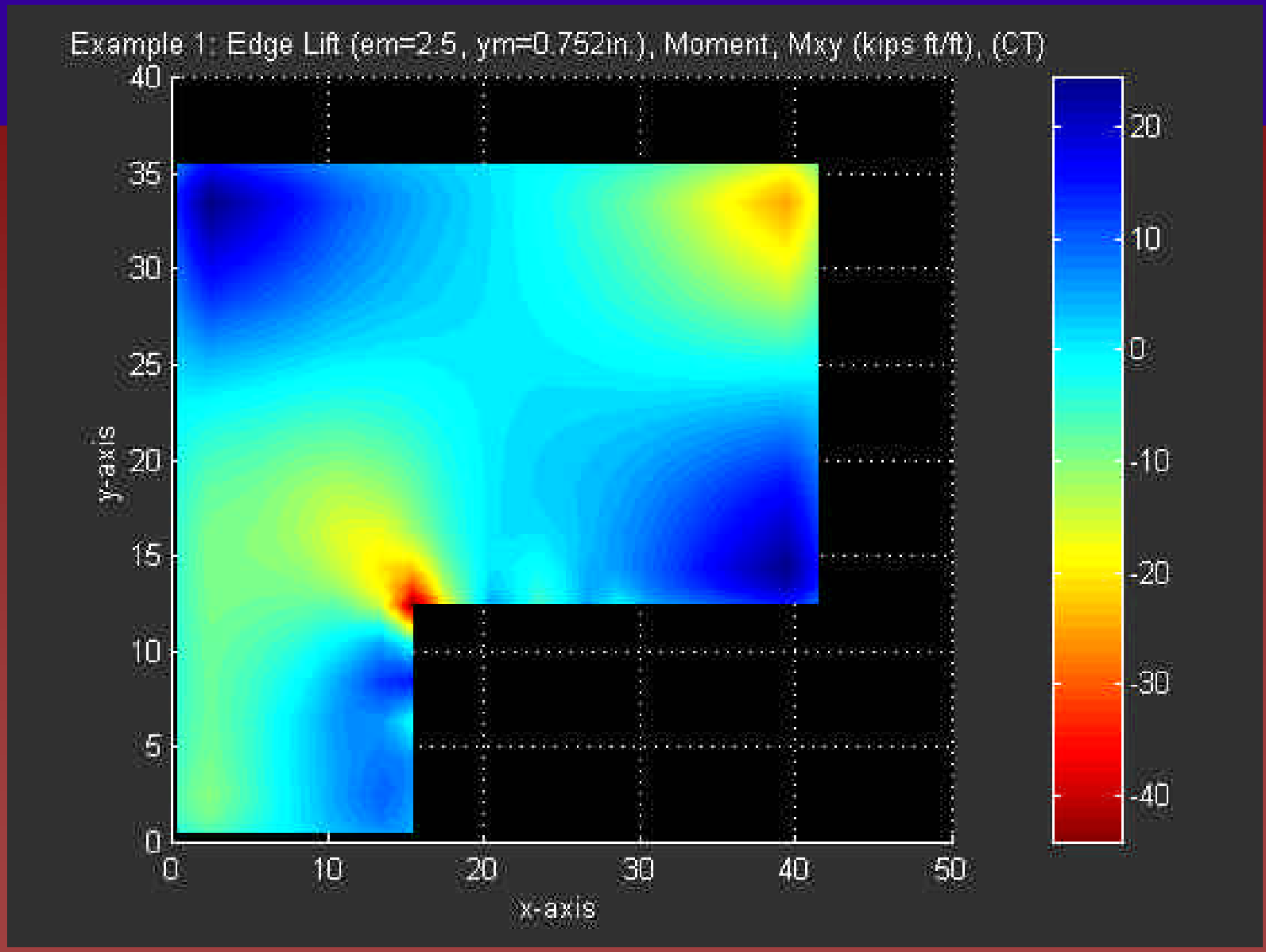

Example 1: Edge Lift (em=2.5ft, ym=0.752in.), Moment, Mx (kips ft/ft)
Moment, Mx (kips ft/ft)
200
100
0
-100
-200
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
100
50
0
-50
-100

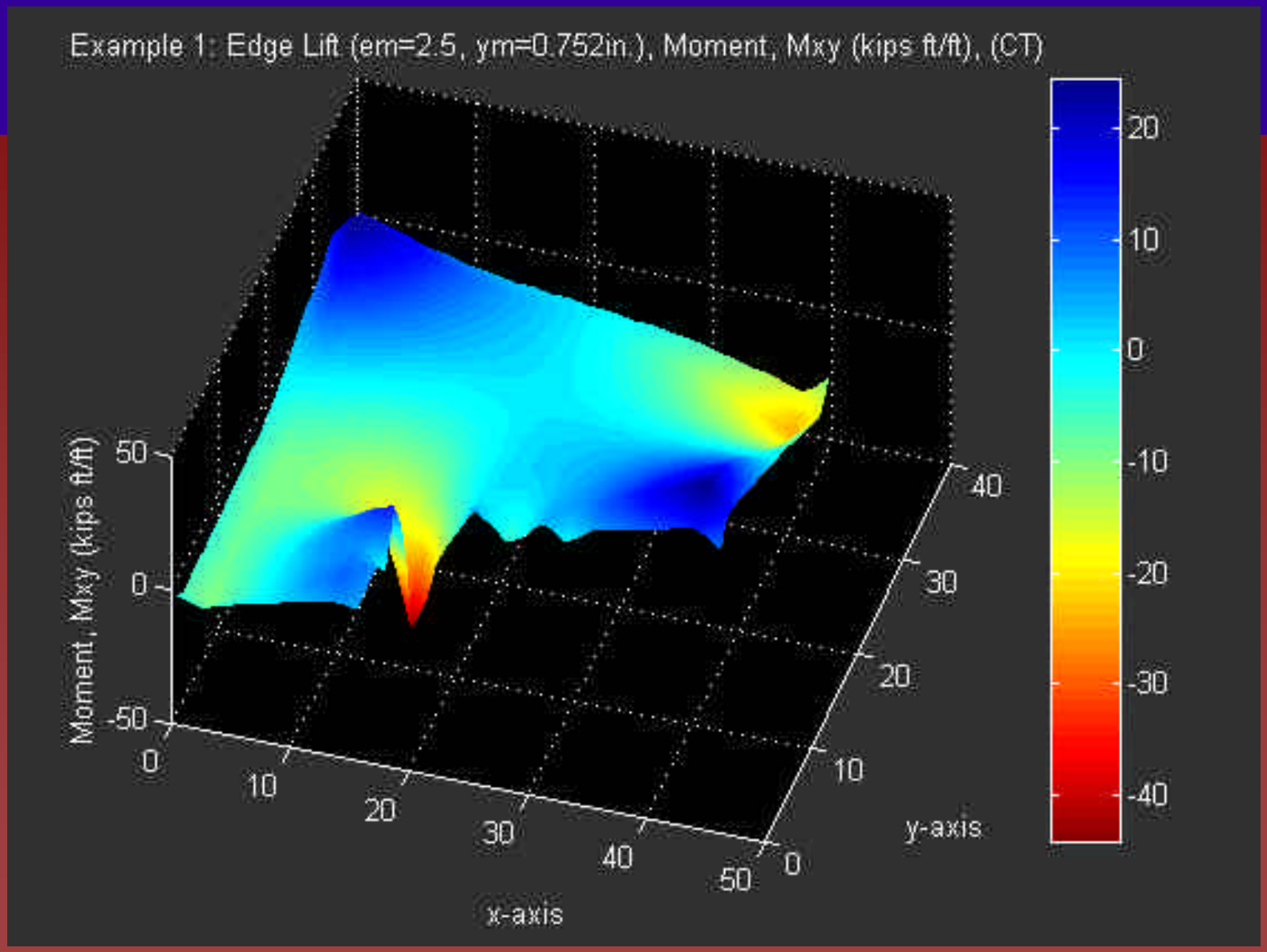

Example 1: Edge Lift (em=2.5, ym=0.752in.), Moment, My (kips ft/ft), (CT)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
40
20
0
-20
-40
-60
-80

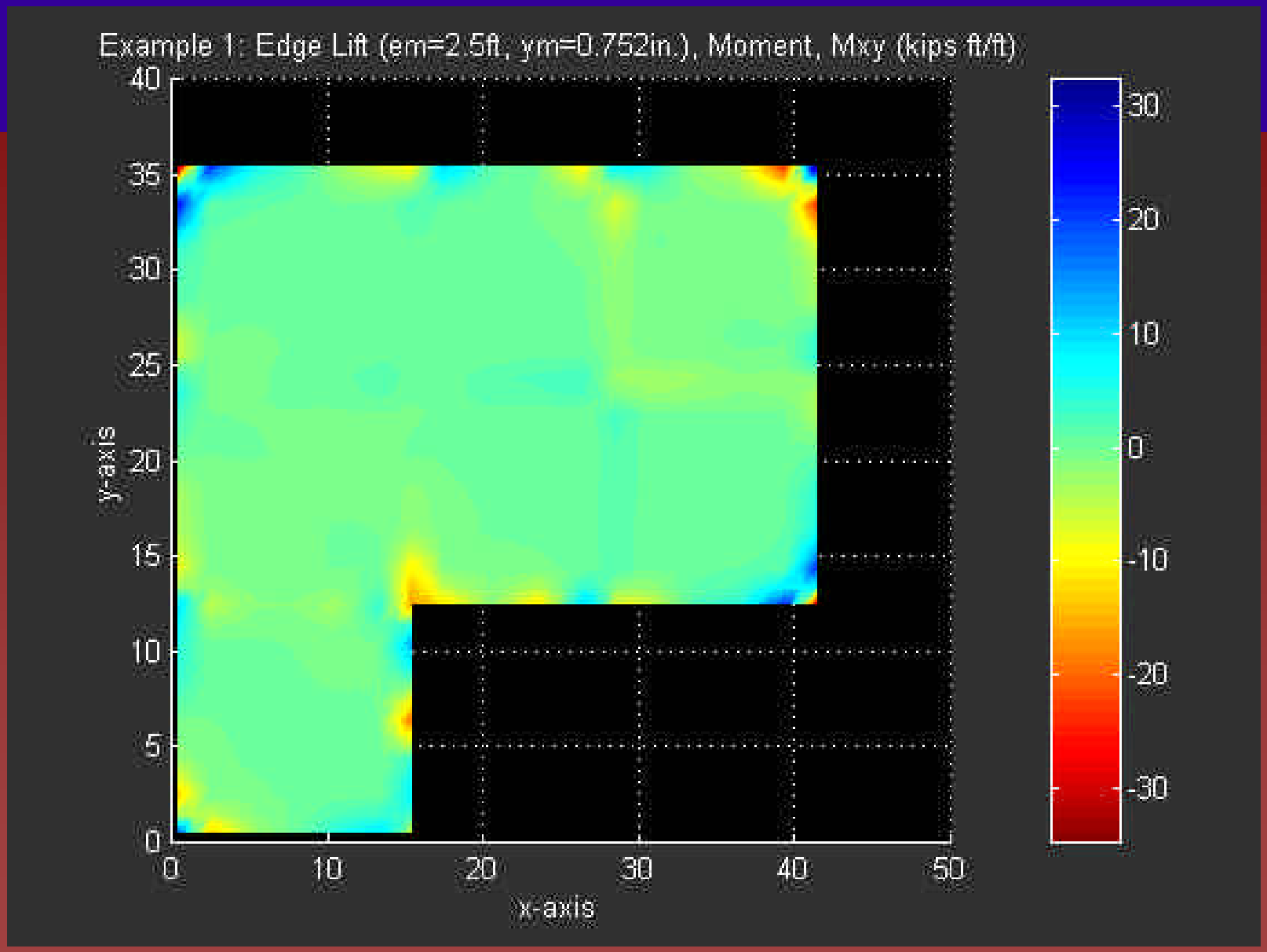

Example 1: Edge Lift (em=2.5, ym=0.752in.), Moment, My (kips ft/ft), (CT)
Moment, My (kips ft/ft)
50
0
-50
-100
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
40
20
0
-20
-40
-60
-80

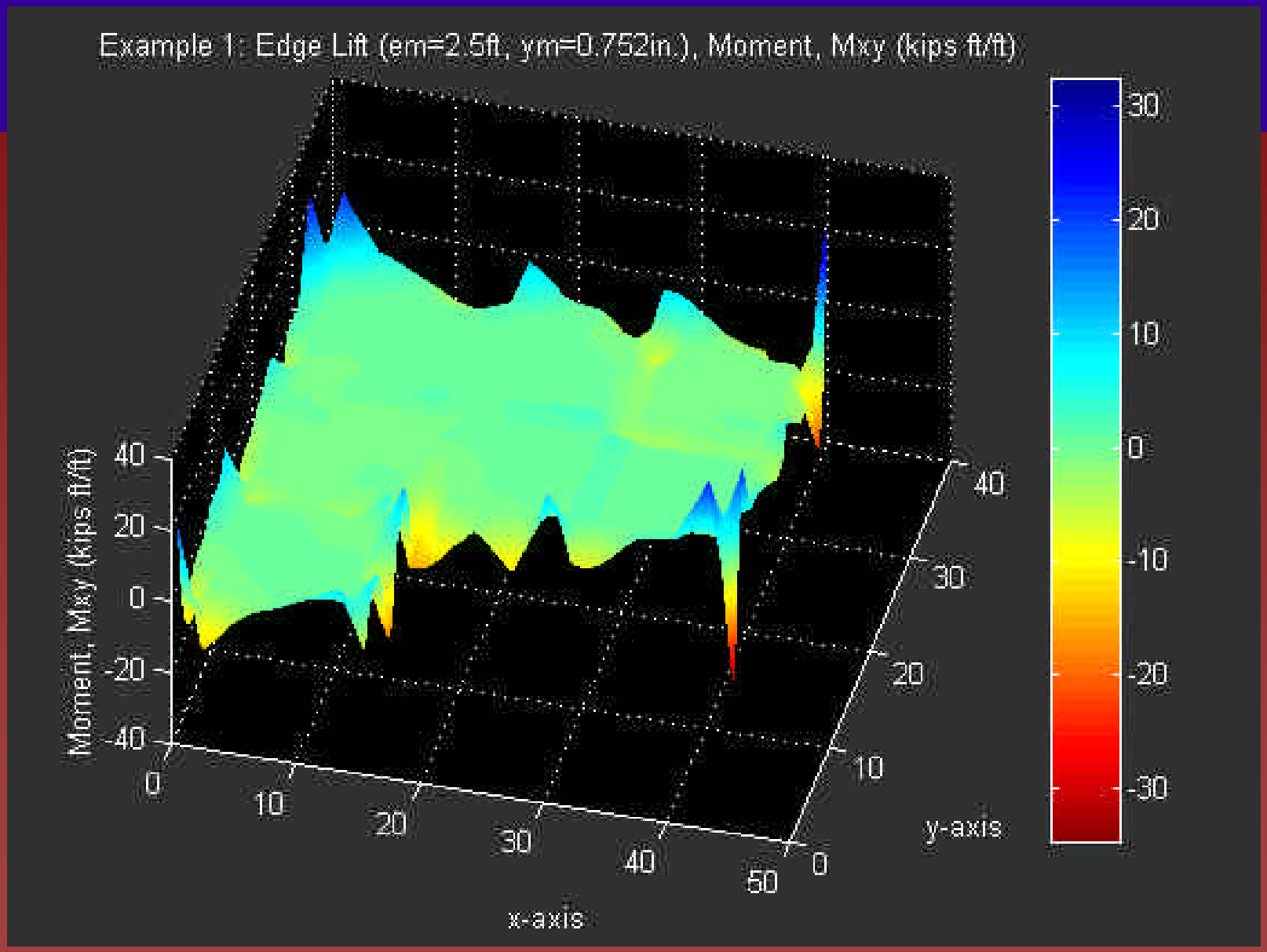

Example 1: Edge Lift (em=2.5ft, ym=0.752in.), Moment, My (kips ft/ft)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
250
200
150
100
50
0
-50
-100
-150
-200

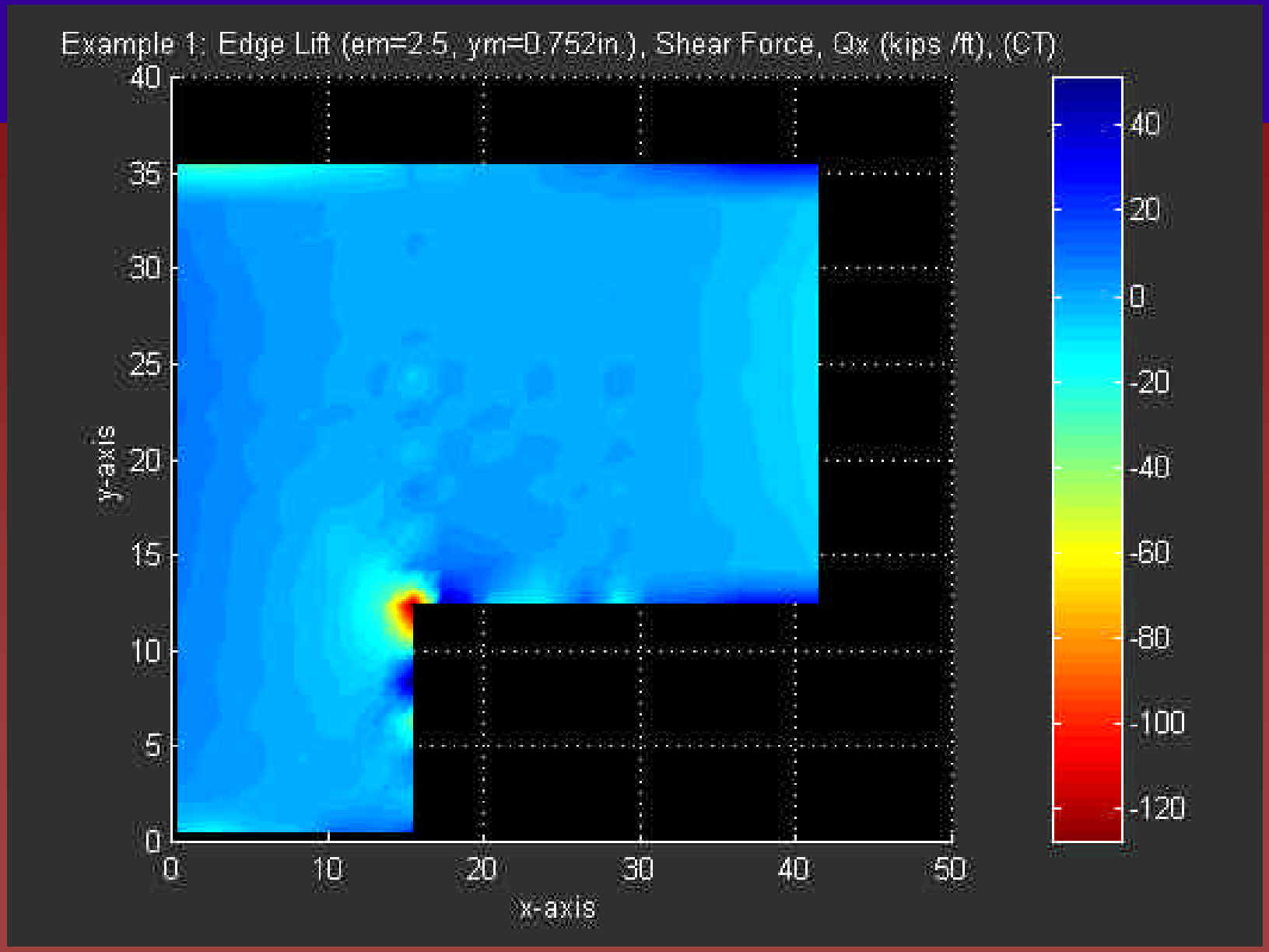

Example 1: Edge Lift (em=2.5ft, ym=0.752in.), Moment, My (kips ft/ft)
Moment, My (kips ft/ft)
400
200
0
-200
-400
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
250
200
150
100
50
0
-50
-100
-150
-200

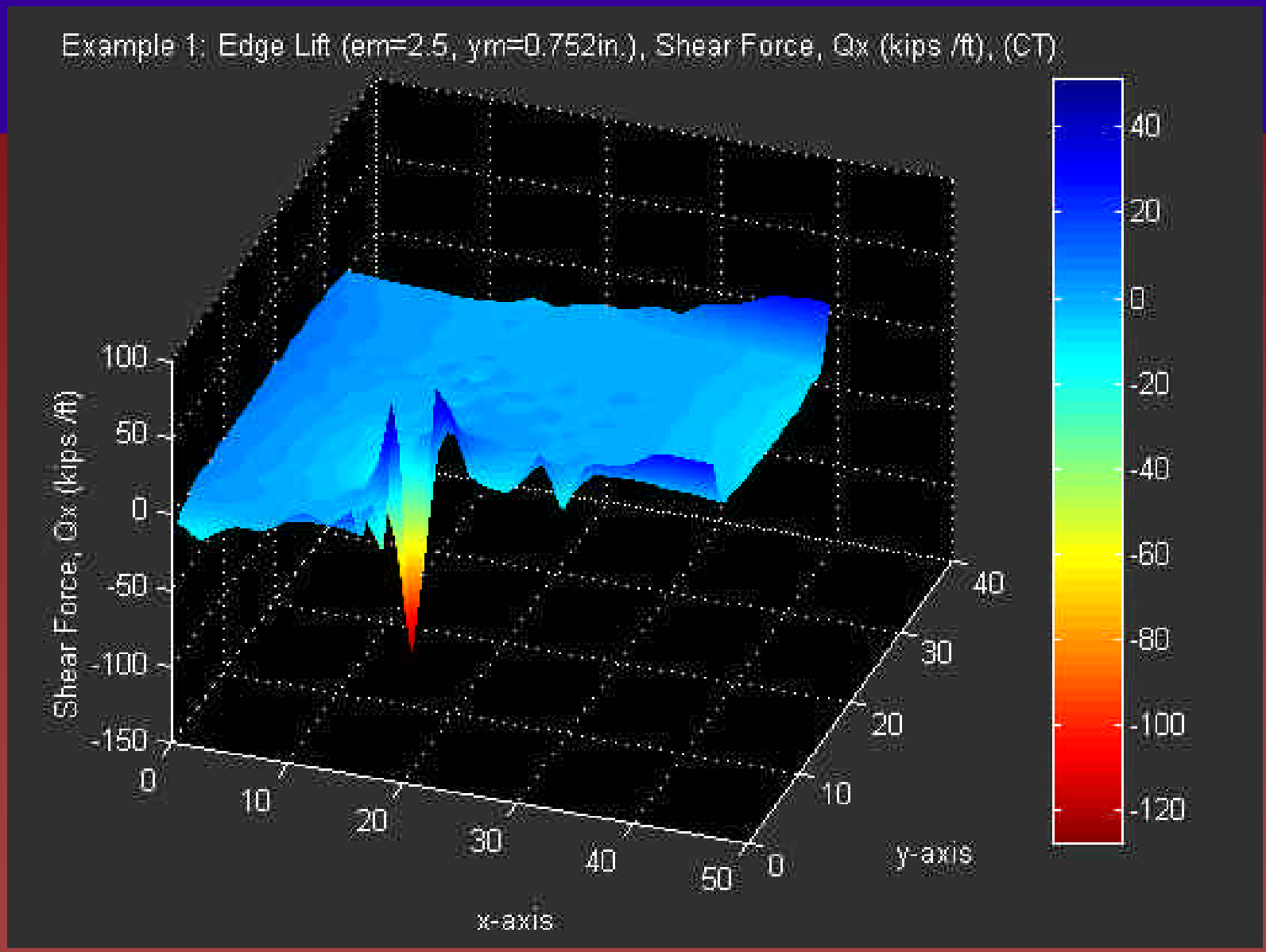

Example 1: Edge Lift (em=2.5, ym=0.752in.), Moment, Mxy (kips ft/ft), (CT)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
20
10
0
-10
-20
-30
-40

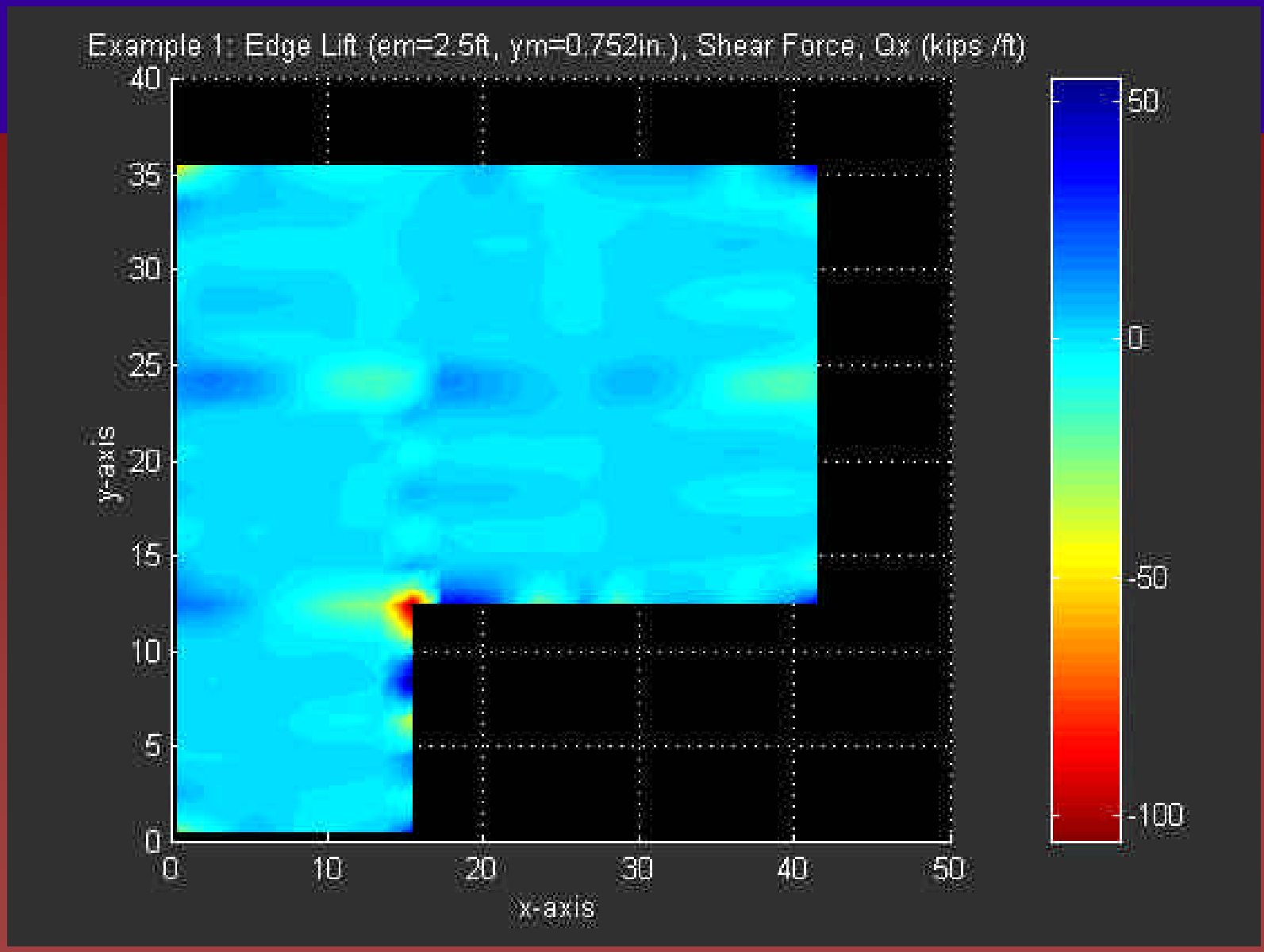

Example 1: Edge Lift (em=2.5, ym=0.752in.), Moment, Mxy (kips ft/ft), (CT)
Moment, Mxy (kips ft/ft)
50
0
-50
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
20
10
0
-10
-20
-30
-40

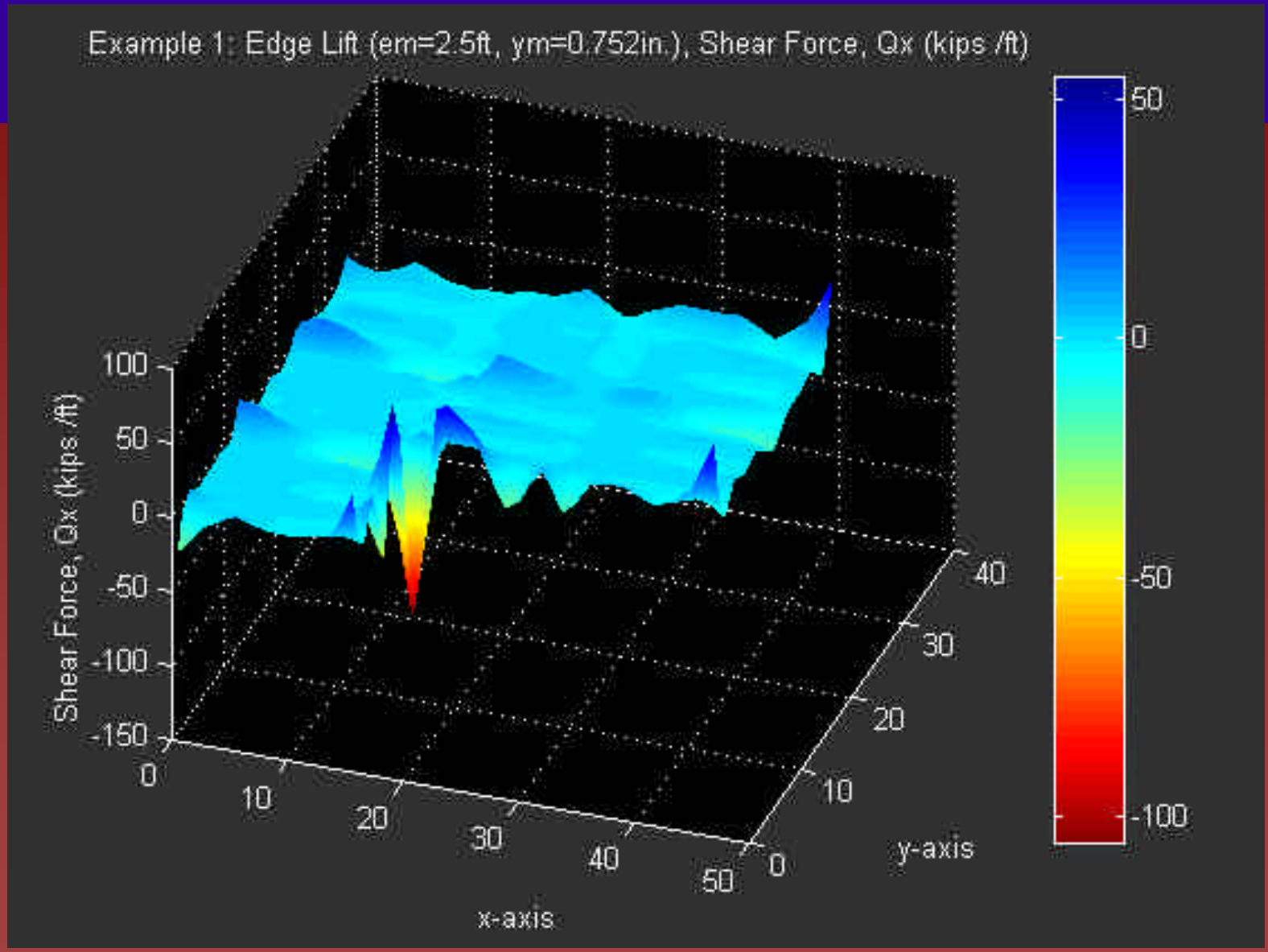

Example 1: Edge Lift (em=2.5ft, ym=0.752in.), Moment, Mxy (kips ft/ft)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
30
20
10
0
-10
-20
-30

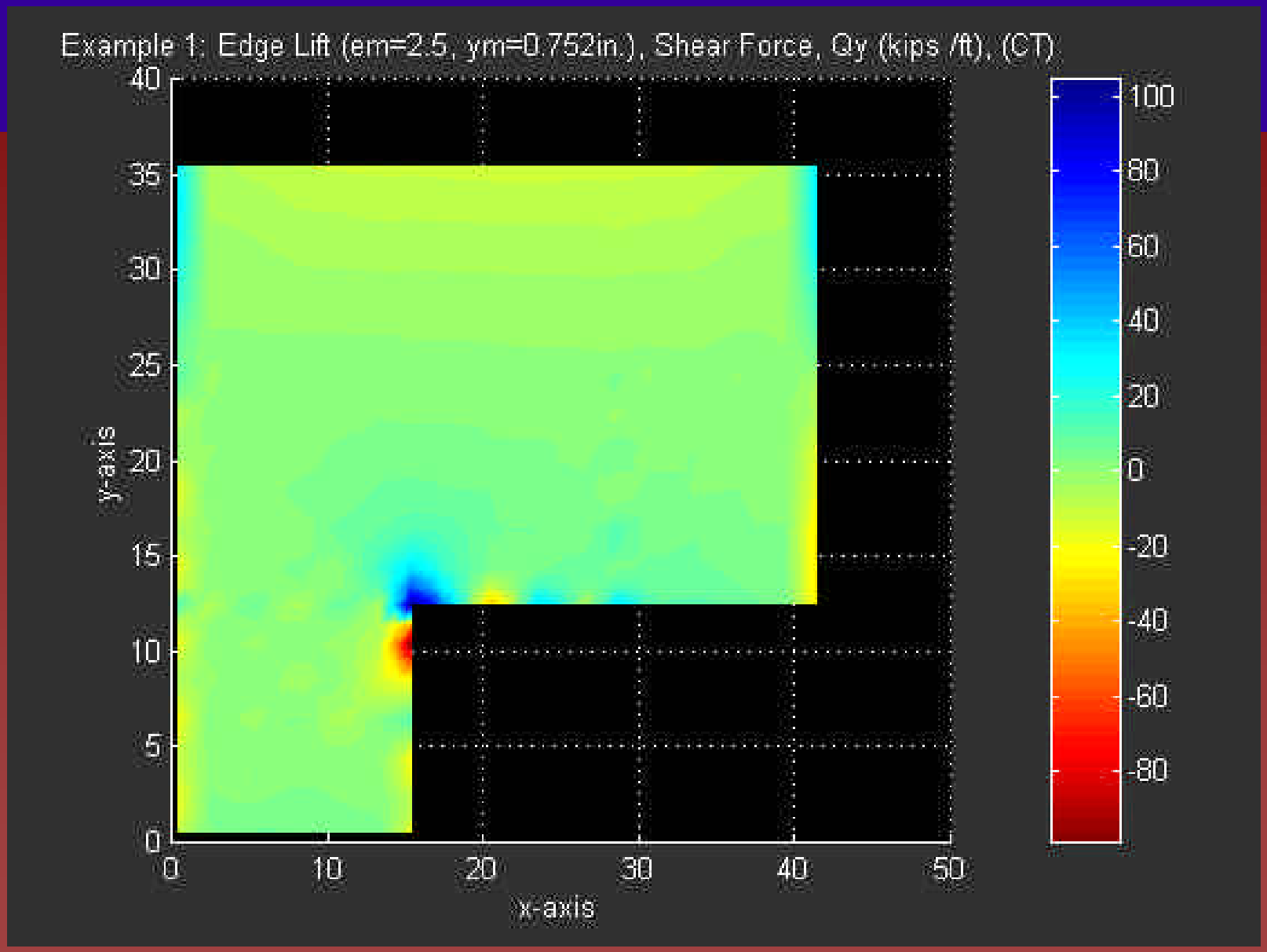

Example 1: Edge Lift (em=2.5ft, ym=0.752in.), Moment, Mxy (kips ft/ft)
Moment, Mxy (kips ft/ft)
40
20
0
-20
-40
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
30
20
10
0
-10
-20
-30

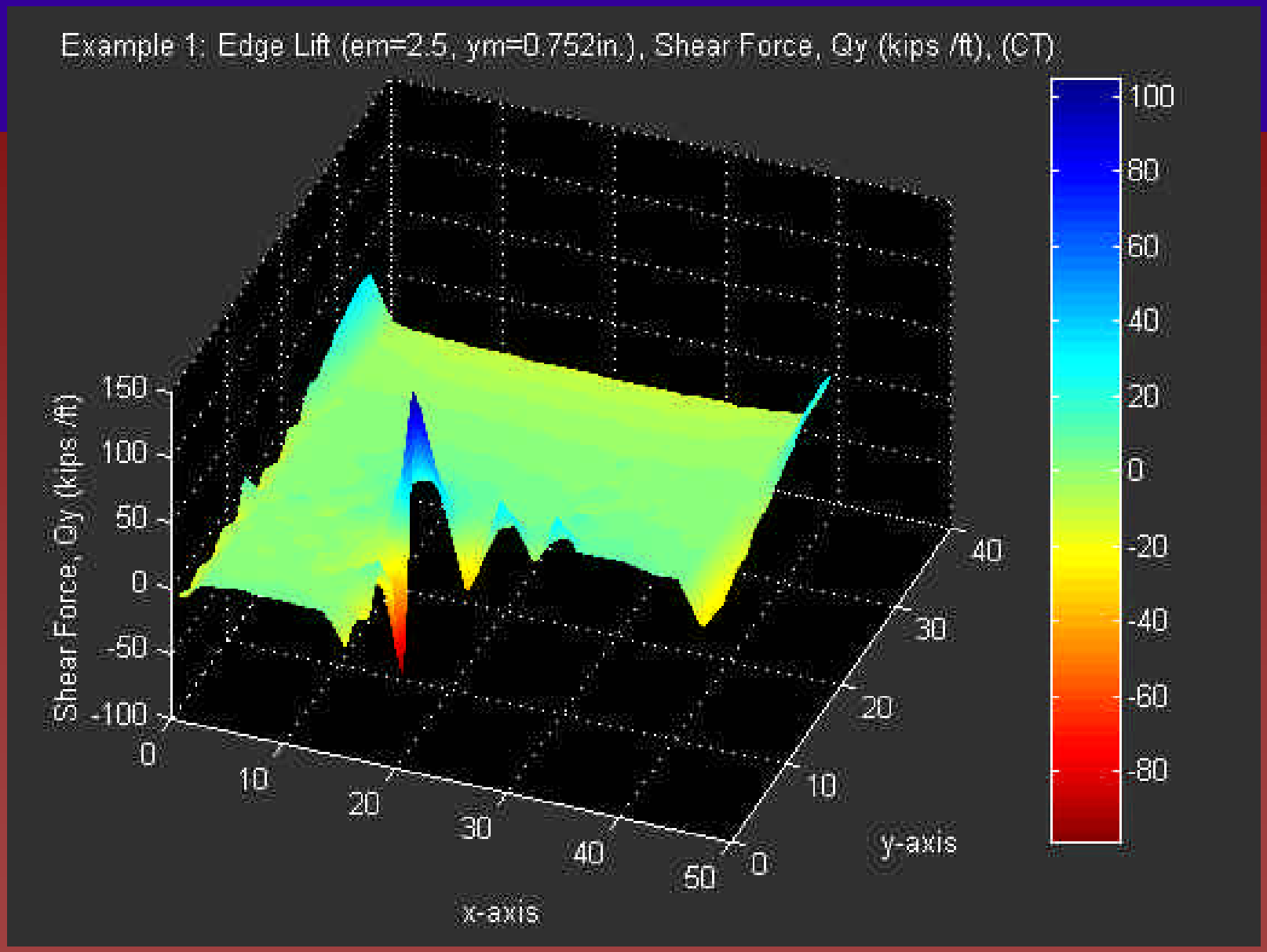

Example 1: Edge Lift (em=2.5, ym=0.752in.), Shear Force, Qx (kips /ft), (CT)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
40
20
0
-20
-40
-60
-80
-100
-120

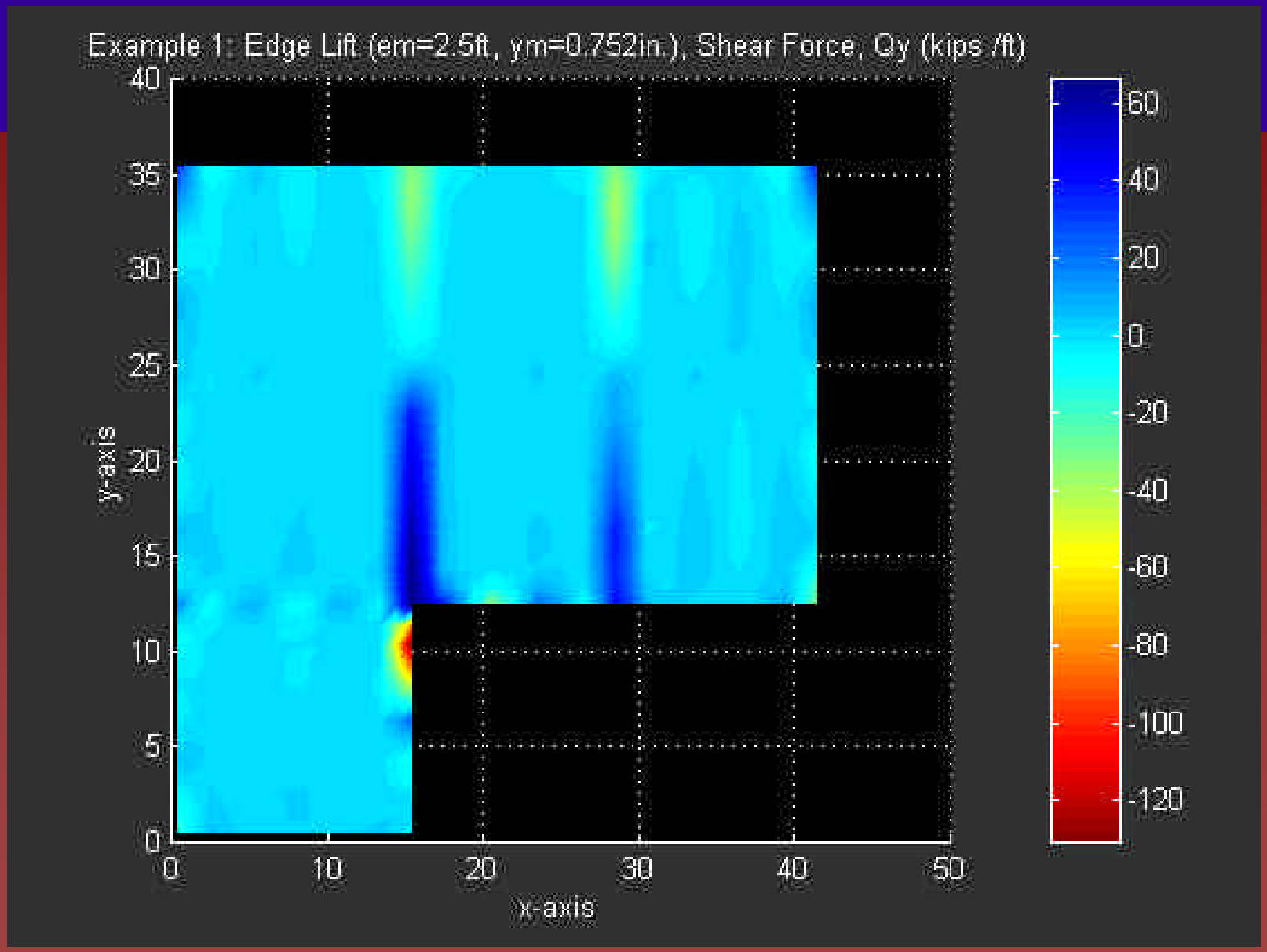

Example 1: Edge Lift (em=2.5, ym=0.752in.), Shear Force, Qx (kips /ft), (CT)
Shear Force, Qx (kips /ft)
100
50
0
-50
-100
-150
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
40
20
0
-20
-40
-60
-80
-100
-120

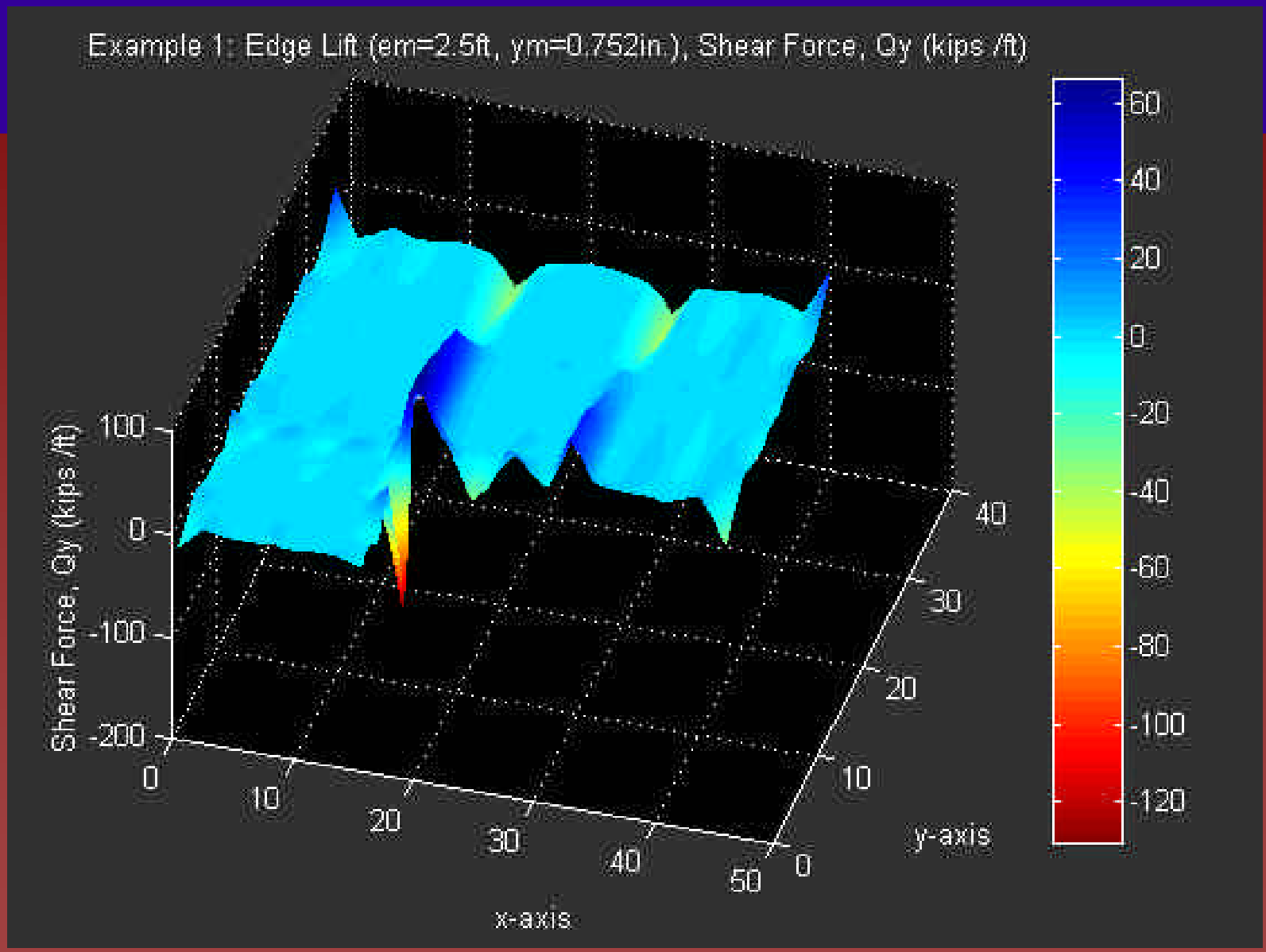

Example 1: Edge Lift (em=2.5ft, ym=0.752in.), Shear Force, Qx (kips /ft)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
50
0
-50
-100


Example 1: Edge Lift (em=2.5ft, ym=0.752in.), Shear Force, Qx (kips /ft)
Shear Force, Qx (kips /ft)
100
50
0
-50
-100
-150
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
50
0
-50
-100


Example 1: Edge Lift (em=2.5, ym=0.752in.), Shear Force, Qy (kips /ft), (CT)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
100
80
60
40
20
0
-20
-40
-60
-80


Example 1: Edge Lift (em=2.5, ym=0.752in.), Shear Force, Qy (kips /ft), (CT)
Shear Force, Qy (kips /ft)
150
100
50
0
-50
-100
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
100
80
60
40
20
0
-20
-40
-60
-80

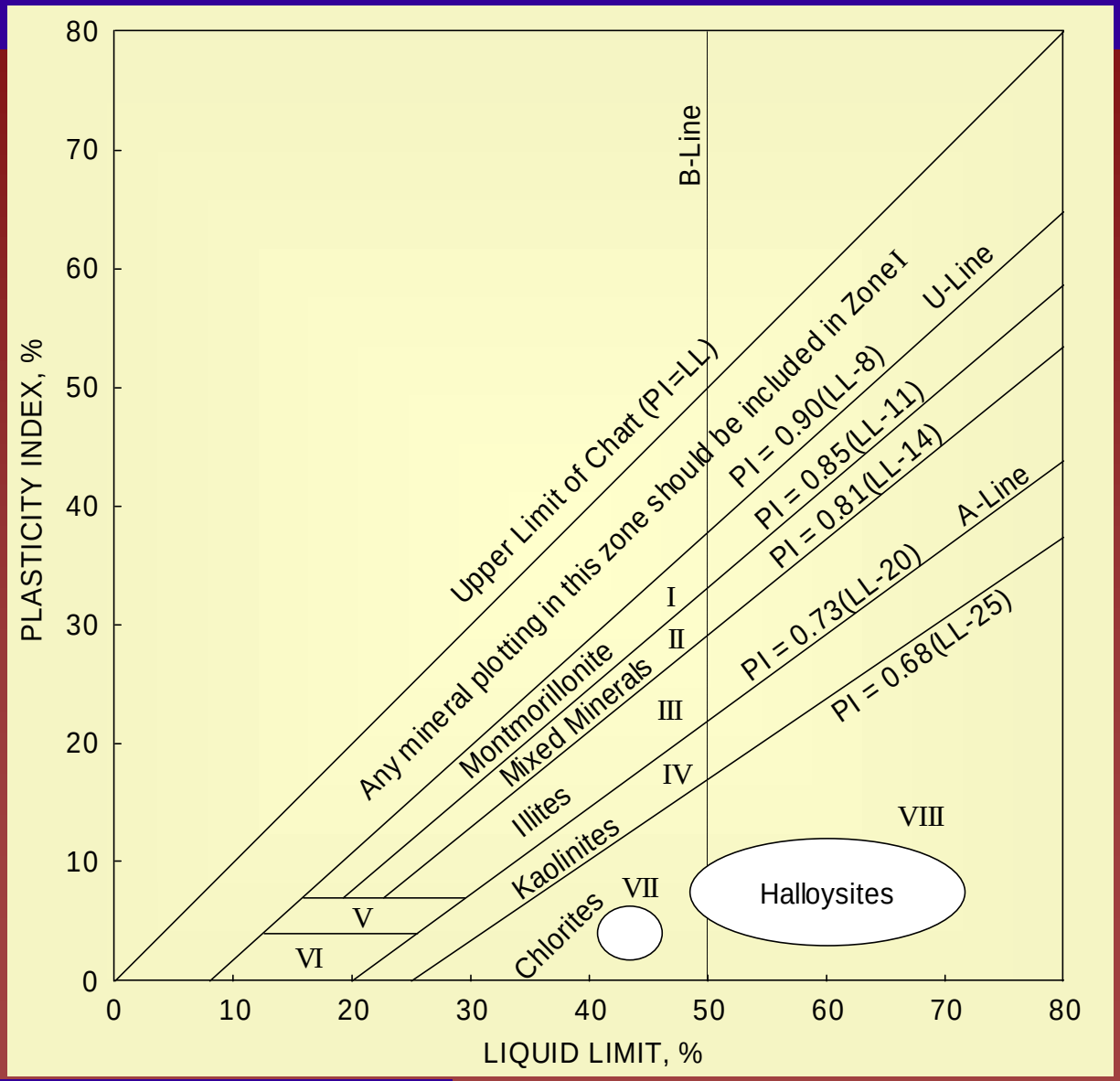

Example 1: Edge Lift (em=2.5ft, ym=0.752in.), Shear Force, Qy (kips /ft)
y-axis
x-axis
0
5
10
15
20
25
30
35
40
0
10
20
30
40
50
60
40
20
0
-20
-40
-60
-80
-100
-120


Example 1: Edge Lift (em=2.5ft, ym=0.752in.), Shear Force, Qy (kips /ft)
Shear Force, Qy (kips /ft)
100
0
-100
-200
0
10
20
30
40
50
x-axis
0
10
20
30
40
y-axis
60
40
20
0
-20
-40
-60
-80
-100
-120

SOIL VOLUME CHANGE CHARTS

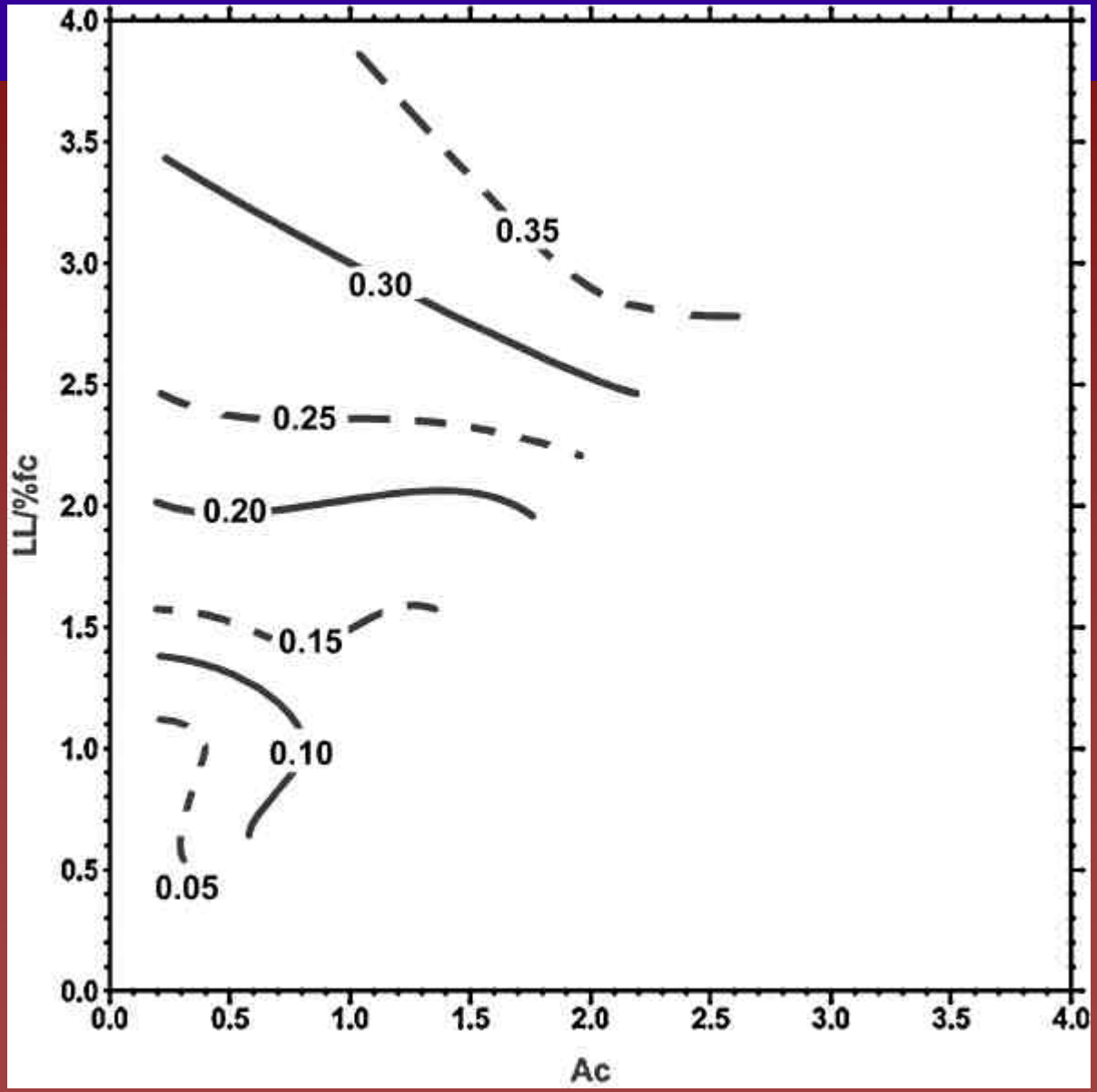
NATURAL RESOURCES
CONSERVATION SERVICE
U.S.D.A.
DATA BASE
(130,000 SAMPLES)

EXPANSIVE SOILS ZONES (A. P. COVAR)



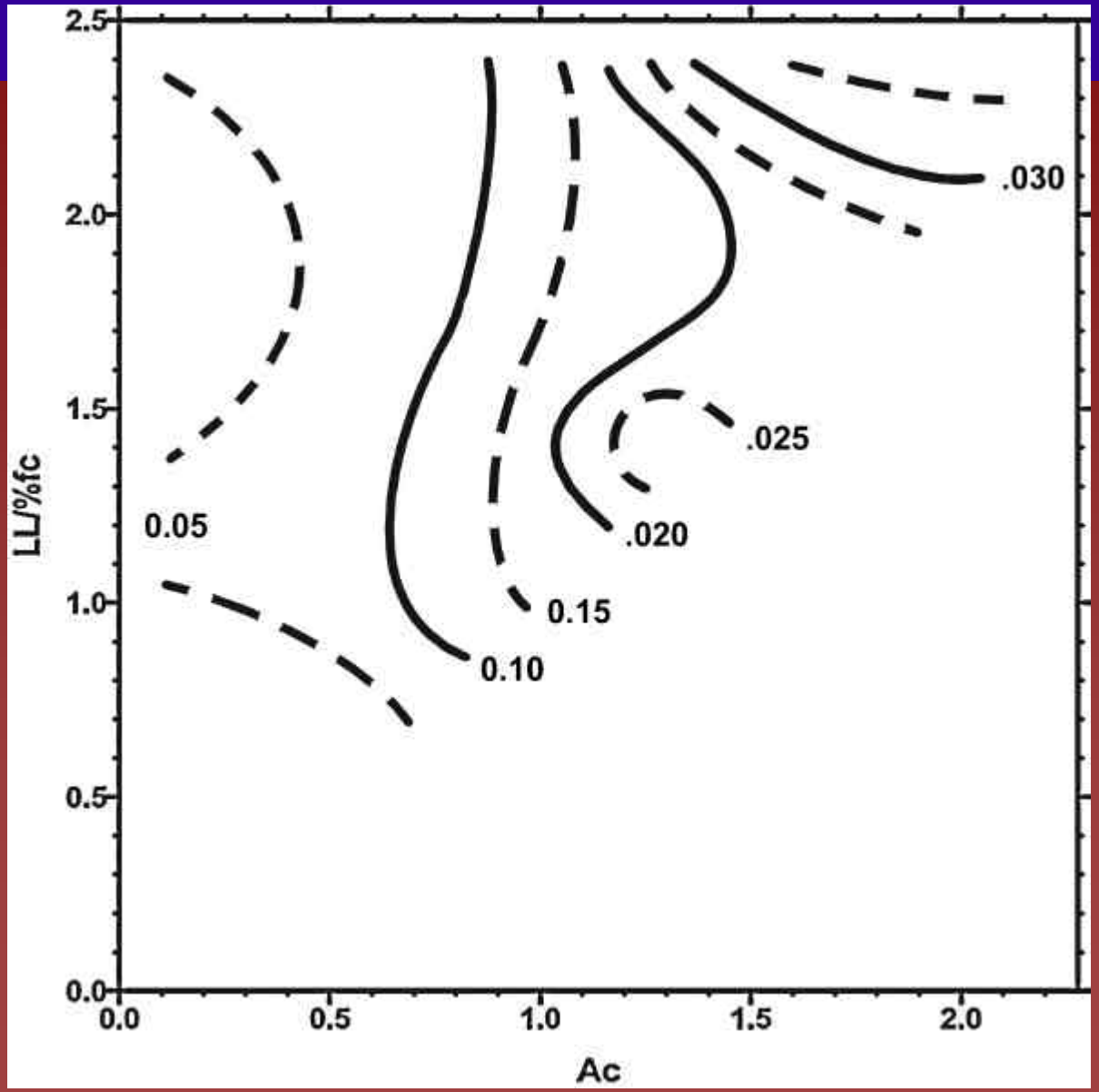
EXPANSIVE SOIL VOLUME CHANGE GUIDE NUMBER (A. P. COVAR)

ZONE 1



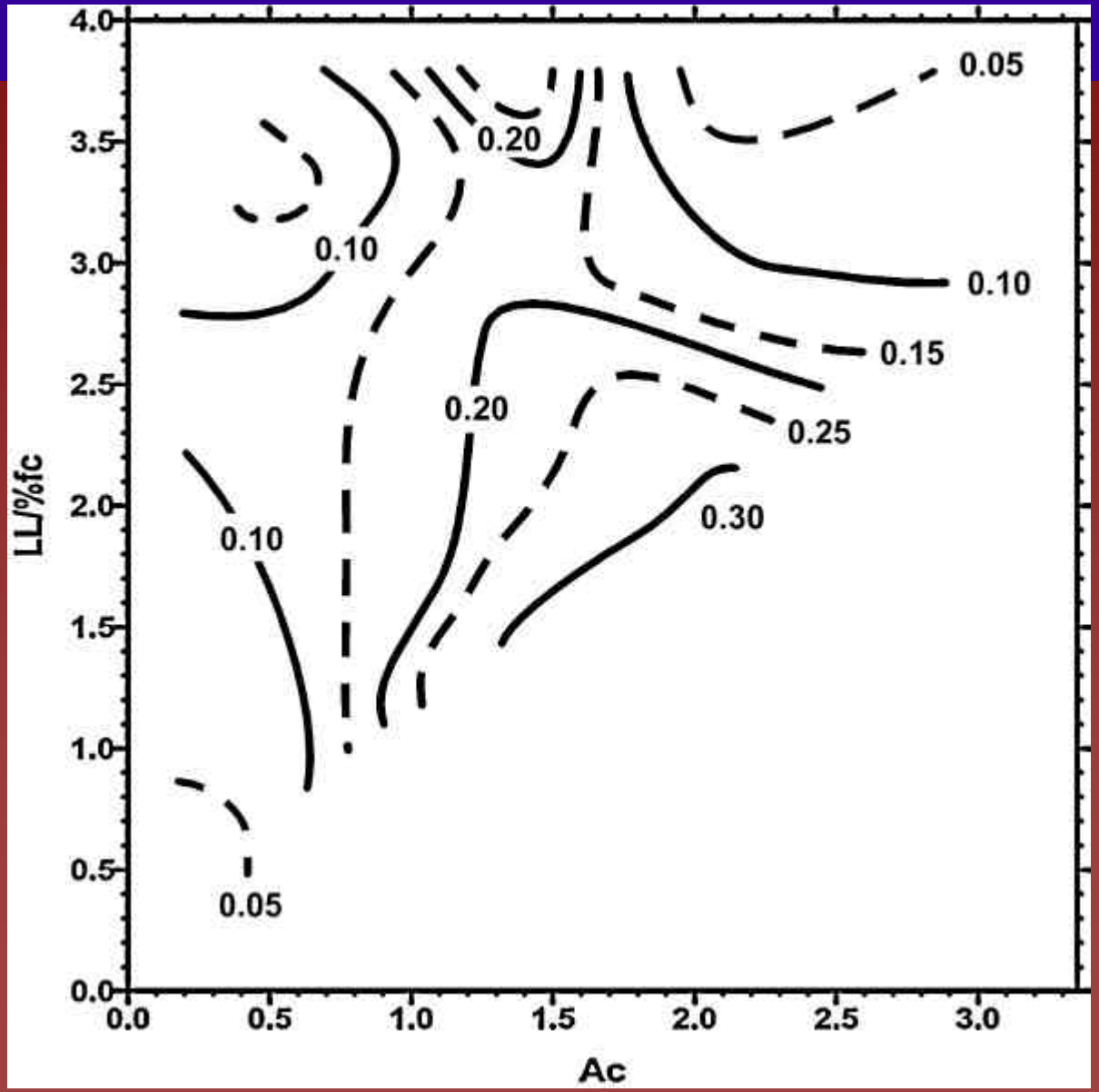
EXPANSIVE SOIL VOLUME CHANGE GUIDE NUMBER (A. P. COVAR)

ZONE 2



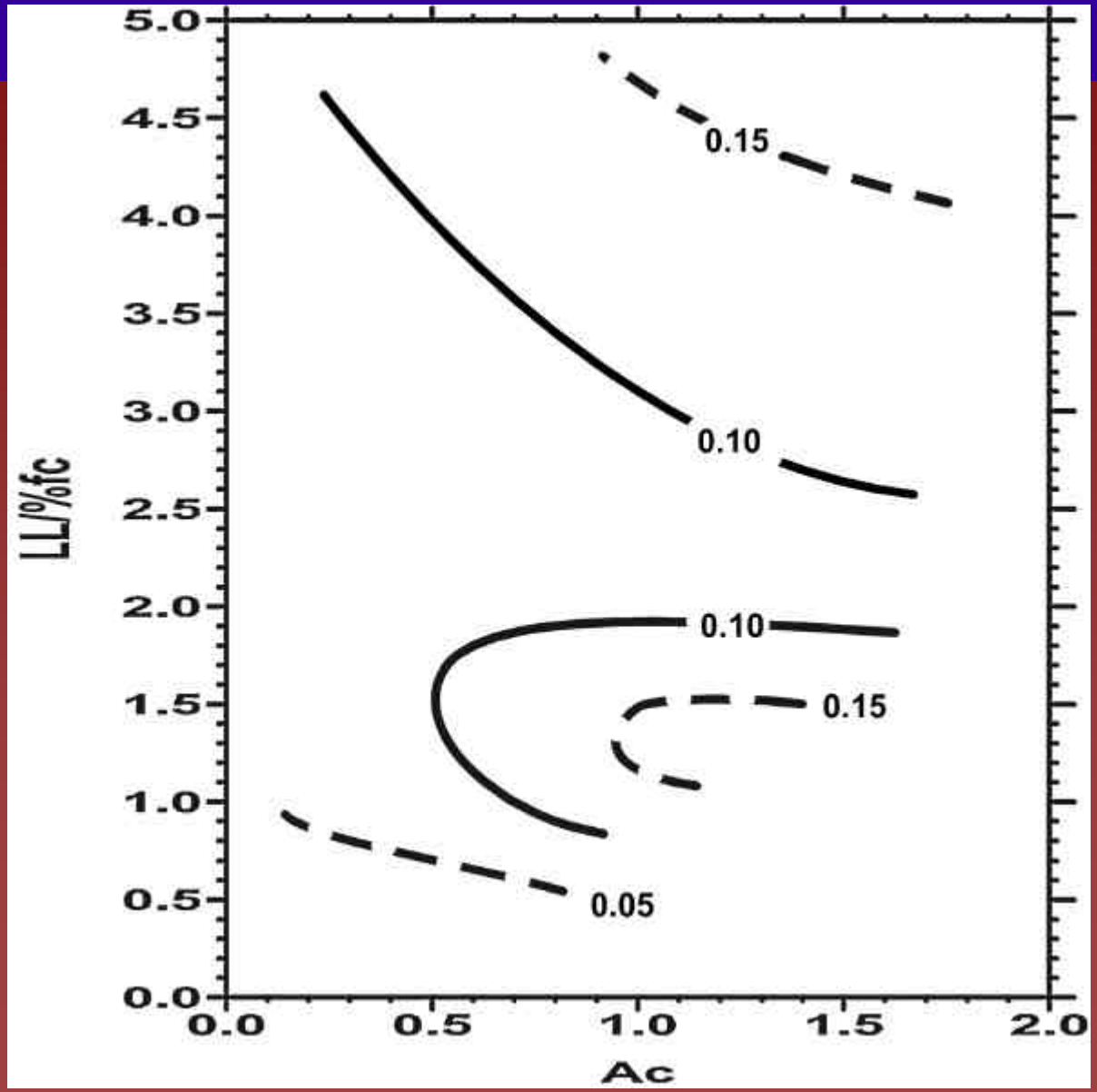
EXPANSIVE SOIL VOLUME CHANGE GUIDE NUMBER (A. P. COVAR)

ZONE 3



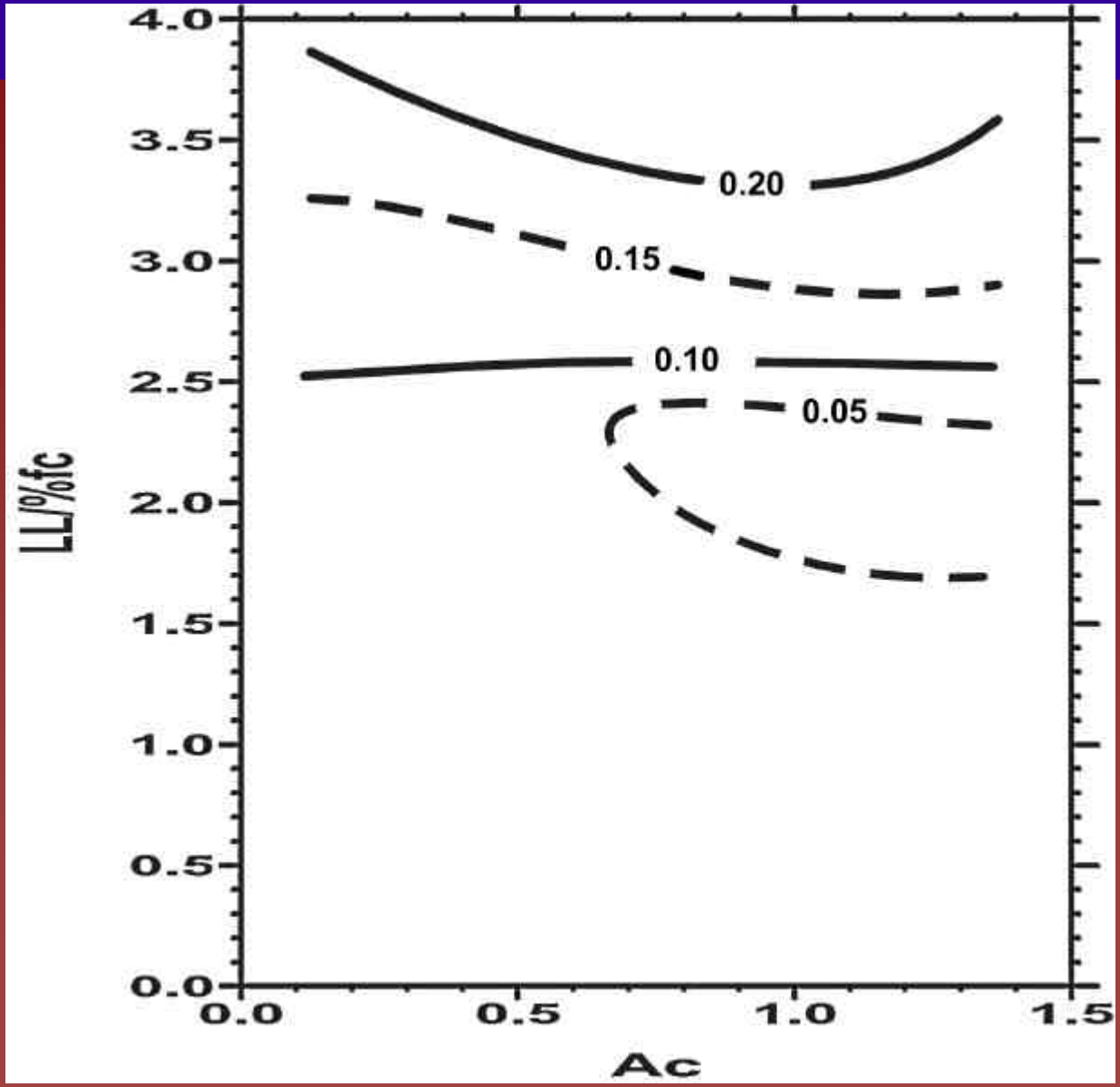
EXPANSIVE SOIL VOLUME CHANGE GUIDE NUMBER (A. P. COVAR)

ZONE 4



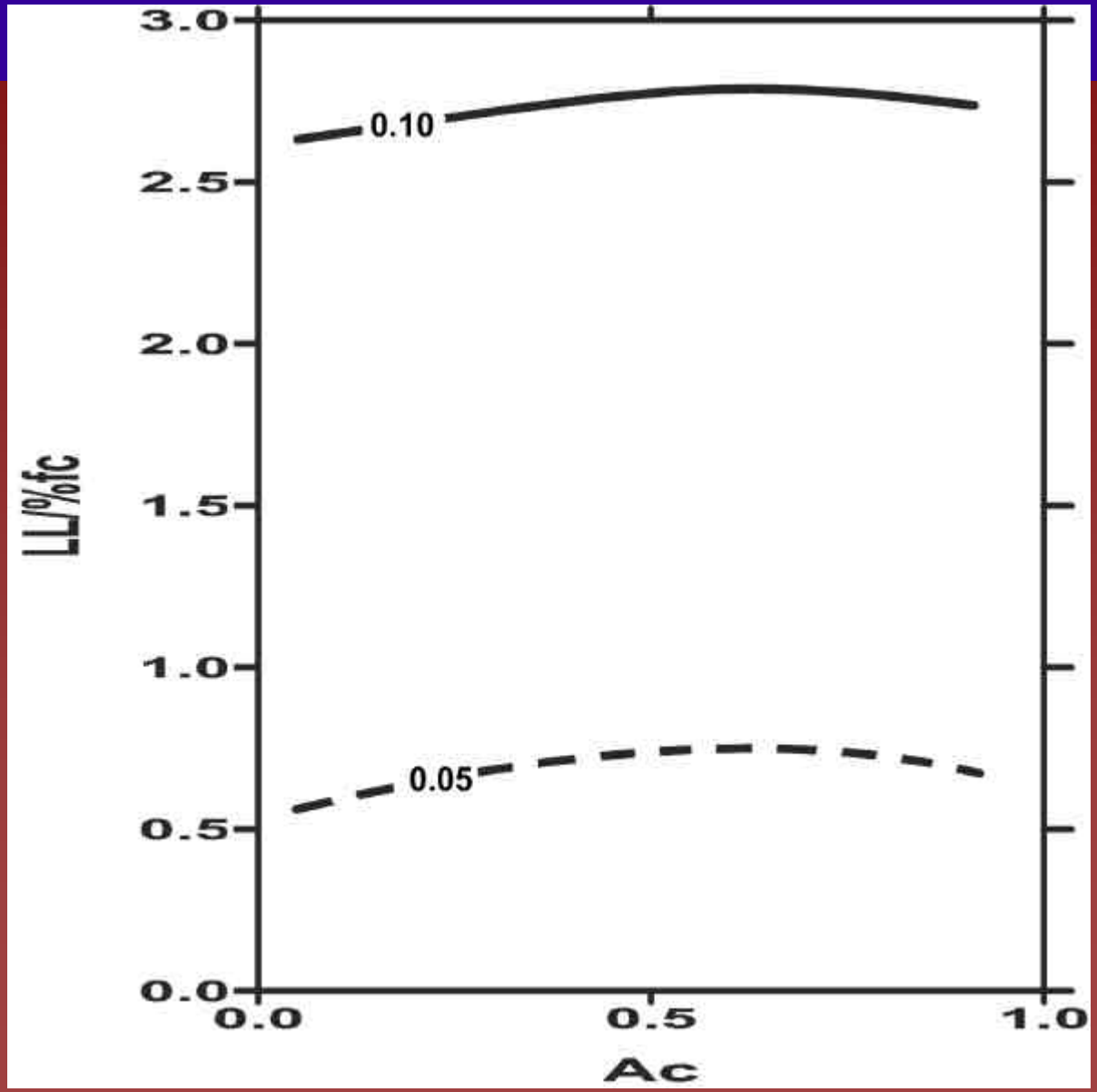
EXPANSIVE SOIL VOLUME CHANGE GUIDE NUMBER (A. P. COVAR)

ZONE 5



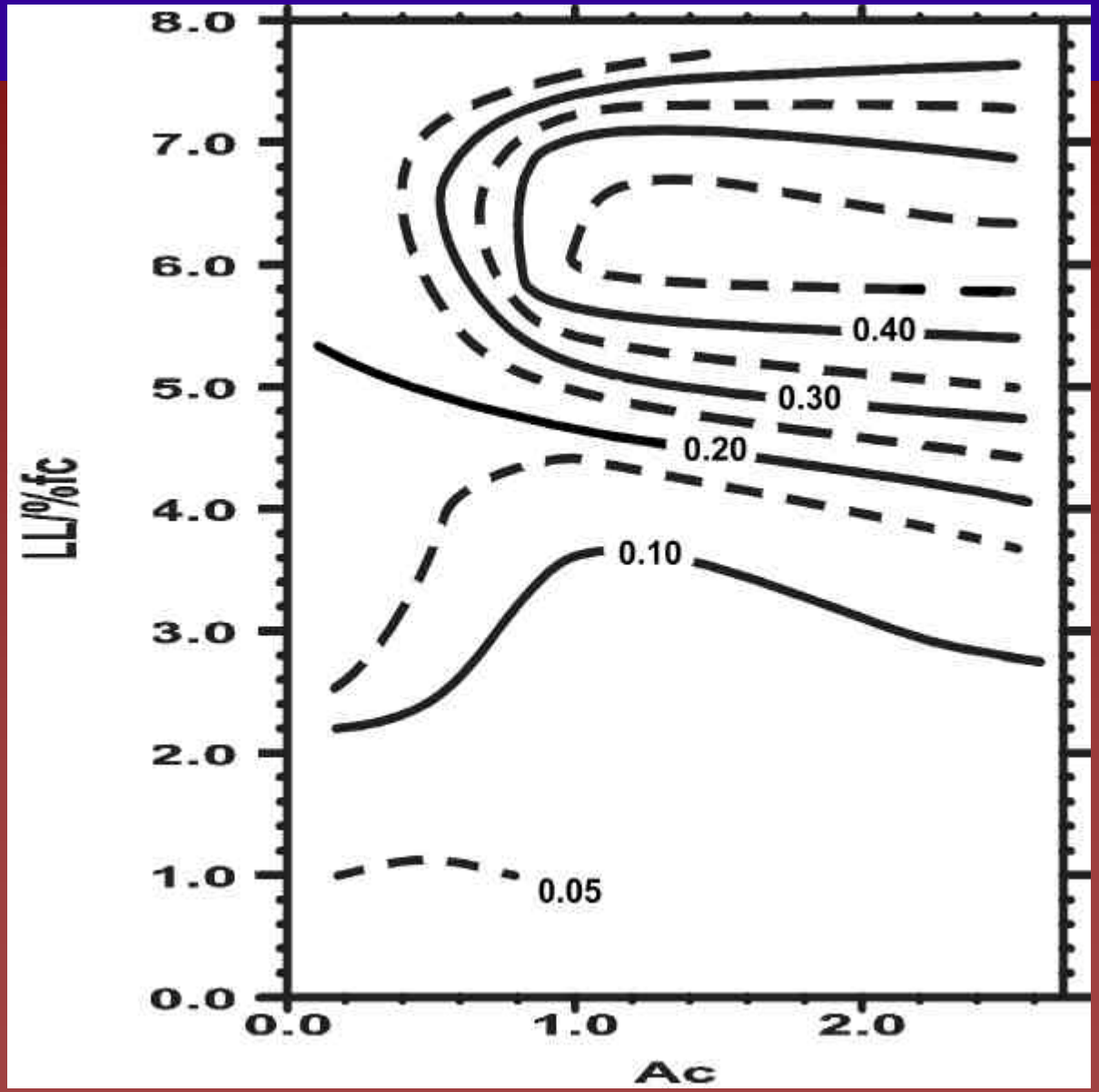
EXPANSIVE SOIL VOLUME CHANGE GUIDE NUMBER (A. P. COVAR)

ZONE 6



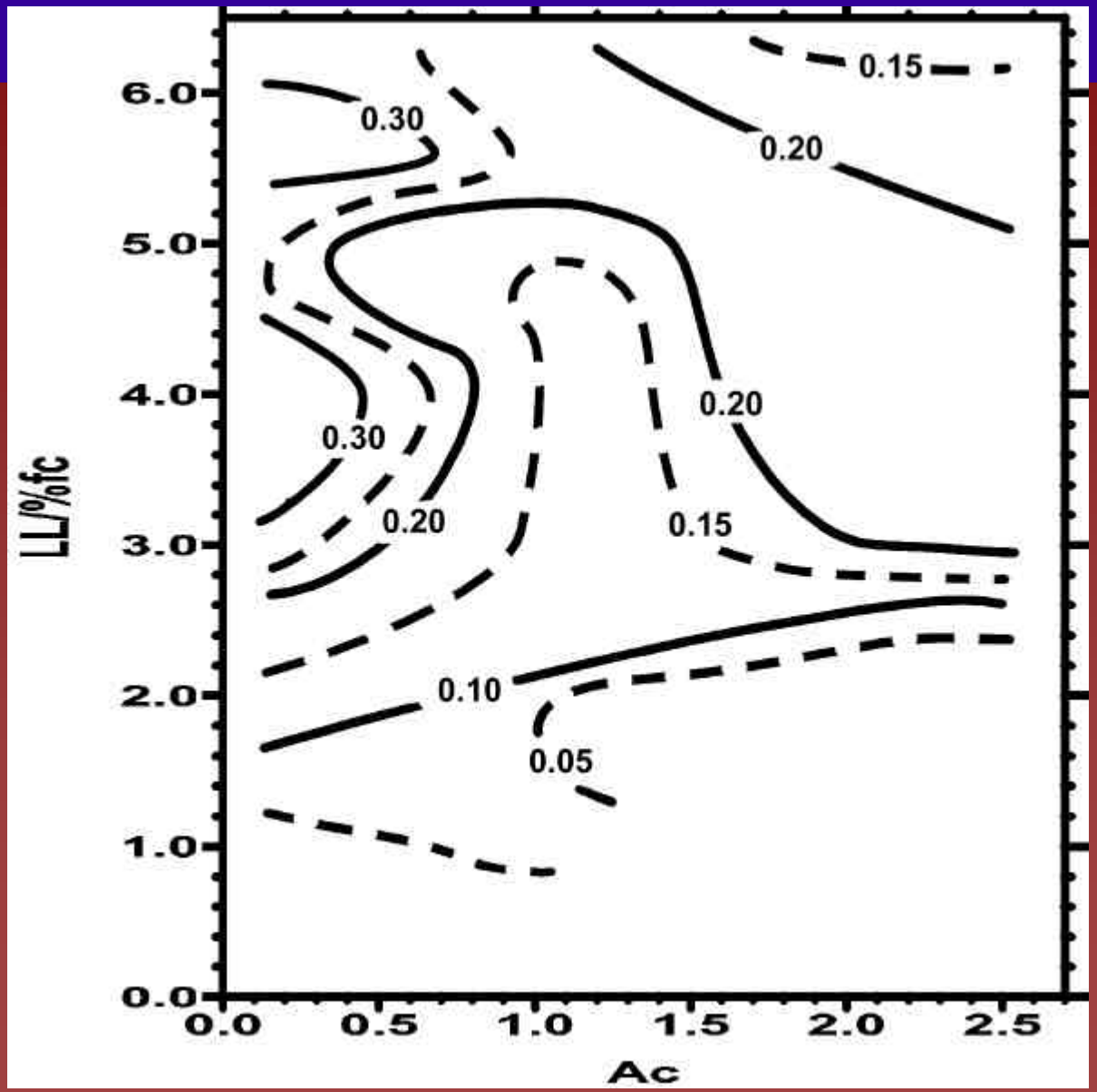
EXPANSIVE SOIL VOLUME CHANGE GUIDE NUMBER (A. P. COVAR)

ZONE 7



EXPANSIVE SOIL VOLUME CHANGE GUIDE NUMBER (A. P. COVAR)

ZONE 8



VOLUME CHANGE

COEFFICIENT, γ_h

=

PERCENT FINE CLAY

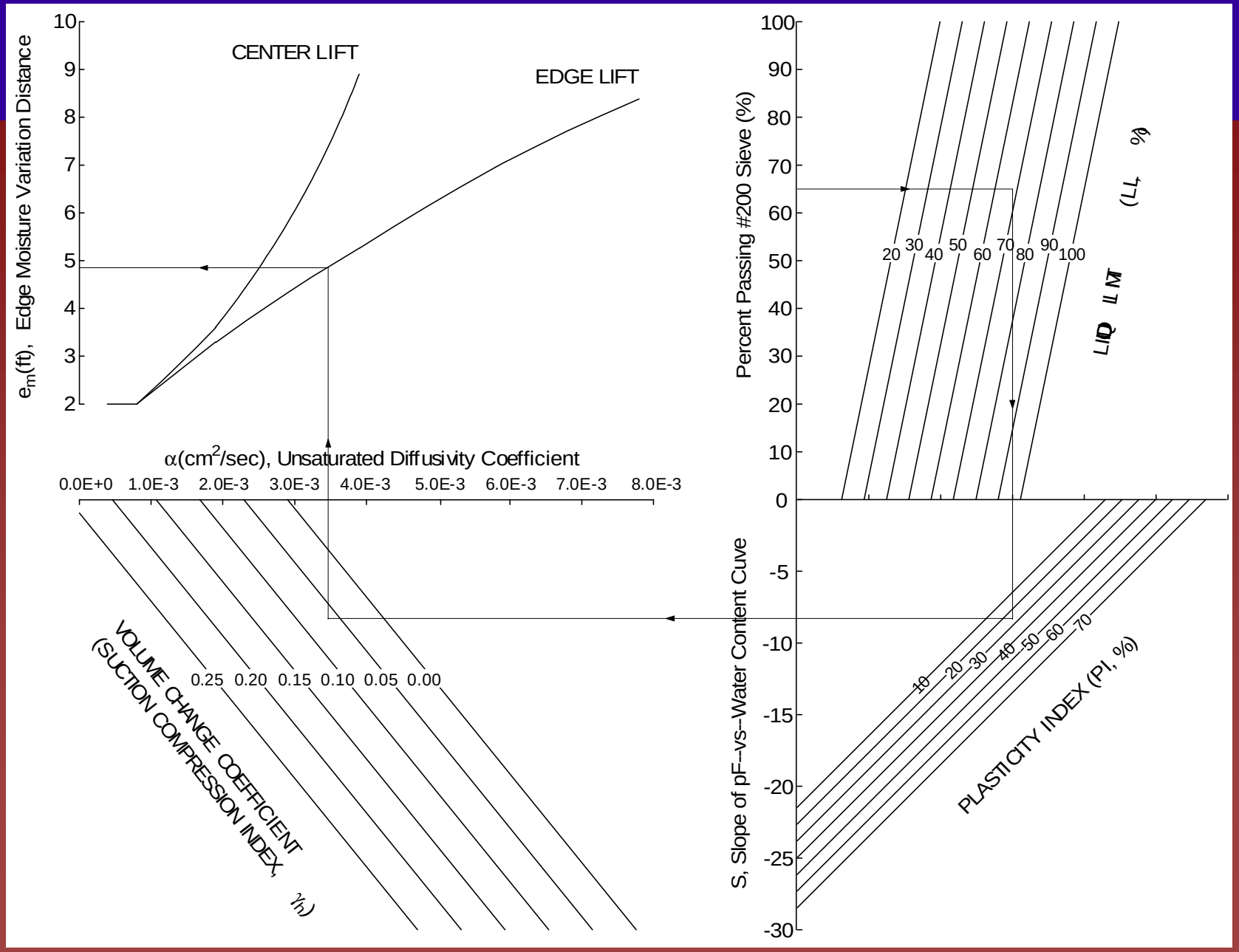
×

VOLUME CHANGE

GUIDE NUMBER

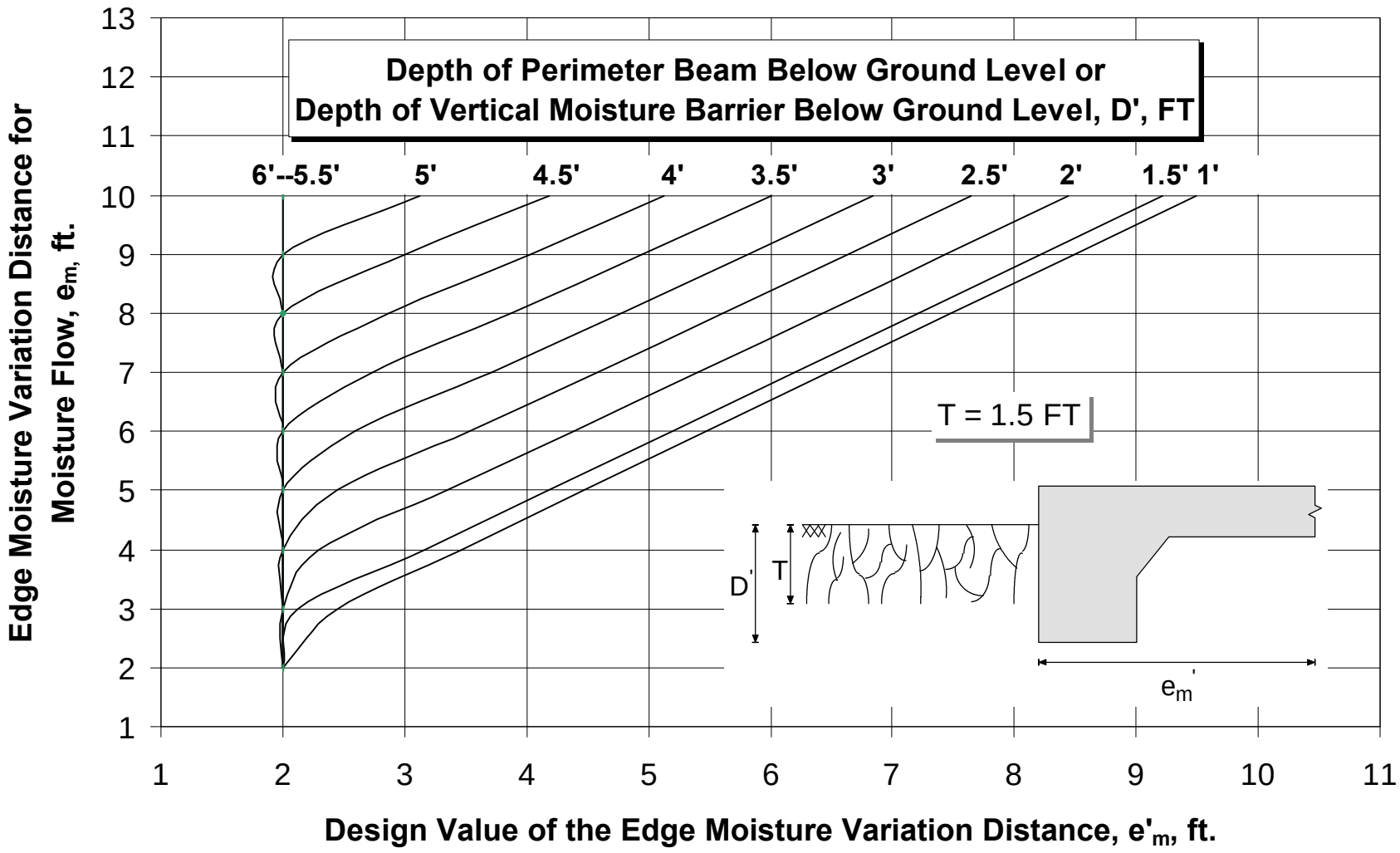
EDGE MOISTURE VARIATION DISTANCE, e_m, ft

EDGE MOISTURE VARIATION DISTANCE

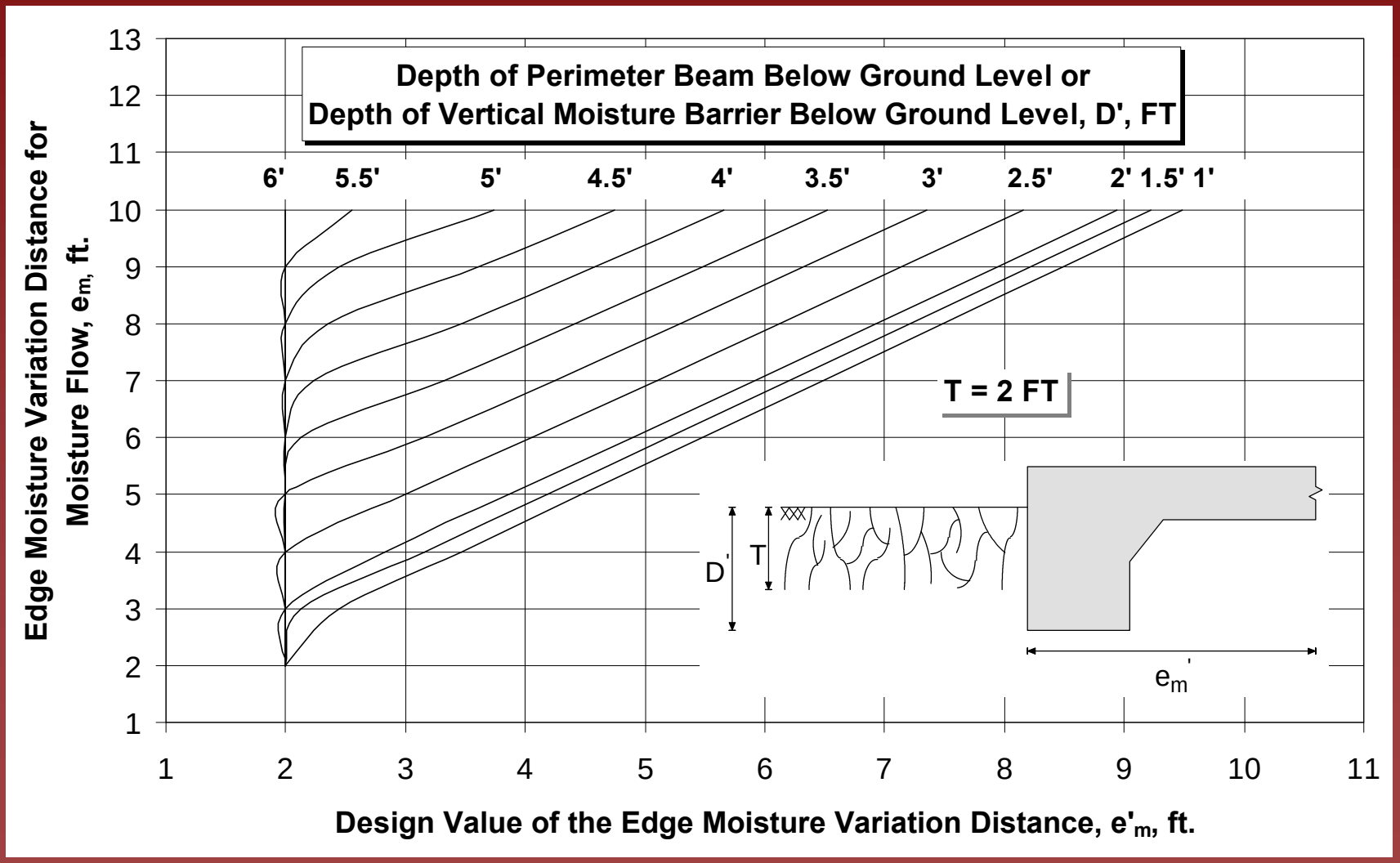


EFFECT OF VERTICAL MOISTURE BARRIER

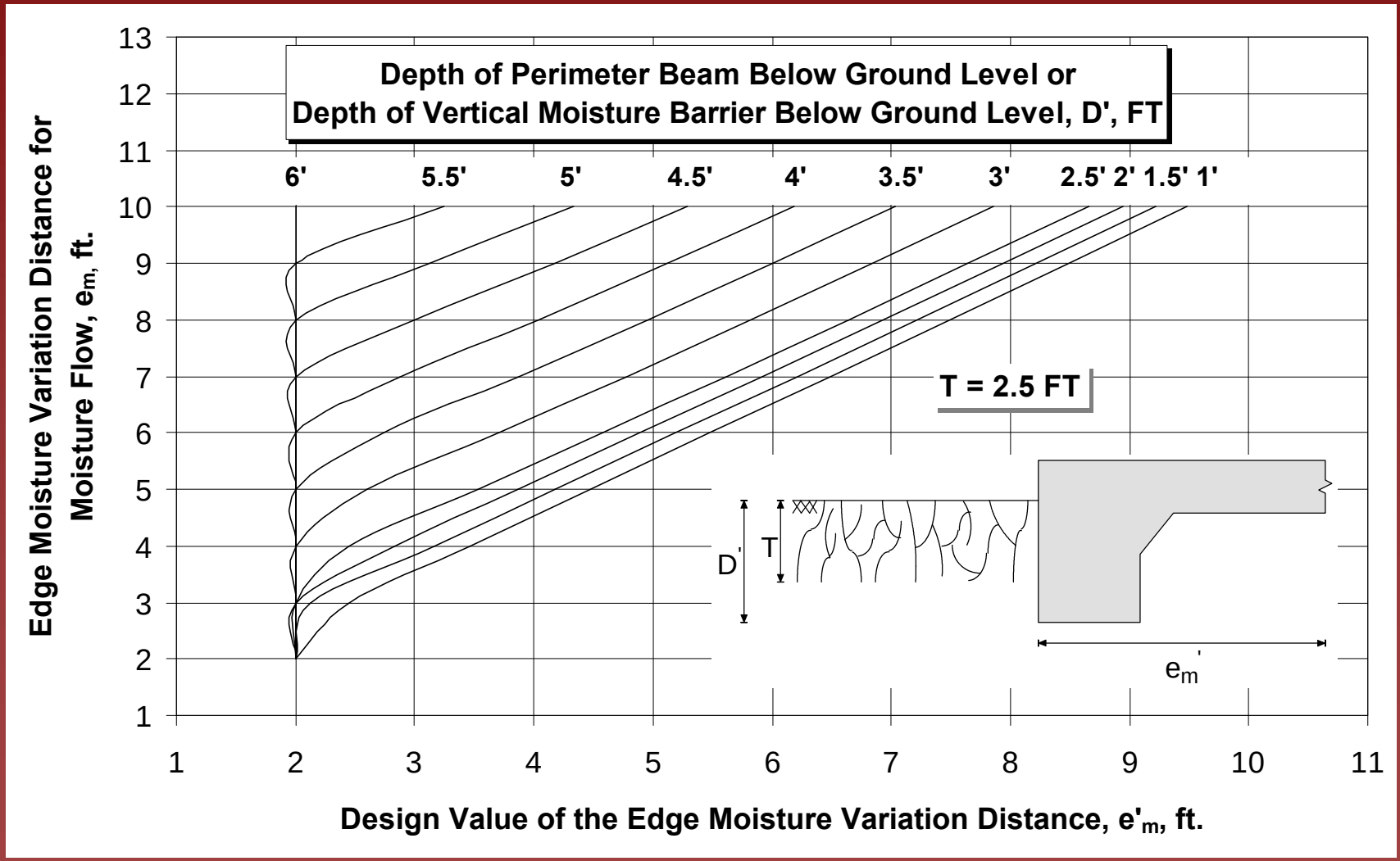
MOISTURE BARRIER
(T = 1.5 ft)



MOISTURE BARRIER
(T = 2.0 ft)



MOISTURE BARRIER
(T = 2.5 ft)



DESIGN AIDS FOR SLABS ON EXPANSIVE SOILS