Concrete Shower Pan Cracking

Dirk Duffner
Duffner Engineering
dduffner@duffnerengineering.com

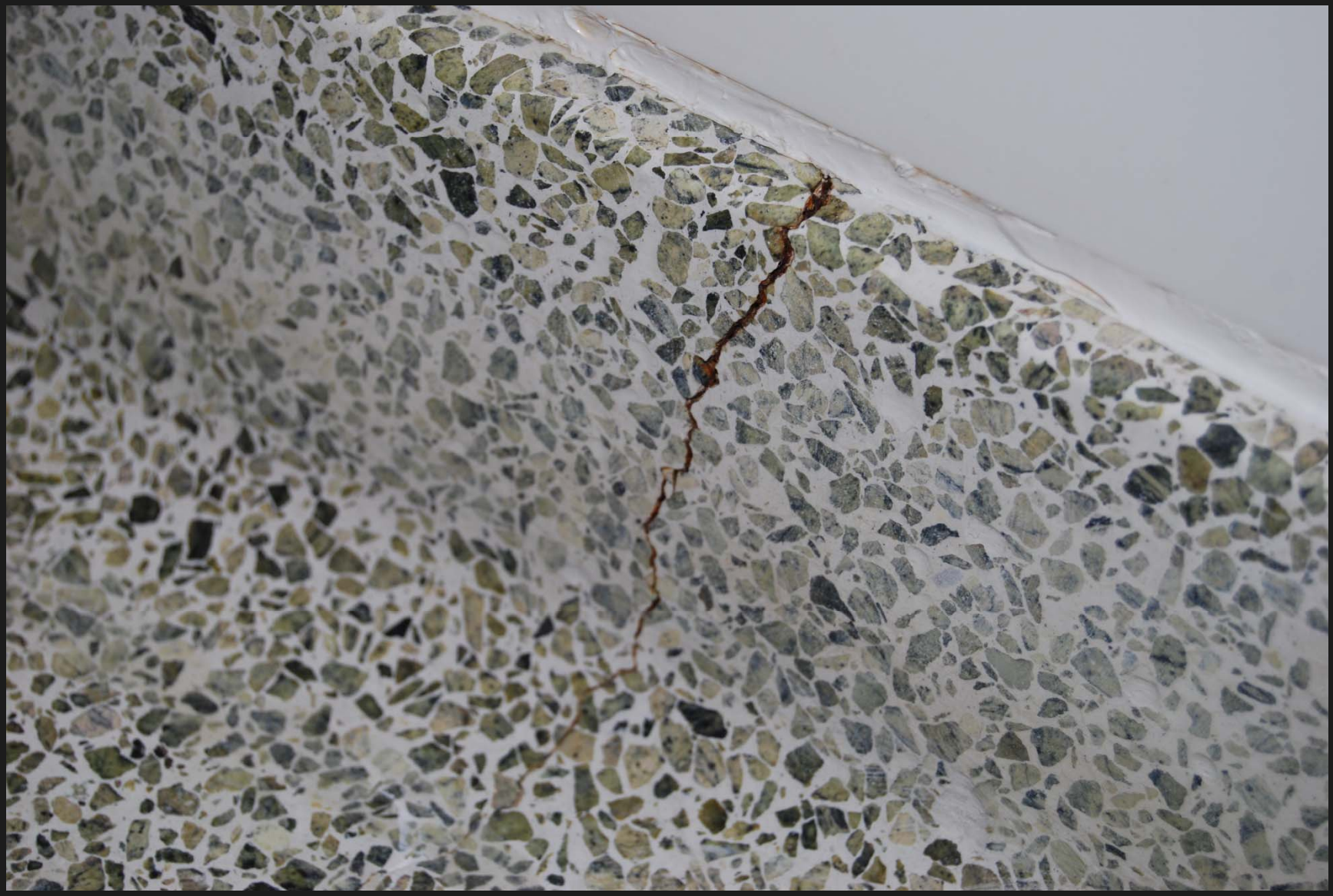
Summary

- Cracks were discovered in concrete shower pans after only a few months of service.
- We conducted an analysis to determine the stress in the pan associated with non uniform drying of the concrete during manufacturing, and with distortion of the pan during installation and usage.

Typical Concrete Shower Pan

Crack Discovered in the Curb

Curb Crack Close-up



Non Uniform Drying Analysis

- Drying Shrinkage = 200 to 800 µin/in; use 400 µin/in
- Density = 0.0839 lb/in^3
- E = 4x10^6 psi
- v = .21
- CTE = 10 µin/in/deg C
- Simulate 400 uin/in non uniform drying with thermal stress delta T = 40 deg c
- All exposed surface nodes = 10 deg C
- All other nodes = 50 deg C

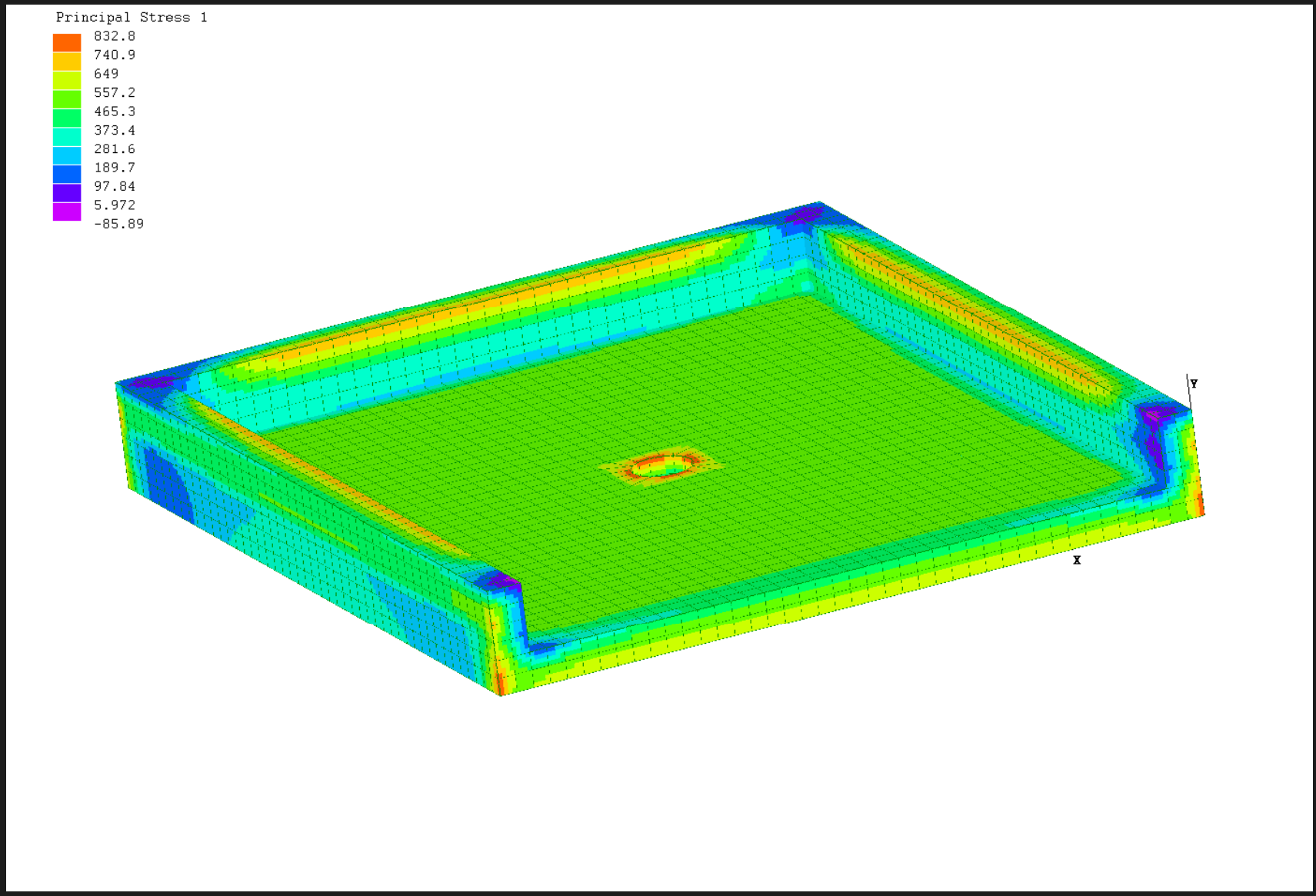
Shower Pan

- Length = 48 in
- Width = 42 in
- Thickness = 2 in
- Curb Height = 6 in
- Strength = 350 psi

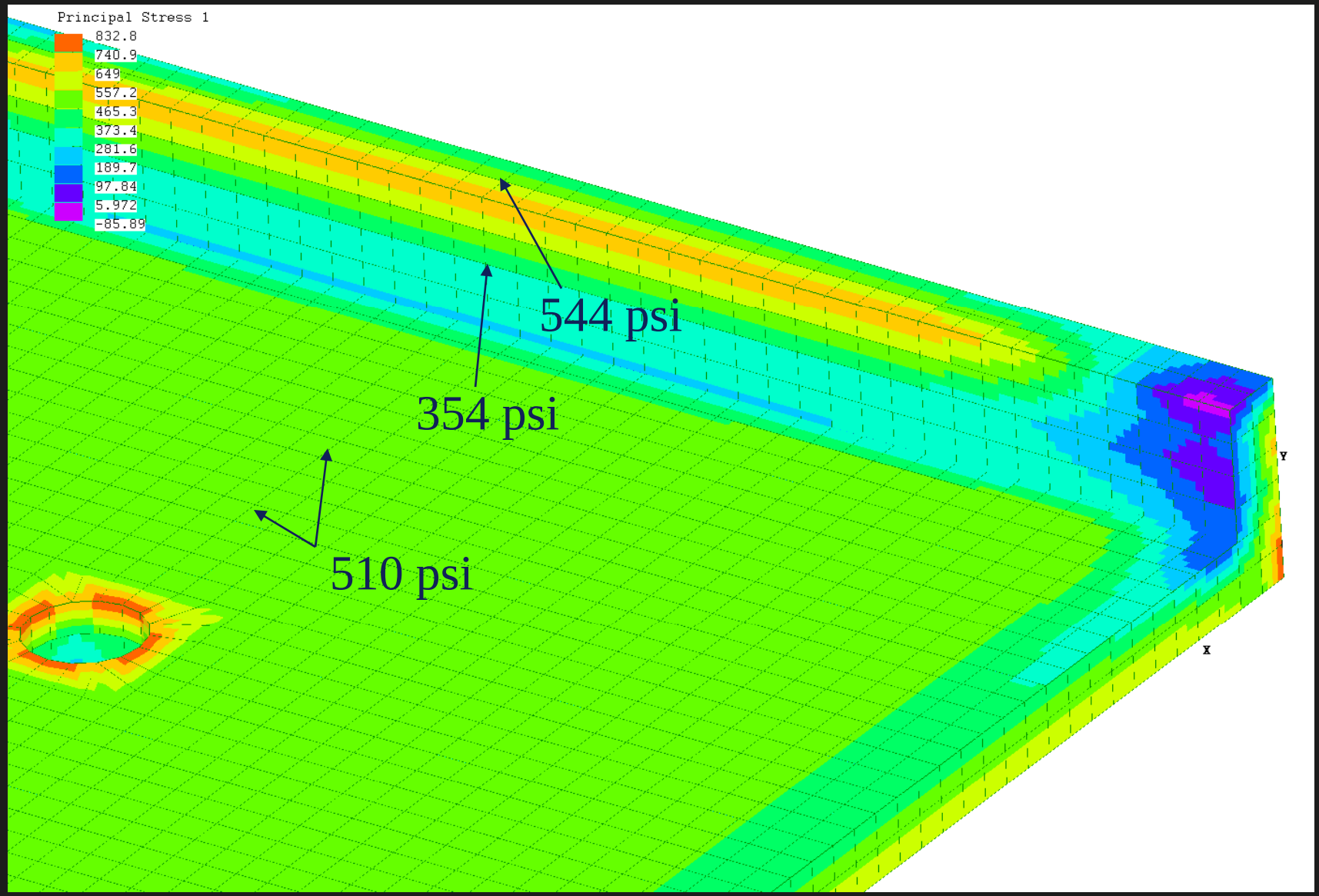
Boundary Conditions

- Pan restrained in vertical direction – all bottom surface nodes set to 0 displacement in y (vertical) direction
- Pan not allowed to curve as a result of shrinkage

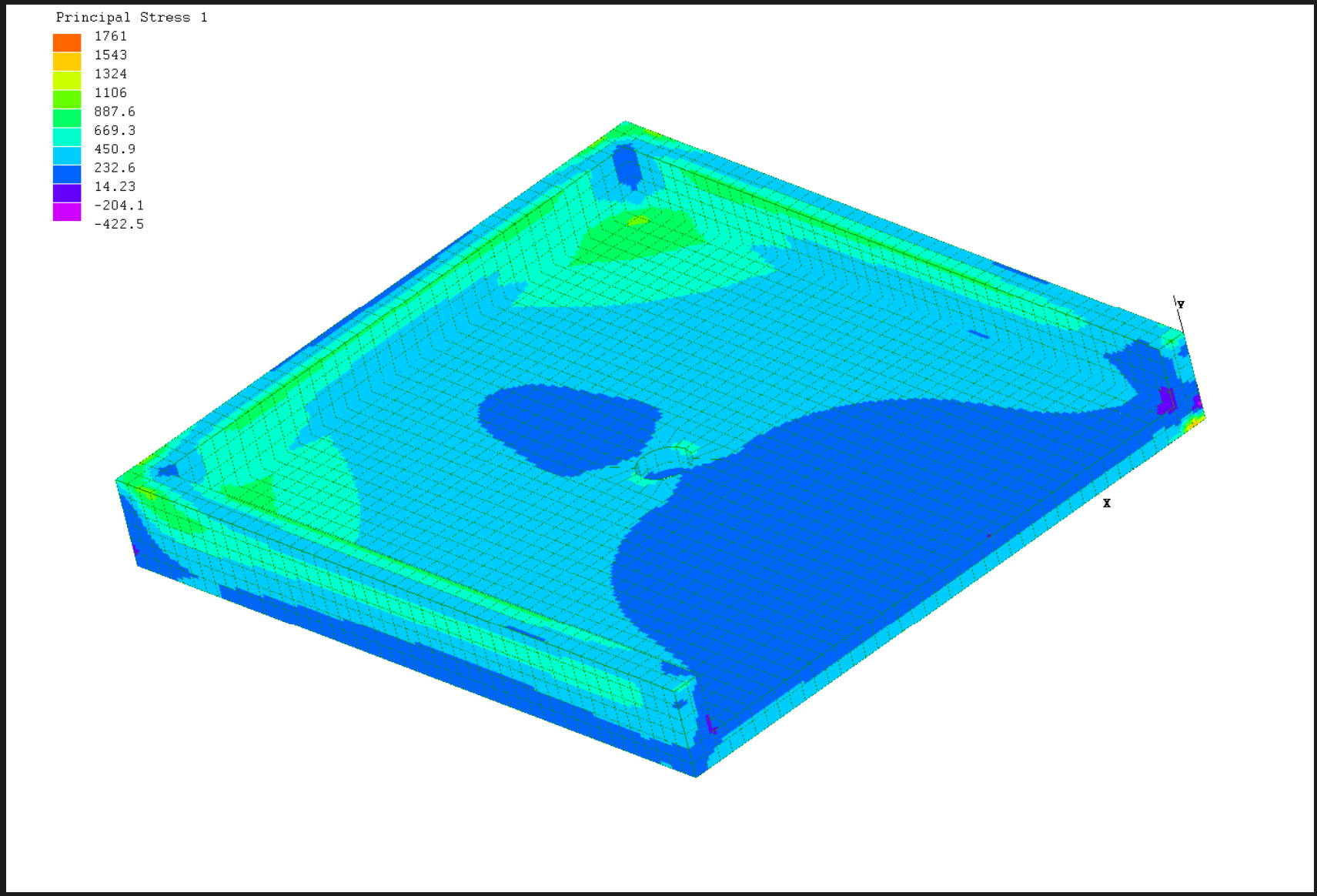
Non Uniform Drying Shrinkage



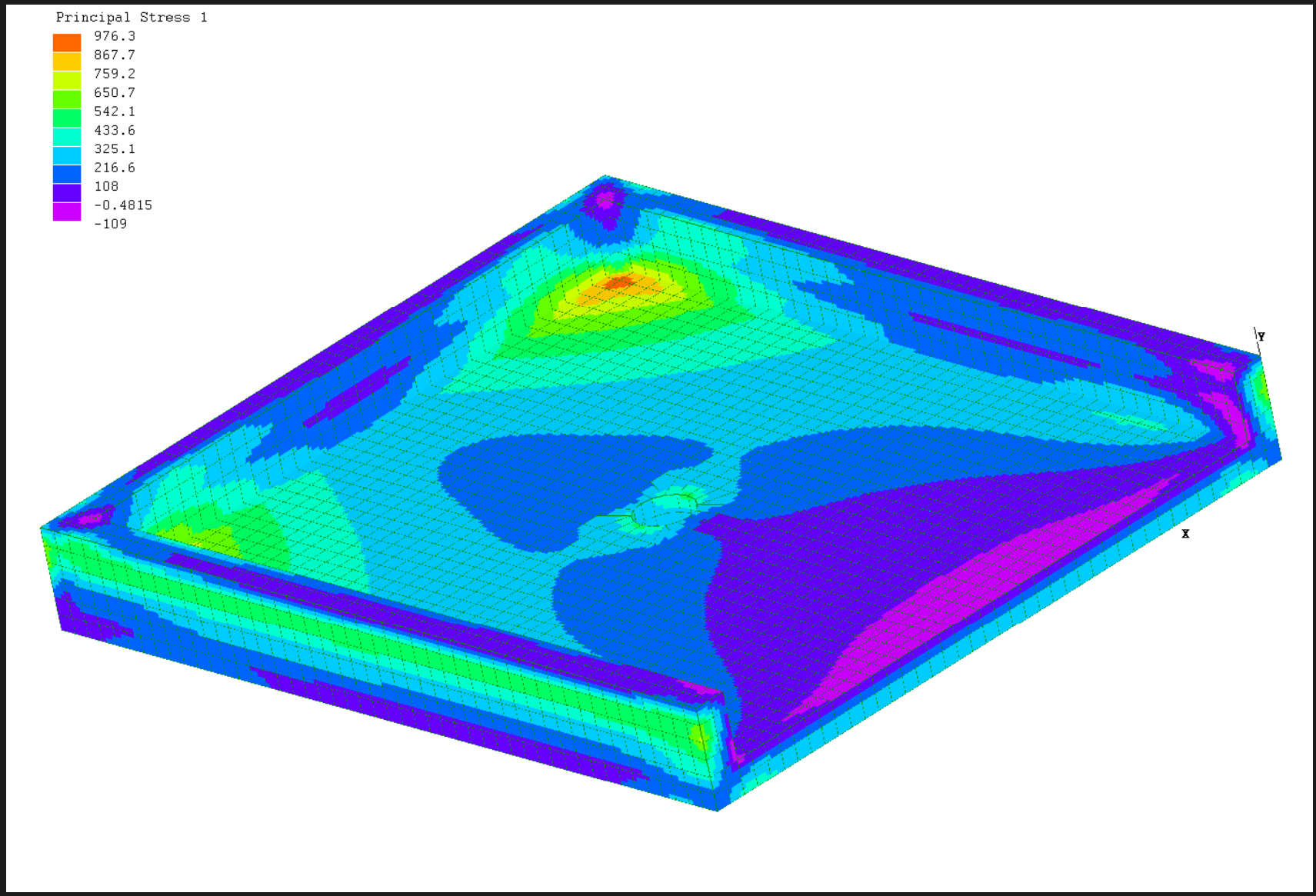
Non Uniform Drying Shrinkage



Vertical Restraint Along Curb



No Vertical Restraint



Remove Shrinkage

- Bending stress
- Upward floor heave
- Upward vertical displacement
  - 2 line deflections crossing at drain
- Curb edge restrained

Upward Heave of Floor .04 Inches