



## 6" Slab

|                                             | Case 1                                   | Case 2                        |
|---------------------------------------------|------------------------------------------|-------------------------------|
| <b><u>Input Values</u></b>                  | <b>6" with #4@18" on center each way</b> | <b>6" with 15 lb/yd Helix</b> |
| <i>Slab Properties</i>                      |                                          |                               |
| Slab Thickness, in                          | 6.0                                      | 6.0                           |
| Width b, in                                 | 12                                       | 12                            |
| <i>Concrete Properties</i>                  |                                          |                               |
| Compressive Strength, psi                   | 4000                                     | 4000                          |
| $\epsilon_c$                                | 0.003                                    | 0.003                         |
| <i>Mesh/Rebar Properties</i>                |                                          |                               |
| Rebar/Mesh Area, in <sup>2</sup>            | 0.20                                     |                               |
| Bar Spacing, in                             | 18                                       |                               |
| Depth, in                                   | 3.0                                      |                               |
| Number of layers of rebar/mesh              | 1                                        |                               |
| Steel Yield Strength, Ksi                   | 60                                       |                               |
| Steel Modulus of Elasticity, ksi            | 29000                                    |                               |
| <i>Helix Properties</i>                     |                                          |                               |
| Dosage, lb/yd <sup>3</sup>                  | 0                                        | 15                            |
| F'e Resistance Factor                       |                                          | 0.5                           |
| Factored Design Strength F'e, psi           | 0                                        | 127                           |
|                                             |                                          |                               |
| <b><u>Calculations</u></b>                  | <b>Case 1</b>                            | <b>Case 2</b>                 |
| <i>Neutral Axis &amp; ACI Stress Block</i>  |                                          |                               |
| $\rho$ (based on h and spacing)             | 0.19%                                    | 0.00%                         |
| Ag equivalent (based on b), in <sup>2</sup> | 72.0                                     | 72.0                          |
| As equivalent (based on b), in <sup>2</sup> | 0.13                                     | 0.00                          |
| $\beta$                                     | 0.85                                     | 0.85                          |
| ec                                          | 0.003                                    | 0.003                         |
| c, in                                       | 0.231                                    | 0.252                         |
| a, in                                       | 0.196                                    | 0.214                         |
| <i>Compressive &amp; Tensile Resistance</i> |                                          |                               |
| Concrete Compression (Cc), kip              | 8.00                                     | 8.73                          |
| Rebar/mesh Tension (T steel), kip           | 8.00                                     | 0.00                          |
| Helix Tension (T helix), kip                | 0.00                                     | 8.73                          |
|                                             |                                          |                               |
| <b><u>Results</u></b>                       | <b>Case 1</b>                            | <b>Case 2</b>                 |
|                                             | <b>6" with #4@18" on center each way</b> | <b>6" with 15 lb/yd Helix</b> |
| Moment Resistance, kip-in                   | 23.2                                     | 26.4                          |
| Percent Increase                            |                                          | 14%                           |
|                                             |                                          |                               |
| First Crack Strength, kip-in                | 34.8                                     | 46.4                          |
| Percent Increase                            |                                          | 33%                           |
|                                             |                                          |                               |
| Shear Strength, kip                         | 8.0                                      | 17.6                          |
| Percent Increase                            |                                          | 120%                          |



## Sample Detailed Calculation:

6" with 15 lb/yd Helix  
1/22/10

### Input Parameters

|                   |           |
|-------------------|-----------|
| Slab Thickness, h | 6 in      |
| $f'_c$            | 4000 psi  |
| $f_y$             | 60 ksi    |
| E steel           | 29000 ksi |
| $\epsilon_c$      | 0.003     |
| b selected        | 12 in     |

### Helix Material Properties

#### Sample Helix Beam Test Data

#### Sample Helix JSCE SF-4 Test Data

| Dosage | Effective Strength |
|--------|--------------------|
| 10     | 183 psi            |
| 15     | 256 psi            |
| 30     | 431 psi            |
| 60     | 647 psi            |

Effective strength this is an average  
measure of the post cracking strength as defined by JSCE SF-4

#### Sample Helix Modulus of Rupture Test Data

| Dosage | Peak Strength |
|--------|---------------|
| 0      | 500 psi       |
| 10     | 610 psi       |
| 15     | 700 psi       |
| 30     | 848 psi       |
| 60     | 1052 psi      |

The modulus of rupture is the peak bending stress

Helix Resistance Factor

0.5 The helix resistance factor is set based on  
material property variations (both in concrete  
and Helix).

JSCE SF-4 Effective Strength

254 psi

$f'_e$ , Helix contribution

127 psi  
Effective Strength x Resistance Factor



Detailed Calculations Continued

### Bending Strength Calculation

|                                        |                                                                                                            |
|----------------------------------------|------------------------------------------------------------------------------------------------------------|
| As, steel area (if applicable)         | in <sup>2</sup><br>Cross sectional area of mesh or rebar steel                                             |
| d, rebar depth (if applicable)         | in<br>depth of rebar or mesh                                                                               |
| Ag, section area                       | 72 in <sup>2</sup><br>Depth X b                                                                            |
| β, stress block constant               | 0.85 per ACI 318<br>If f'c > 8000 beta = 0.65<br>If f'c < 8000 beta = 1.05 - .05*f'c/1000                  |
| c, neutral axis depth                  | 0.252 in<br>$c = \frac{As \cdot fy + fe \cdot b \cdot h}{0.85 \cdot f'c \cdot b \cdot \beta + fe \cdot b}$ |
| a, depth of stress block               | 0.214 in<br>a = beta X c                                                                                   |
| Cc, concrete compressive force         | 8.7 kip<br>Cc = 0.85*f'c/1000*b*a                                                                          |
| Cs, steel compressive force            | 0 kip<br>c < steel depth Cs = 0<br>c > steel depth Cs = As*fy                                              |
| Ts, Tensile contribution of rebar/mesh | 0 kip<br>Cs = 0 Ts = As*Fy<br>Cs non zero Ts = 0                                                           |
| Tf, Tensile contribution of Helix      | 8.73 kip<br>(Helix Contribution/1000)*(h-c)*b                                                              |
| <b>Mn, Moment Strength</b>             | <b>26.4 kip-in</b><br>Sum of the moments<br>Cc*(steel depth-a/2)+Tf*(h-d-(h-c)/2)                          |

### First Crack Strength

|                                      |                                                        |
|--------------------------------------|--------------------------------------------------------|
| MOR, Modulus of Rupture              | 644 psi                                                |
| <b>First Crack Strength (moment)</b> | <b>46.4 kip-in</b><br>(MOR*b*h <sup>2</sup> )/(6*1000) |

### Shear Strength

|                                 |                                          |
|---------------------------------|------------------------------------------|
| Vs, Shear Resistance Rebar/Mesh | 0 kip<br>(As*fy*1000)*(number of layers) |
| Vh, Shear Resistance Helix      | 18 kip                                   |
| <b>Shear Resistance</b>         | <b>18 kip</b><br>Vs+Vh                   |