HELIX™

Side By Side Performance – US Units

Date: May 25, 2012 7URUF

Project Name: **6"Wall**

Input		Rebar/Mesh	Design 1	Design 2
Case Description		6" Wall with 6X6-W2.9XW2.6WWM O.C.	6" Wall with 9 lb/yd Helix	6" Wall with25 lb/yd Helix
Iterative Design Factors				
Section Thickness, h	in	6	6	6
Helix Dosage, Dos	lb/yd^3		**9**	**25**
Beta/ Sigma (2,3 or 4)		3	3	3
Helix Resistance Factor		0.00	0.52	0.74
Concrete Strength,f'c	psi	3000	3000	3000
Rebar/Mesh Input				
Type		6X6-W2.9XW2.6wwm O.C.		
Cross Section Area, a_b	in^2	0.058		
Spacing, s (non zero)	in	12		
Depth, d	in	3		
Number of Layers		1		
Yield Strength, fy	psi	60000		
Resistance Factor		0.9		
Section Width, b	in	12	12	12

Output				
Bending Moment Capacity	**kip-in**	**9.2**	**15.2**	**45.4**
Percent Increase			65%	392%
First Crack Strength	**kip-in**	**32.7**	**37.1**	**43.3**
Percent Increase			13%	32%
Durability	**lb-in**	**63**	**404**	**892**
Percent Increase			546%	1327%
Shear Strength	**kip**	**6.7**	**10.1**	**12.1**
Percent Increase			50%	80%

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Design Summary- Existing Rebar or Mesh Based Design / US Units

Date:	May 25, 2012
Estimated Pour Date:	
Company:	
Project Manager:	
Type of Project:	
Project Size:	
Project Name:	6"Wall
Location:	
Engineer:	
Client:	

Input Summary:

6" Wall with 6X6-W2.9XW2.6WWM O.C.

Output summary:

Helix Dosage	9.0	lb/yd^3	
Thickness	6.0	in	
Added Safety Factors:			*Load factor*
	1.9		*Polytorx ANOVA*

Results:

Bending Moment Capacity	**15.2**	**kip-in**
Durability	**404**	**lb-in**
Shear Strength	**10.1**	**kip**
First Crack Strength, MOR	**37.1**	**kip-in**

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Rebar / Mesh Strength and Durability

Calculated using internationally recognized standards ACI 318-08

6" Wall with 6X6-W2.9XW2.6WWM O.C.

Concrete Input					
Section Thickness, h	6	in			
Section Width, b	12	in			
Concrete Strength, f'_c	3000	psi			
Rebar/Mesh Input					
Rebar Mesh Type:	6X6-W2.9XW2.6wwm O.C.				
	Flexural		Shear		
Cross Section Area, a_b / a_{sv}	0.058	in^2		in^2	
Spacing, s / s_v	12	in		in	
Depth, d	3	in			
Number of Layers, nl	1				
Steel Strength, f_y / f_{yv}	60000	psi		psi	
Steel Resistance Factor, φ / $φ_v$	0.9				
Calculations					
Equivalent Steel Area, a_s	0.06	in^2	$a_s = a_b \times b / s$		
Factored Yield Strength, φ f_y	54000	psi	$\varphi f_y = \varphi \times f_y$		
Stress Block Constant, β	0.90		$\beta = 1.05 – 0.05\ F'_c/1000$		
Neutral Axis Depth, c	0.1	in	$c = (a_s \times \varphi f_y) / (0.85\ F'_c \times b \times \beta)$		
Stress Block Depth, a	0.1	in	$a=\beta \times c$		
Concrete Compression	3.13	kip	$Cc=0.85 \times f'_c \times (b \times a) / 1000$		
Rebar/Mesh Tension	3.13	kip	$Ts=a_s \times \varphi f_y / 1000$		

Bending Moment Capacity, M_n	**9.2**	**kip-in**	$M_n = Cc \times (d-a/2)/1000 \times (1.05 \text{ for 2 layers})$ if $a_s = 0$ then a is set to zero
Durability, D	**63**	**lb-in**	$D = (0.002 \times bh^2/12*8.3\sqrt{f'c})/2$ $+(0.08 \times 0.5 \times Mn/4 \times 1000)/2$
Shear Strength, V_n	**6.7**	**kip**	$Vn =b \times h\ 2 \sqrt{f'c} + asv \times fyv/1000 \times (h-d)/s$
First Crack Strength, MOR	**32.7**	**kip-in**	$MOR = b \times h^2 \times 8.3\sqrt{f'c} / 6 / 1000$

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Helix Strength and Durability

Calculated using internationally recognized standards - JSCE SF-4, JSCE SF-6, ACI 318-08

6” Wall with 9 lb/yd Helix

Inputs			
Helix Dosage	9.0	lb/yd³	*iterative*
Section Thickness, h	6	in	*iterative*
Compressive Strength, F'_c	3000	psi	*specified*
Helix Safety factor, H_φ	0.52		*Polytorx ANOVA*
Width, b	12.0	in	*specified*
Helix Properties (see page 4)			
Residual Strength, $H_{F'_e}$	140.3	psi	*JSCE SF-4*
Factored Residual Strength, $fH_{F'_e}$	72.6	psi	$fH_{F'_e} = H_{F'_e} \times H_\varphi$
Shear Strength, H_V	89.85	psi	*JSCE SF-6*
Durability, H_D	59.9	lb-in	*JSCE SF-4*
First Crack Strength, H_{MOR}	514.7	psi	*JSCE SF-4*
Calculations			
Section Area, a_g	72	in3	$a_g = h \times b$
Stress Block Constant, β	0.90		$B = 1.05 – 0.05\ F'_c/1000$
Neutral Axis Depth, c	0.2	in	$c = (fH_{F'_e} \times b \times h) / (0.85\ F'_c \times b \times \beta + fH_{F'_e} \times b)$
Stress Block Depth, a	0.17	in	$a = \beta \times c$
Concrete Compression, Cc	5	kip	$Cc = 0.85 \times f'_c \times (b \times a) / 1000$
Helix Tension, T_h	5	kip	$T_h = fH_{F'_e} \times (h – c) \times b / 1000$

Bending Moment Capacity, M_n	**15.2**	**kip-in**	$M_n = T_h \times (h – (h – c)/2 - a/2)$
Increase	**65%**		
Durability, D	**404**	**lb-in**	$D = H_d \times (b/4in) \times (h/4in)^2$
Increase	**546%**		
Shear Strength, V_n	**10.1**	**kip**	$Vn = b \times h\ (2 \sqrt{f'c} + Phi \times Hv) + asv \times fyv/1000 \times (d-(h-d))/s \times 0.85$
Increase	**50%**		
First Crack Strength, MOR	**37.1**	**kip-in**	$MOR = b \times h^2 \times H_{MOR} / 6 / 1000$
Increase	**13%**		

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Side By Side Performance – US Units

Date: May 25, 2012 7URUF

Project Name: **24”W X 20”DFooting**

Input		Rebar/Mesh	Design 1	Design 2
Case Description		20”Footing with 3-#5@6”Bottom @3”cover	20”Footing with 28 lb/yd Helix	20”Footing with 35 lb/yd Helix
Iterative Design Factors				
Section Thickness, h	in	20	20	20
Helix Dosage, Dos	lb/yd^3		**28**	**35**
Beta/ Sigma (2,3 or 4)		3	3	3
Helix Resistance Factor		0.00	0.76	0.81
Concrete Strength,f'c	psi	4000	4000	4000
Rebar/Mesh Input				
Type		3- #5@6” @3”cover		
Cross Section Area, a_b	in^2	0.310		
Spacing, s (non zero)	in	6		
Depth, d	in	16.69		
Number of Layers		1		
Yield Strength, fy	psi	60000		
Resistance Factor		0.9		
Section Width, b	in	24	24	24

Output				
Bending Moment Capacity	**kip-in**	**1089.9**	**1161.1**	**1465.2**
Percent Increase			7%	34%
First Crack Strength	**kip-in**	**839.9**	**1139.7**	**1209.2**
Percent Increase			36%	44%
Durability	**lb-in**	**5870**	**21798**	**26395**
Percent Increase			271%	350%
Shear Strength	**kip**	**51.6**	**95.4**	**100.5**
Percent Increase			85%	95%

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Design Summary- Existing Rebar or Mesh Based Design / US Units

Date:	May 25, 2012
Estimated Pour Date:	
Company:	
Project Manager:	
Type of Project:	
Project Size:	
Project Name:	24"W X 20"DFooting
Location:	
Engineer:	
Client:	

Input Summary:

20"Footing with 3- #5@6"Bottom @3"cover

Output summary:

Helix Dosage	28.0	lb/yd^3	
Thickness	20.0	in	
Added Safety Factors:			*Load factor*
	1.3		*Polytorx ANOVA*

Results:

Bending Moment Capacity	**1,161.1**	**kip-in**
Durability	**21,798**	**lb-in**
Shear Strength	**95.4**	**kip**
First Crack Strength, MOR	**1,139.7**	**kip-in**

HELIX™

Rebar / Mesh Strength and Durability

Calculated using internationally recognized standards ACI 318-08

20"Footing with 3- #5@6"Bottom @3"cover

Concrete Input

Section Thickness, h	20	in			
Section Width, b	24	in			
Concrete Strength, f'_c	4000	psi			

Rebar/Mesh Input

Rebar Mesh Type:	3- #5@6" @3"cover				
	Flexural		Shear		
Cross Section Area, a_b / a_{sv}	0.310	in^2		in^2	
Spacing, s / s_v	6	in		in	
Depth, d	16.69	in			
Number of Layers, nl	1				
Steel Strength, f_y / f_{yv}	60000	psi		psi	
Steel Resistance Factor, φ / $φ_v$	0.9				

Calculations

Equivalent Steel Area, a_s	1.24	in^2	$a_s = a_b \times b / s$
Factored Yield Strength, φ f_y	54000	psi	$\varphi f_y = \varphi \times f_y$
Stress Block Constant, β	0.85		$\beta = 1.05 - 0.05\ F'_c/1000$
Neutral Axis Depth, c	1.0	in	$c = (a_s \times \varphi f_y) / (0.85\ F'_c \times b \times \beta)$
Stress Block Depth, a	0.82	in	$a = \beta \times c$
Concrete Compression	66.96	kip	$Cc = 0.85 \times f'_c \times (b \times a) / 1000$
Rebar/Mesh Tension	66.96	kip	$Ts = a_s \times \varphi f_y / 1000$

Bending Moment Capacity, M_n	**1,089.9**	**kip-in**	$M_n = Cc \times (d-a/2)/1000 \times (1.05 \text{ for 2 layers})$ *if* $a_s = 0$ *then a is set to zero*
Durability, D	**5,870**	**lb-in**	$D = (0.002 \times bh^2/12*8.3\sqrt{f'c})/2$ $+(0.08 \times 0.5 \times Mn/4 \times 1000)/2$
Shear Strength, V_n	**51.6**	**kip**	$Vn = b \times h\ 2\ \sqrt{f'c} + asv \times fyv/1000 \times (h-d)/s$
First Crack Strength, MOR	**839.9**	**kip-in**	$MOR = b \times h^2 \times 8.3\sqrt{f'c} / 6 / 1000$

HELIX™

Helix Strength and Durability

Calculated using internationally recognized standards - JSCE SF-4, JSCE SF-6, ACI 318-08

20”Footing with 28 lb/yd Helix

Inputs			
Helix Dosage	28.0	lb/yd³	*iterative*
Section Thickness, h	20	in	*iterative*
Compressive Strength, F'_c	4000	psi	*specified*
Helix Safety factor, H_φ	0.76		*Polytorx ANOVA*
Width, b	24.0	in	*specified*
Helix Properties (see page 4)			
Residual Strength, $H_{F'_e}$	340.6	psi	*JSCE SF-4*
Factored Residual Strength, $fH_{F'_e}$	260.5	psi	$fH_{F'_e} = H_{F'_e} \times H_\varphi$
Shear Strength, H_V	119.4	psi	*JSCE SF-6*
Durability, H_D	145.3	lb-in	*JSCE SF-4*
First Crack Strength, H_{MOR}	712.3	psi	*JSCE SF-4*
Calculations			
Section Area, a_g	480	in3	$a_g = h \times b$
Stress Block Constant, β	0.85		$B = 1.05 – 0.05\ F'_c/1000$
Neutral Axis Depth, c	1.7	in	$c=(fH_{F'_e} \times b \times h) / (0.85\ F'_c \times b \times \beta + fH_{F'_e} \times b)$
Stress Block Depth, a	1.41	in	$a=\beta \times c$
Concrete Compression, Cc	115	kip	$Cc=0.85 \times f'_c \times (b \times a) / 1000$
Helix Tension, T_h	115	kip	$T_h = fH_{F'_e} \times (h – c) \times b / 1000$

Bending Moment Capacity, M_n	**1,161.1**	**kip-in**	$M_n = T_h \times (h – (h – c)/2-a/2)$
Increase	**7%**		

Durability, D	**21,798**	**lb-in**	$D = H_d \times (b/4in) \times (h/4in)^2$
Increase	**271%**		

Shear Strength, V_n	**95.4**	**kip**	$Vn =b \times h (2 \sqrt{f'c} + Phi \times Hv)+asv \times fyv/1000 \times (d-(h-d))/s \times 0.85$
Increase	**85%**		

First Crack Strength, MOR	**1,139.7**	**kip-in**	$MOR = b \times h^2 \times H_{MOR} / 6 / 1000$
Increase	**36%**		

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Side By Side Performance – US Units

Date:	May 25, 2012	7URUF
Project Name:	Slab-on-Grade	

Input		Rebar/Mesh	Design 1	Design 2
Case Description		6"SOG with 2-Layers 6X6-W1.4XW1.4 WWM	6"SOG with 9 lb/yd Helix	6"SOG with 25 lb/yd Helix
Iterative Design Factors				
Section Thickness, h	in	6	6	6
Helix Dosage, Dos	lb/yd³		**9**	**25**
Beta/ Sigma (2,3 or 4)		2	2	2
Helix Resistance Factor		0.00	0.64	0.80
Concrete Strength,f'c	psi	3000	3000	3000
Rebar/Mesh Input				
Type		6X6-W1.4XW1.4 WWM		
Cross Section Area, a_b	in^2	0.028		
Spacing, s (non zero)	in	12		
Depth, d	in	4.41		
Number of Layers		2		
Yield Strength, fy	psi	60000		
Resistance Factor		0.9		
Section Width, b	in	12	12	12

Output				
Bending Moment Capacity	**kip-in**	**7.0**	**18.7**	**48.9**
Percent Increase			169%	602%
First Crack Strength	**kip-in**	**32.7**	**37.1**	**43.3**
Percent Increase			13%	32%
Durability	**lb-in**	**51**	**404**	**892**
Percent Increase			689%	1643%
Shear Strength	**kip**	**6.7**	**10.8**	**12.6**
Percent Increase			62%	87%

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Design Summary- Existing Rebar or Mesh Based Design / US Units

Date:	May 25, 2012
Estimated Pour Date:	
Company:	
Project Manager:	
Type of Project:	
Project Size:	
Project Name:	Slab-on-Grade
Location:	
Engineer:	
Client:	

Input Summary:

6"SOG with 2-Layers 6X6-W1.4XW1.4 WWM

Output summary:

Helix Dosage	9.0	lb/yd^3	
Thickness	6.0	in	
Added Safety Factors:			*Load factor*
	1.6		*Polytorx ANOVA*

Results:

Bending Moment Capacity	**18.7**	**kip-in**
Durability	**404**	**lb-in**
Shear Strength	**10.8**	**kip**
First Crack Strength, MOR	**37.1**	**kip-in**

HELIX™

Rebar / Mesh Strength and Durability

Calculated using internationally recognized standards ACI 318-08

6"SOG with 2-Layers 6X6-W1.4XW1.4 WWM

Concrete Input

Section Thickness, h	6	in			
Section Width, b	12	in			
Concrete Strength, f'_c	3000	psi			

Rebar/Mesh Input

Rebar Mesh Type:	6X6-W1.4XW1.4 WWM				
	Flexural			Shear	
Cross Section Area, a_b / a_{sv}	0.028	in^2			in^2
Spacing, s / s_v	12	in			in
Depth, d	4.41	in			
Number of Layers, nl	2				
Steel Strength, f_y / f_{yv}	60000	psi			psi
Steel Resistance Factor, φ / $φ_v$	0.9				

Calculations

Equivalent Steel Area, a_s	0.03	in^2	$a_s = a_b \times b / s$
Factored Yield Strength, φf_y	54000	psi	$\varphi f_y = \varphi \times f_y$
Stress Block Constant, β	0.90		$\beta = 1.05 – 0.05\ F'_c/1000$
Neutral Axis Depth, c	0.1	in	$c = (a_s \times \varphi f_y) / (0.85\ F'_c \times b \times \beta)$
Stress Block Depth, a	0.05	in	$a=\beta \times c$
Concrete Compression	1.51	kip	$Cc=0.85 \times f'_c \times (b \times a) / 1000$
Rebar/Mesh Tension	1.51	kip	$Ts=a_s \times \varphi f_y / 1000$

Bending Moment Capacity, M_n	**7.0**	**kip-in**	$M_n = Cc \times (d-a/2)/1000 \times (1.05 \text{ for 2 layers})$ if $a_s = 0$ then a is set to zero
Durability, D	**51**	**lb-in**	$D = (0.002 \times bh^2/12*8.3\sqrt{f'c})/2$ $+(0.08 \times 0.5 \times Mn/4 \times 1000)/2$
Shear Strength, V_n	**6.7**	**kip**	$Vn =b \times h\ 2 \sqrt{f'c} + asv \times fyv/1000 \times (h-d)/s$
First Crack Strength, MOR	**32.7**	**kip-in**	$MOR = b \times h^2 \times 8.3\sqrt{f'c} / 6 / 1000$

HELIX™

Helix Strength and Durability

Calculated using internationally recognized standards - JSCE SF-4, JSCE SF-6, ACI 318-08

6”SOG with 9 lb/yd Helix

Inputs			
Helix Dosage	9	lb/yd³	*iterative*
Section Thickness, h	6	in	*iterative*
Compressive Strength, F'_c	3000	psi	*specified*
Helix Safety factor, H_φ	0.64		*Polytorx ANOVA*
Width, b	12.0	in	*specified*
Helix Properties (see page 4)			
Residual Strength, $H_{F'_e}$	140.3	psi	*JSCE SF-4*
Factored Residual Strength, $fH_{F'_e}$	89.7	psi	$fH_{F'_e} = H_{F'_e} \times H_\varphi$
Shear Strength, H_V	89.85	psi	*JSCE SF-6*
Durability, H_D	59.9	lb-in	*JSCE SF-4*
First Crack Strength, H_{MOR}	514.7	psi	*JSCE SF-4*
Calculations			
Section Area, a_g	72	in3	$a_g = h \times b$
Stress Block Constant, β	0.90		$B = 1.05 – 0.05\ F'_c/1000$
Neutral Axis Depth, c	0.2	in	$c=(fH_{F'_e} \times b \times h) / (0.85\ F'_c \times b \times \beta + fH_{F'_e} \times b)$
Stress Block Depth, a	0.2	in	$a=\beta \times c$
Concrete Compression, Cc	6	kip	$Cc=0.85 \times f'_c \times (b \times a) / 1000$
Helix Tension, T_h	6	kip	$T_h = fH_{F'_e} \times (h – c) \times b / 1000$

Bending Moment Capacity, M_n	**18.7**	**kip-in**	$M_n = T_h \times (h – (h – c)/2-a/2)$
Increase	**169%**		

Durability, D	**404**	**lb-in**	$D = H_d \times (b/4in) \times (h/4in)^2$
Increase	**689%**		

Shear Strength, V_n	**10.8**	**kip**	$Vn = b \times h\ (2 \sqrt{f'c} + Phi \times Hv)+asv \times fyv/1000 \times (d-(h-d))/s \times 0.85$
Increase	**62%**		

First Crack Strength, MOR	**37.1**	**kip-in**	$MOR = b \times h^2 \times H_{MOR} / 6 / 1000$
Increase	**13%**		