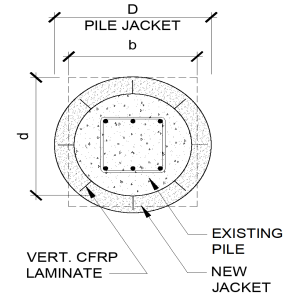


Confinement & Shear Strengthening of a Concrete Pile using the SCS System

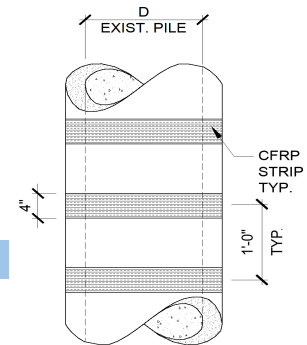
Existing pile size, properties and capacity:

$D_{Existing\ Pile} =$	24 in	24" Dia. w/ 6 #8 & #3 ties @12"oc
$f'_{c, Existing\ Pile} =$	4,000 psi	Existing concrete compressive strength
$f_y, Existing\ Pile =$	60,000 psi	Yield Strength of existing Reinforcement
$A_{sv} =$	0.11 in ²	Area of existing shear reinforcement (#3)
$\phi =$	0.65	Strength reduction factor
$\phi V_{n, Existing} =$	53 kips	Original shear capacity of existing pile



New epoxy grout Jacket & CFRP strips size & properties:

$f'_c =$	9,500 psi	Compressive strength (7 Days)
$D_{Pile\ Jacket} =$	32 in.	
$b, d =$	819 in	For circular sections: $b, d = 0.8D^2_{Pile\ Jacket}$
$t_f =$	0.040 in	Nominal thickness of CFRP strips
$w_f =$	4 in	Nominal width of CFRP strips
$n =$	2	
$A_{fv} = 2nt_f w_f =$	0.640 in ²	
$s_f =$	12 in	Spacing between CFRP strips
$E_f =$	14,200,000 psi	Tensile modulus of CFRP
$d_{eq} =$	25.67 in.	From Flexural Calcs



Determine shear strength:

$f_{tu}^* =$	128,000 psi	CFRP Tensile Strength
$\Rightarrow \phi =$	0.65	Strength Reduction Factor per ACI 318 9.3.2.3
$\psi_f =$	0.95	Add'l Reduction Factor, ACI 440.2R-Tab.11.3
$\epsilon_{fe} =$	0.0040	
$f_{fe} = \epsilon_{fe} E_f =$	56,800 psi	Nominal Shear strength per ACI 440.2R (11-4d)
$V_f = A_{fv} f_{fe} (d_{fv}/s_f) =$	77,762 lbs	ACI 440.2R (11.4a)
$V_{f, Max} = 8(f'_c)^{0.5} b d =$	638,766 lbs	ACI 440.2R-17 (11.4.3)
$V_c = 2(f'_c)^{0.5} b d =$	71,549 lbs	
$\phi V_n = \phi(V_c + \psi V_f) =$	95 kips	Design shear strength; ACI 440.2R-17 (11-3b)

Comparison of shear strength (Existing pile vs. SCS system):

$\phi V_{n, Existing} =$	53 kips	Shear capacity of existing pile (Original)
$\phi V_{n, Jacket} =$	95 kips	Shear capacity of new SDS jacket system only
$n = V_{n, Jacket} / V_{n, Existing} =$	177%	Shear strength increase ratio (%)