

WALL / SLAB REINFORCEMENT DESIGN TEMPLATE

REF. 1. ACI 318 Building Code and Commentary
2. ACI 350 Code Requirements for Environmental Structures

Password: obgmbi
Please Fill in the gray boxes.

Client Name:	U.S. ARMY CORPS OF ENGINEERS	Design By:	MBI
Project Name:	FARGO – MOORHEAD , FEASIBILITY STUDY, PHASE 4	Review By:	
Work Description:	Sheyenne Aquaduct Structure - Walls and Piers	Date:	2/14/2011
		Job #:	34091004

Cross Section Properties		Material Properties		Factors					
Height	h (in)	36	in	Concrete	f'_c (ksi)	4	ksi	ϕ Flex	0.9
Width	b (in)	12	in	Steel	E (ksi)		ksi	ϕ Shear	0.75
Section as		Wall Section			f_y (ksi)	60	ksi	Governing Code	
Section Modulus	S (in ³)	2592 in ³			E (ksi)	29000	ksi	ACI 350- 01	
Design Forces									
Shear	Vu (kips)	35							
Moment	Mu (k-ft/ft)	156.88							

Flexural Reinforcement Design		Minimum Required Steel				
Cover	3	in	$3fc'^{1/2}/fy =$	0.00316	$200/fy =$	0.00333
Length Bet. Mov. Jt.	50	ft	$\rho_{min Flex} =$	0.0033333	$A_s min Flex =$	1.308 in ²
Bar index	# 5		$\rho_{min T\&S} =$	0.005	$A_s min T\&S =$	0.720 in ²
d (Tension Reinf.)	32.6875	in	$\rho_{Balance} =$	0.0285068	$A_s max =$	11.1818 in ²
Design Mom. (Fact.)	156.88	kip-ft / ft	Rn	0.163	Constant	0.096
					OK	
a	1.608	in	$A_s Required =$	1.093 in ²	$\rho Required =$	0.00279
k	0.049		$A_s Provide =$	1.308 in ²		
j	0.98		$A_s Selected =$	# 9	$A_s Selected =$	2.000 in ²
Moment Calculated	156.88	kip-ft	Spacing @	6	in	< Amax
Difference Δ	0.000		Spacing is OK per ACI 318			
a'	2.941		Tension controlled $\phi = 0.9$			
β_1	0.85		Same as f assumed initially, OK.			
c	3.460					
ϵ_t	0.0253	>	0.005			
ϕM_n	280.95	kip-ft / ft	>	Design Moment, Section OK		

Cracking moment Capacity		Flexural Moment Capacity			
$f_r =$	474.34	psi	$A_s Selected =$	2.000	in ²
$M_r Cracking =$	102.46	k-ft	$M_u Flex =$	280.95	k-ft

Shear Reinforcement Design		
Vc	49.62	kip
ϕ Shear	0.75	
ϕVc	37.21	kip
Vs	9.45	kip
		Vu = 35.00 kip

Minimum Shear Reinforcement		11.4.6 — Minimum shear reinforcement	
11.4.6.1 — A minimum area of shear reinforcement, $A_{v,min}$, shall be provided in all reinforced concrete flexural members (prestressed and nonprestressed) where V_u exceeds $0.5\phi V_c$, except in members satisfying one or more of (a) through (f):		Is any of the requirements (a thru f) satisfied? <input checked="" type="checkbox"/> YES	
(a) Footings and solid slabs;		$Av Min / s =$	0.0095
(b) Hollow-core units with total untopped depth not greater than 12.5 in. and hollow-core units where V_u is not greater than $0.5\phi V_{cw}$;		OR	$50bw/ft =$
(c) Concrete joist construction defined by 8.13;			0.010
(d) Beams with h not greater than 10 in.;		No Shear reinforcement required.	
(e) Beam integral with slabs with h not greater than 24 in. and not greater than the larger of 2.5 times thickness of flange, and 0.5 times width of web;		Spacing Requirement	
(f) Beams constructed of steel fiber-reinforced, normalweight concrete with f'_c not exceeding 6000 psi, h not greater than 24 in., and V_u not greater than $\phi 2\sqrt{f'_c} b_w d$.		$s = d/2$	16.34375 in
		$4fc'^{0.5}bw*d$	99.23 kip
		$smax =$	17.00 in
		OR	$Vs =$
		$Av Min =$	0.17 in ²
		$Av/s = Vs/ft*d$	0.0048
		$Av Required =$	0.08 in ²
		$Av Provide =$	0.17 in ²
		Stirrup Size	# 3
		# Legs	2
		$A_s Selected =$	0.220 in ²
		> Av Provide, OK	

Calculation of Moment Capacity with Min. Reinforcement			
Analyze as a	8		
1	$\rho_{min Flex}$	0.00333	Flexural Members
2	$\rho_{min Wall Ver.}$	0.0015	Wall Vertical (ACI 318 Section 14.3.2)
3	$\rho_{min Wall Hor.}$	0.0025	Wall Horizontal (ACI 318 Section 14.3.2)
4	$\rho_{min Slab T\&S}$	0.0018	Temp. & Shrink for Slabs (ACI 318 Section 7.12.2.1)
5	$\rho_{min Wall Ver.}$	0.003	Wall Vertical (ACI 350 Section 14.3.2)
6	$\rho_{min Wall Hor.}$	0.005	Wall Horizontal (ACI 350 Section 14.3.3)
7	$\rho_{min Slab T\&S}$	0.0018	Temp. & Shrink (ACI 318 Section 7.12.2.1)
8	Select Reinforcement Below		
$A_s Selected$	# 9	@	12 in
			$A_s Selected = 1$ in ²
Than ρ_{min}	0.00000		
$A_s = \rho_{min} * bd$ or bh	1.0000	in ²	One Face Only $A_s =$
			0.5 in ²
$T = A_s * fy$	60.000	kip	$T = A_s * fy$
			30.000 kip
$a = T / (0.85 b fc')$	1.471	in	$a = T / (0.85 b fc')$
			0.735
$M = T*(d-a/2)$	159.761	kip-ft	$M = T*(d-a/2)$
			80.800 kip-ft
$M_u = \phi * M$	143.785	kip-ft	$M_u = \phi * M$
			72.720 kip-ft