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 Describtion:	**Sheyenne Aquaduct Structure - Tributary Channel Deck**	**Date:**	**2/14/2011**
		Job #:	**34091004**

Cross Section Properties			
Height	h (in)	24	in
Width	b (in)	12	in
Section as		Slab Section	
Section Modulus	S (in3)	1152	in^3
Design Forces			
Shear	Vu (kips)	35	kip
Moment	Mu (k-ft/ft)	145.4	kip-ft / ft

Material Properties			
Concrete	f_c' (ksi)	4	ksi
	E (ksi)		ksi
Steel	f_y (ksi)	60	ksi
	E (ksi)	29000	ksi
	n	9	

Factors	
ϕFlex	0.9
ϕShear	0.75
Governing Code	
ACI 350- 01	

Flexural Reinforcement Design

Cover	3	in	*Minimum Required Steel*			
Length Bet. Mov. Jt.	50	ft	$3fc'^{1/2}/fy$ =	0.00316	200/fy =	0.00333
Bar index	# 5		$\rho_{min\ Flex}$ =	0.0033333	$A_{s\ min\ Flex}$ =	0.828 in^2
d (Tension Reinf.)	20.6875	in	$\rho_{min\ T\&S}$ =	0.005	$A_{s\ min\ T\&S}$ =	0.720 in^2
Design Mom. (Fact.)	145.4	kip-ft / ft	$\rho_{Balance}$ =	0.0285068	$A_{s\ max}$ =	7.07681 in^2
			Rn	0.377	Constant	0.222
					OK	
a	2.441	in	**$A_{s\ Required}$ =**	1.660 in^2	ρ Required =	0.00669
k	0.118		$A_{s\ Provide}$ =	**1.660** in^2		
j	0.94					
Moment Calculated	145.40	kip-ft	$A_{s\ Selected}$ =	# 9	$A_{s\ Selected}$ =	2.000 in^2
Difference Δ	**0.000**		Spacing @	6 in	**< Amax**	
a'	2.941		**Spacing is OK per ACI 318**			
β_1	0.85					
c	3.460		**Tension controlled**		ϕ	**0.9**
ε_t	0.0149	>	0.005		**Same as f assumed initially, OK.**	
ϕM_n	172.95	kip-ft / ft	>	Design Moment, Section OK		

Cracking moment Capacity

$f_{r\ =}$	474.34	psi	
$M_{r\ Cracking\ =}$	45.54	k-ft	

Flexural Moment Capacity

$A_{s\ Selected\ =}$	2.000	in^2
$M_{u\ Flex\ =}$	172.95	k-ft

Shear Reinforcement Design

Vc	31.40	kip				
ϕShear	0.75					
ϕVc	23.55	kip	<	Vu =	35.00	kip
Vs	23.12	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):

(a) Footings and solid slabs;

(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 $0.5\phi V_{cw}$;

(c) Concrete joist construction defined by 8.13;

(d) Beams with h not greater than 10 in.;

(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;

(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 $\phi 2\sqrt{f_c'}\,b_w d$.

Is any of the requirements (a thru f) satisfied? YES

Av Min / s =	0.0095	OR	50bw/fyt=	0.010	
Av Min/s =	0.01				

Shear Reinforcement Required

Spacing Requirement

s = d/2	10.34375 in	OR	24	in	
4fc'^0.5*bw*d	62.80 kip	>	Vs =	23.12	kip
smax =	11.00 in				
$A_{v\ Min\ =}$	0.11 in^2				
Av/s = Vs/fyt*d	0.0186				
$A_{v\ Required\ =}$	0.20 in^2	$A_{v\ Provide\ =}$	0.20	in^2	
Stirrup Size	# 3	$A_{s\ Selected\ =}$	0.220	in^2	
# Legs	2	**> Av Provide, OK**			

Calculation of Moment Capacity with Min. Reinforcement

Analize 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*** As=	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)	99.761	kip-ft	M = T*(d-a/2)	50.800	kip-ft
$M_u = \phi$*M	89.785	kip-ft	$M_u = \phi$*M	45.720	kip-ft