

CONCRETE DESIGN CALCULATOR: Quiz-4 Solution Section (3)



Select Strength:	$f_y = 60000 \text{ psi}; f_c = 4000 \text{ psi}$	Select design ρ :	ρ_{max}	Select Load Case:	$1.2D + 1.4L$
$f_y = 60000$	$F_y = 4000$	Design $\rho = 0.0069$		Est $w_s [k/ft] = 1.78$	
$\rho_{max} = 0.0033$	$\rho_{max} = 0.0181$	Design $R_n = 388.79$		$M_u [ft-k] = 227.8$	
$R_n \text{ of } \rho_{max} [psi] = 192.2$	$R_n \text{ of } \rho_{max} [psi] = 952.0$	$b_w d^3 = 7813.549$		$M_u [ft-k] = 253.2$	
		$d = 22.10$		Density [pcf] 150	

Enter Givens & Estimates:

$w_s [k/ft]$	0.55	$b_w [in]$	14	$b_{eff} [in]$	80
$w_s [k/ft]$	0.4	$h [in]$	27	$t [in]$	3
Length [ft]	32	$d [in]$	24	$a [in]$	0.49
Clear Cover [in]	3	$A_g [in^2]$	2.65	β_1	0.85
Est Self Wt [pcf]	400	$A_{s,max} [in^2]$	1.214	$c [in]$	0.57
Actual Self Wt [pcf]	450.00	$A_{s,max} [in^2]$	1.280	e_s	0.1227
		$\phi M_u [ft-k]$	253.36		

Neutral Axis Calculations:

T [kips]	142.2	$z [in] =$	21.60
$A_g [in^2]$	41.8	$z [in] =$	22.50
$A_{s,req} [in^2]$	240	Governing z	22.50

N.A. is in the flange

Select A_s in Tension:

BAR	Qty	$A_s [in^2]$
#8	3	2.37

If $a < ht$

$A_s [in^2]$	2.6496
--------------	--------

If $a > t$	
$A_{s,req} [in^2]$	10.88
$M_{u,max} [k-ft]$	1224.00
$M_{u,r} [k-ft]$	996.16
R_n	1441.20
$\rho_s =$	0.03
$a [in]$	14.64
$c [in]$	17.22
e_s	0.00
$A_{s,req} [in^2]$	13.27
$A_s [in^2]$	24.15

Bar Selection:

BAR	Number of Bars in a Single Layer of Reinforcing													
	2		3		4		5		6		7		8	
	Area	Width	Area	Width	Area	Width	Area	Width	Area	Width	Area	Width	Area	Width
#4	0.39	6.80	0.58	8.30	0.78	9.80	0.98	11.30	1.18	12.80	1.37	14.30	1.57	15.80
#5	0.61	6.90	0.91	8.50	1.23	10.20	1.55	11.80	1.84	13.4	2.15	15.00	2.45	16.70
#6	0.88	7.00	1.32	8.80	1.77	10.50	2.21	12.30	2.65	14.00	3.09	15.80	3.53	17.50
#7	1.20	7.20	1.80	9.00	2.41	10.90	3.01	12.80	3.61	14.70	4.21	16.50	4.81	18.40
#8	1.57	7.30	2.35	9.30	3.14	11.30	3.93	13.30	4.71	15.30	5.50	17.30	6.28	19.30
#9	2.00	7.60	3.00	9.80	4.00	12.10	5.00	14.30	6.00	16.60	7.00	18.80	8.00	21.10
#10	2.53	7.80	3.79	10.40	5.06	12.90	6.33	15.50	7.59	18.00	8.86	20.50	10.12	23.10
#11	3.12	8.10	4.68	10.90	6.25	13.80	7.81	16.60	9.37	19.40	10.94	22.20	12.50	25.00
#14	4.50	8.90	6.75	12.30	9.00	15.70	11.25	19.00	13.50	22.40	15.75	25.80	18.00	29.20
#18	8.00	10.60	12.00	14.10	16.00	19.60	20.00	24.50	24.00	28.80	28.00	35.10	32.00	37.70

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Table of Contents Engineering Calculations With Excel

1. Understanding the eBook Engineering Calculations With Excel
 - The Rise of Digital Reading Engineering Calculations With Excel
 - Advantages of eBooks Over Traditional Books
2. Identifying Engineering Calculations With Excel
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Engineering Calculations With Excel
 - User-Friendly Interface
4. Exploring eBook Recommendations from Engineering Calculations With Excel
 - Personalized Recommendations
 - Engineering Calculations With Excel User Reviews and Ratings
 - Engineering Calculations With Excel and Bestseller Lists
5. Accessing Engineering Calculations With Excel Free and Paid eBooks
 - Engineering Calculations With Excel Public Domain eBooks
 - Engineering Calculations With Excel eBook Subscription Services
 - Engineering Calculations With Excel Budget-Friendly Options
6. Navigating Engineering Calculations With Excel eBook Formats

- ePub, PDF, MOBI, and More
 - Engineering Calculations With Excel Compatibility with Devices
 - Engineering Calculations With Excel Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Engineering Calculations With Excel
 - Highlighting and Note-Taking Engineering Calculations With Excel
 - Interactive Elements Engineering Calculations With Excel
 8. Staying Engaged with Engineering Calculations With Excel
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Engineering Calculations With Excel
 9. Balancing eBooks and Physical Books Engineering Calculations With Excel
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Engineering Calculations With Excel
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine Engineering Calculations With Excel
 - Setting Reading Goals Engineering Calculations With Excel
 - Carving Out Dedicated Reading Time
 12. Sourcing Reliable Information of Engineering Calculations With Excel
 - Fact-Checking eBook Content of Engineering Calculations With Excel
 - Distinguishing Credible Sources
 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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