Concrete Beam Design

Job: Sample 1
Beam ID: 1
Time: 4:09 p.m. 8/30/2005

Designed By: Clint Auderer
Checked By:
Program: Concrete Beam Design v2.0

C O N C R E T E B E A M D E S I G N

Description: Fixed Supports

Code	: ACI (2002)	Design Method	: Ultimate Strength
Member Type	: Beam	Cross Section Shape	: T-Beam

Span Data:

Main Span Length	: 25.000 Ft		
Left End Support	: Fixed	Right End Support	: Fixed
Left Support Width	: 12.000 In	Right Support Width	: 12.000 In
Left Haunch Start Location	: Not Present	Right Haunch Start Location	: Not Present

Cross Section Data:

Total Depth at Mid-Span	: 24.000 In	Top Width at Mid-Span	: 22.000 In
Flange Height at Mid-Span	: 4.000 In	Bottom Width at Mid-Span	: 10.000 In

Material Data:

f'c	: 4.000 K/In^2	Flexural Reinforcing fy	: 60.000 K/In^2
Concrete Density	: 144.000 Lb/Ft^3	Shear Reinforcing fvy	: 60.000 K/In^2
Concrete Tensile Strength	: 0.420 K/In^2	Stress Block, Beta	: 0.850

Design Criteria:

Bottom Cover to Stirrup	: 1.500 In	Top Cover to Stirrup	: 1.500 In
Side Cover to Stirrup	: 1.500 In		
Total Load Deflection Limit	: L/240.00	Live Load Deflection Limit	: L/360.00
Allow Cuts in Tension Zone	: Y	Check Crack Control Provisions	: Y

E C H O O F L O A D I N P U T

	DEAD LOAD	LIVE LOAD	WIND LOAD	EARTHQUAKE LOAD	ROOF LOAD
Check Deflection:		Yes			
Main Span					
# 1 Uniform Load:	-1.000 K /Ft	-4.000 K /Ft			
Distance to Begin:	0.000 Ft	0.000 Ft			
Distance to End:	25.000 Ft	25.000 Ft			

C R I T I C A L S H E A R S & M O M E N T S

Load Combination Dead Load: 1.400 x Dead Load
Load Combination # 1: 1.200 x Dead Load + 1.600 x L + 0.500 x R
Load Combination # 2: 1.200 x Dead Load + 1.000 x L + 1.600 x R
Load Combination # 3: 1.200 x Dead Load + 0.800 x W + 1.600 x R
Load Combination # 4: 1.200 x Dead Load + 1.000 x L + 1.600 x W + 0.500 x R

	DEAD LOAD	LOAD COMB 1	LOAD COMB 2	LOAD COMB 3	LOAD COMB 4
Shear Left End:	17.500 K	95.000 K	65.000 K	15.000 K	65.000 K
Moment Left End:	-72.917 K -Ft	-395.833 K -Ft	-270.833 K -Ft	-62.500 K -Ft	-270.833 K -Ft
Shear Right End:	-17.500 K	-95.000 K	-65.000 K	-15.000 K	-65.000 K
Moment Right End:	-72.917 K -Ft	-395.833 K -Ft	-270.833 K -Ft	-62.500 K -Ft	-270.833 K -Ft
Maximum Moment :	36.458 K -Ft	197.917 K -Ft	135.417 K -Ft	31.250 K -Ft	135.417 K -Ft
Located at:	12.500 Ft	12.500 Ft	12.500 Ft	12.500 Ft	12.500 Ft
Max Deflection :	-0.031 In	-0.306 In	-0.306 In	-0.031 In	-0.306 In
Located at:	12.500 Ft	12.500 Ft	12.500 Ft	12.500 Ft	12.500 Ft

	Dead Part:			-0.031	In		-0.031	In		-0.031	In		-0.031	In
	Inflection Points:	5.283	Ft	5.283	Ft		5.283	Ft		5.283	Ft		5.283	Ft
		19.717	Ft	19.717	Ft		19.717	Ft		19.717	Ft		19.717	Ft
Reaction	Left End:	17.500	K	95.000	K		65.000	K		15.000	K		65.000	K
Reaction	Right End:	17.500	K	95.000	K		65.000	K		15.000	K		65.000	K

C R I T I C A L S H E A R S & M O M E N T S

	LOAD COMB 5		LOAD COMB 6		LOAD COMB 7		LOAD COMB 8		LOAD COMB 9	
Load Combination # 5:	1.200 x Dead Load + 1.000 x L + 1.400 x E + 0.200 x R									
Load Combination # 6:	0.900 x Dead Load + 1.600 x W									
Load Combination # 7:	0.900 x Dead Load + 1.400 x E									
Load Combination # 8:	1.200 x Dead Load - 0.800 x W + 1.600 x R									
Load Combination # 9:	1.200 x Dead Load + 1.000 x L - 1.600 x W + 0.500 x R									
Shear Left End:	65.000	K	11.250	K	11.250	K	15.000	K	65.000	K
Moment Left End:	-270.833	K -Ft	-46.875	K -Ft	-46.875	K -Ft	-62.500	K -Ft	-270.833	K -Ft
Shear Right End:	-65.000	K	-11.250	K	-11.250	K	-15.000	K	-65.000	K
Moment Right End:	-270.833	K -Ft	-46.875	K -Ft	-46.875	K -Ft	-62.500	K -Ft	-270.833	K -Ft
Maximum Moment :	135.417	K -Ft	23.438	K -Ft	23.438	K -Ft	31.250	K -Ft	135.417	K -Ft
Located at:	12.500	Ft	12.500	Ft	12.500	Ft	12.500	Ft	12.500	Ft
Max Deflection :	-0.306	In	-0.031	In	-0.031	In	-0.031	In	-0.306	In
Located at:	12.500	Ft	12.500	Ft	12.500	Ft	12.500	Ft	12.500	Ft
Dead Part:	-0.031	In	-0.031	In	-0.031	In	-0.031	In	-0.031	In
Inflection Points:	5.283	Ft	5.283	Ft	5.283	Ft	5.283	Ft	5.283	Ft
	19.717	Ft	19.717	Ft	19.717	Ft	19.717	Ft	19.717	Ft
Reaction Left End:	65.000	K	11.250	K	11.250	K	15.000	K	65.000	K
Reaction Right End:	65.000	K	11.250	K	11.250	K	15.000	K	65.000	K

C R I T I C A L S H E A R S & M O M E N T S

	LOAD COMB 10		LOAD COMB 11		LOAD COMB 12		LOAD COMB 13		LOAD COMB 14	
Load Combination #10:	1.200 x Dead Load + 1.000 x L - 1.400 x E + 0.200 x R									
Load Combination #11:	0.900 x Dead Load - 1.600 x W									
Load Combination #12:	0.900 x Dead Load - 1.400 x E									
Shear Left End:	65.000	K	11.250	K	11.250	K				
Moment Left End:	-270.833	K -Ft	-46.875	K -Ft	-46.875	K -Ft				
Shear Right End:	-65.000	K	-11.250	K	-11.250	K				
Moment Right End:	-270.833	K -Ft	-46.875	K -Ft	-46.875	K -Ft				
Maximum Moment :	135.417	K -Ft	23.438	K -Ft	23.438	K -Ft				
Located at:	12.500	Ft	12.500	Ft	12.500	Ft				
Max Deflection :	-0.306	In	-0.031	In	-0.031	In				
Located at:	12.500	Ft	12.500	Ft	12.500	Ft				
Dead Part:	-0.031	In	-0.031	In	-0.031	In				
Inflection Points:	5.283	Ft	5.283	Ft	5.283	Ft				
	19.717	Ft	19.717	Ft	19.717	Ft				
Reaction Left End:	65.000	K	11.250	K	11.250	K				
Reaction Right End:	65.000	K	11.250	K	11.250	K				

S E C T I O N D E S I G N I N F O R M A T I O N

S E C T I O N F L E X U R A L D E S I G N

Mid-Span Region
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Cross-Section Information

Total Depth	:	24.000	In	Distance to Centroid As	:	21.63	In
Top Width	:	22.000	In	Distance to Centroid A's	:	2.38	In
Flange or Recess Depth	:	4.000	In				
Bottom Width	:	10.000	In				
For Design Moment, Mu	:	197.917	K -Ft				
Required As	:	2.117	In^2 (p : 0.004)				
Required A's	:	0.000	In^2 (p : 0.000)				

Provided As	:	2.370	In^2 (p : 0.005)				
Provided A's	:	0.000	In^2 (p : 0.000)				
Reduction Factor, Phi	:	0.90					
Moment Capacity, *Mn	:	220.493	K -Ft				
Gross Area	:	288.000	In^2				
Gross Moment of Inertia	:	15584.000	In^4	Neutral Axis Location	:	13.67	In
N (Es/Ec)	:	8.04		Modulus, Ec	:	3606.51	K /In ^2
Cracked Moment of Inertia	:	6160.575	In^4	Neutral Axis Location	:	18.60	In
Cracking Moment	:	44.676	K -Ft				

At Left Support
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Cross-Section Information							
Total Depth	:	24.000	In	Distance to Centroid As	:	20.43	In
Top Width	:	22.000	In	Distance to Centroid A's	:	2.44	In
Flange or Recess Depth	:	4.000	In				
Bottom Width	:	10.000	In				
For Design Moment, Mu	:	-349.283	K -Ft				
Required As	:	5.066	In^2 (p : 0.025)				
Required A's	:	0.899	In^2 (p : 0.000)				
Provided As	:	6.000	In^2 (p : 0.029)				
Provided A's	:	1.833	In^2 (p : 0.009)				
Reduction Factor, Phi	:	0.81					
Moment Capacity, *Mn	:	-413.438	K -Ft				
Gross Area	:	288.000	In^2				
Gross Moment of Inertia	:	15584.000	In^4	Neutral Axis Location	:	10.33	In
N (Es/Ec)	:	8.04		Modulus, Ec	:	3606.51	K /In ^2
Cracked Moment of Inertia	:	9298.245	In^4	Neutral Axis Location	:	14.62	In
Cracking Moment	:	59.087	K -Ft				

At Right Support
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Cross-Section Information							
Total Depth	:	24.000	In	Distance to Centroid As	:	20.43	In
Top Width	:	22.000	In	Distance to Centroid A's	:	2.44	In
Flange or Recess Depth	:	4.000	In				
Bottom Width	:	10.000	In				
For Design Moment, Mu	:	-349.283	K -Ft				
Required As	:	5.066	In^2 (p : 0.025)				
Required A's	:	0.899	In^2 (p : 0.000)				
Provided As	:	6.000	In^2 (p : 0.029)				
Provided A's	:	1.833	In^2 (p : 0.009)				
Reduction Factor, Phi	:	0.81					
Moment Capacity, *Mn	:	-413.438	K -Ft				
Gross Area	:	288.000	In^2				
Gross Moment of Inertia	:	15584.000	In^4	Neutral Axis Location	:	10.33	In
N (Es/Ec)	:	8.04		Modulus, Ec	:	3606.51	K /In ^2
Cracked Moment of Inertia	:	9298.245	In^4	Neutral Axis Location	:	14.62	In
Cracking Moment	:	59.087	K -Ft				

* Indicates That Nominal Resistance Includes Appropriate Phi Factor

B O T T O M B A R S

Mid-Span Region
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Design Moment, Mu : 197.92 K -Ft As Required : 2.117 In^2 As Provided : 2.370 In^2 d : 21.625 In

Bar Size : #8 Number of Layers : 1 Layer Spacing : 0.00 In
Number of Bars : 3 Bars in Lower Layer : 3 Ld : 33.48 In

At Left Support
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Percent of Bars Continuing into Support : 66 Suggested Bar Cutoff (from Centerline of Support): 85.25 In

At Right Support
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Percent of Bars Continuing into Support : 66 Suggested Bar Cutoff (from Centerline of Support): 85.25 In

T O P B A R S - L E F T S U P P O R T

Design Moment, Mu : -349.28 K -Ft As Required : 5.066 In^2 As Provided : 6.000 In^2 d : 20.433 In

Bar Size : #9 Number of Layers : 2 Layer Spacing : 2.26 In
Number of Bars : 6 Bars in Top Layer : 3 Ld1 : 58.93 In ***Anchor Bars
A's Required : 0.899 In^2 d' : 2.439 In

Suggested Bar Cutoff : 84.00 In (from Centerline of Support)

T O P B A R S - R I G H T S U P P O R T

Design Moment, Mu : -349.28 K -Ft As Required : 5.066 In^2 As Provided : 6.000 In^2 d : 20.433 In

Bar Size : #9 Number of Layers : 2 Layer Spacing : 2.26 In
Number of Bars : 6 Bars in Top Layer : 3 Ld1 : 58.93 In ***Anchor Bars
A's Required : 0.899 In^2 d' : 2.439 In

Suggested Bar Cutoff : 84.00 In (from Centerline of Support)

M A X I M U M D E F L E C T I O N S

Span	Load Comb	Short Total	Long Total	Max Allow	Short Live Load	Max Allow		Ieffective
		In	In	In	In	In		In^4
MAIN	DEAD	-0.031		1.250	OK			15584.00
	1	-0.306	-0.475	1.250	OK	-0.275	0.833 OK	7956.44
	2	-0.306	-0.475	1.250	OK	-0.275	0.833 OK	7956.44
	3	-0.031	-0.063	1.250	OK	-0.000	0.833 OK	15584.00
	4	-0.306	-0.475	1.250	OK	-0.275	0.833 OK	7956.44
	5	-0.306	-0.475	1.250	OK	-0.275	0.833 OK	7956.44
	6	-0.031	-0.063	1.250	OK	-0.000	0.833 OK	15584.00
	7	-0.031	-0.063	1.250	OK	-0.000	0.833 OK	15584.00
	8	-0.031	-0.063	1.250	OK	-0.000	0.833 OK	15584.00
	9	-0.306	-0.475	1.250	OK	-0.275	0.833 OK	7956.44
	10	-0.306	-0.475	1.250	OK	-0.275	0.833 OK	7956.44
	11	-0.031	-0.063	1.250	OK	-0.000	0.833 OK	15584.00
	12	-0.031	-0.063	1.250	OK	-0.000	0.833 OK	15584.00

S H E A R D E S I G N - M A I N S P A N

Left Side: Number @ Spacing	Al	Right Side: Number @ Spacing	Al
	In^2		In^2
Spacing starts from face of support			
@ 0.750 , 1 @ 1.500 In		@ 0.750 , 1 @ 1.500 In	
7 @ 3.000 In		7 @ 3.000 In	
3 @ 4.000 In		3 @ 4.000 In	
2 @ 5.000 In		2 @ 5.000 In	
2 @ 6.000 In		2 @ 6.000 In	
2 @ 8.000 In		2 @ 8.000 In	
1 @ 3.000 In		1 @ 3.000 In	
2 @ 5.000 In		2 @ 5.000 In	
1 @ 6.000 In		1 @ 6.000 In	
6 @ 7.000 In		6 @ 7.000 In	
Beyond 11.188 Ft From Face None Required		Beyond 11.188 Ft From Face None Required	

Use #3 Stirrups - 2 Vertical Legs

Shear Steel Checked for Left Tension Zone At : 7.10 Ft (from Centerline of Support)
Shear Steel Checked for Right Tension Zone At : 7.10 Ft (from Centerline of Support)