MIDAS Training Series

Midas Training Series

> midas Civil

Title: All-In-One Super and Sub Structure Design

NAME

Edgar De Los Santos / MIDAS IT – United States

2016

Substructure Training Series

- Session 1: 3D substructure analysis and design
- Session 2: All-In-One Super & Sub Structure Design
- Session 3: Essential Soil-Structure Interaction for Bridge



Content

- Midas Civil: All-in-one Solution
- Advantages of full model
- MIDAS Modeling
 - Superstructure and substructure interaction
 - Boundary conditions
- Midas Civil Design
 - RC Design
 - Pier Cap Design
 - Column Design

Midas Training Series

> midas Civil

2016

Midas Civil All-In-One Solution

2016

Midas

Training Series

> midas Civil

midas Civil – All-in-one Solution



Importance of Full Model Analysis

2016

Midas

Training Series

> midas Civil

Advantages of Full Model Analysis

-More accurate results

The entire structure works together as a system. The behavior of the superstructure influences the substructure and vice versa. Separating them, creates a discrepancy with its real behavior. In the case of Seismic analysis, for example, the period of the structure is influenced by the stiffness of the substructure. It changes with the stiffness and geometry of the substructure.

-No need for multiple files

Everything can be done in one model file.

-Less time modeling

Since everything is modeled in one file, there is no time waste transferring the information from one program to the other.

-More realistic behavior (Parameters are not assumed)

Modeling the entire system can be very useful because the amount of assumed parameters is reduced. Providing us a more realistic behavior, displacements, stresses, etc.

-More economical design

Having the entire system modeled gives us a less conservative/ more accurate analysis which gives us a more economical structure.

Midas Training Series

Midas Civil Modeling

2016

midas

Civil

Midas

Training Series

Pier & Abutments

2016

midas

Civil

Midas

Training Series

Piers & Abutments

an integral part of the load path between the superstructure and the foundation

Functions of Piers:

- To transfer the superstructure vertical loads to the foundation
- To resist all horizontal forces acting on the bridge

Abutments in addition to the above functions of piers are used at the ends of bridges to retain the embankment



Superstructure and Substructure Modeling

2016

Midas

Training Series

> midas Civil

Bridge modeling

System model, analysis and design Best modeling approach #1: Wizard #2: Manual / CAD Import



What is the Composite Girder Wizard?

• Wizard-modeling

- Steel Composite Bridge
- PSC Composite Bridge
- Report Generation for design & load rating check
- AASHTO
 - Steel Composite
 RC Pier
 - PSC Composite
 Cross-frames
- Canada Code (Will be updated this year)
 - Steel Composite
 - PSC Composite

PSC Composite Girder Wizard



Wizard : Layout



- Girder Type
 - Precast / Splice
- Modeling Type
 - All Frame
 - Girder as frame, Deck as plate
- Bridge dimension input
 - Span length, curvature gap spacing
 - Girder alignment options
 - Same spacing
 - Offset spacing
- Bridge dimension input
 - Sub-structure definition

Wizard : Section

Pre/Post-Tensioned Composit	e Girder Bridge Wizard .oad Construction Stag	je			X				
Deck Thickness	0.8	ft	Number of Girders	6 Apply	Guide				
Haunch Height	0.25	ft	Circles Ma						
Material			Girder No.	Girder Offset (f					
Deck	1 1: Concrete	▼	1		-21.25				
Girder	1 1: Concrete	▼	2		-12.75				
Diaphragm	1 1: Concrete	▼	4		4.25				
Diaphragm Information			Transverse Deck Ele	ment	10.75				
Define Dia	phragm Section		Spacing						
Intermediate Spacing	Divisions per Span	•	Distances	▼ 5	ft				
Diaphragm	Name	Divisions per Span	Angle type Perpendicular		•				
End Support	1:AASHTO TYPE4								
Pier Support	1:AASHTO TYPE4								
Intermediate	1:AASHTO TYPE4	2							
Girder Information Span 1 Span 2 No. of Divisions No. N 1	1 Apply ame Star	Guide t (ft) End (ft) 0 109.75	E Genera	Define Girder Section					
Open Sav	e As			ОК	Cancel				

- Girder information
 - Number of girder
 - Section assignment per spans
- Design material selection
 - Deck / Girder / Diaphragm
- Diaphragm distribution options
 - Distance
 - Division per Span

Wizard : Tendon



- Tendon type
 - Straight
 - Harped 1 & 2
 - Curved
- Tendon definition table
 - Number of tendons
 - Distribution distance
 - Vertical displacement
- Tendon Assignment List
 - Different tendon assignment per spans
 - As many assignment as user wants
- Detailed tendon table

Wizard : Load

it section rendom	Construction Sta	gel							
Pavement and Barrier									
ł	4	De	ck width						
	b1 b2		^{b3} <u>→</u>		b4		b5 ★+		
	→P1								
b1 1.5 ft	t b2 8.75	ft b3	2 f	t	b4 8.75	ft	b5	1.5 ft	
Dead Loads									
		DC				D١	N		
	✓ Self Weight✓ Wet Con'c								
Before	Weight Density	0.15	kips/ft^3						
composite	Thickness	0.8	ft						
	Form Work	0	kips/ft^2						
	Barrier	0.14	kips/ft		Wearing Surfac	e			
	Median Strip	0.18	kips/ft		Weight Density	- C).14	kips/ft^3	
Composite	Additional Load	0	kips/ft		Thickness	C).26	ft	
	Positions (P1)	0	ft		Utilities	C)	kips/ft	
					Positions (P2)	0)	ft	
Live Loads	Define Moving Load Ca	se	Defin	e Traffi	ic Lanes		Defin	ne Vehicles	

- Pavement and Barrier
- Composite load cases
 - Pre-composite load cases (DC 1-1)
 - Post-composite load case (DC 1-2)
 - Wearing surface & additional (DC 2)
- Moving load analysis
 - Moving load code selection
 - Lane definition
 - Vehicle selection

Wizard : Construction Stage

	oned Composite Girder Bridge Wizard		
out Secti	on Tendon Load Construction Stage		
Constr	uction Stage Guide		
🗸 Gird	er Splice		
	Girder Splice Construction	Temporary Support Position	
			_
V Post	t-tensioning Tendons		
	Define Post Tendons		
Stage	Stage Description	Load Condition	Duration (Day)
1	Self Weight Activated, Prestress load in Preca	Self Weight is Activated	10
3-1	Deck is Activated as a Load	Wet Concrete Load is Activated	10
3-2	Deck is in Composite Stage, span continuous	Wet Concrete Load is deactivated	
4	After-Composite Load is Activated	DC2, DW Load is Activated	10
5	Long Term Effect is Considered	-	10000 -
		I	10000
			10000 =
Reinfo	rcement		
Reinfo	rcement Define Reinforcement		
Reinfo	rcement Define Reinforcement		
Reinfo	rcement Define Reinforcement		
Reinfo	rcement Define Reinforcement		
Reinfo	rcement Define Reinforcement		
Reinfo	rcement Define Reinforcement		
Reinfo	rcement		
Reinfo	rcement Define Reinforcement		
Reinfo	rcement Define Reinforcement		
Reinfo	rcement Define Reinforcement		
Reinfo	rcement Define Reinforcement		

- Visual guide for construction sequence
- Concrete pouring sequence
 - Splice girder pouring sequence
 - Temporary support position
- Stage duration input
- Girder reinforcement definition

Bridge Bearings

2016

midas

Civil

Midas

Training Series

Bridge Bearings:

Functions of bridge bearings:

- Transfer forces from superstructure to Substructure
- Provide rotational &/or translational Restraints

To accommodate the deformations occurring due to:

- •Thermal expansion/contraction
- •Elastic deformation under live load
- •Seismic forces
- •Creep and shrinkage of concrete
- •Settlement of supports
- •Longitudinal forces tractive/ braking
- •Wind loads







Bearing Modeling

2016

Midas

Training Series

> midas Civil

Boundary Conditions

Define Supports	Point Surface Spring Spring Spring Spring Spring Spring	Elastic Link	Rigid Link	General Link *	▶ ← ● Beam End Release	Beam End Offsets	Plate End Release
Supports	Spring Supports		Link		R	Release/Offse	t

Nodal boundary conditions

- Constraint for degree of freedom (Supports)
- Elastic boundary element (Spring supports)
 - Point Spring Supports
 - Surface Spring Supports
 - General Spring Supports
- Elastic link element (Elastic Link)
- General Link element (General Link)
 - Element Type
 - Force Type

Element boundary conditions

- Element End Release
 - Beam End Release
 - Plate End Release
- Rigid End Offset distance (Beam End Offset)
- Rigid Link

Boundary Conditions



- Elastic bearings of a	bridge structur	e, which separate	the bridge
deck from the piers.	-		-

- Used to simulate the support conditions
- Compression-only Elastic link : the soil boundary conditions.
- Rigid Link : Connects two nodes with an "infinite" stiffness



Boundary Conditions

Link 1

Link

Link

Usage

- Elastic bearings of a bridge structure, which separate the bridge deck from the piers.

- Compression-only Elastic link : the soil boundary conditions.
- Rigid Link : Connects two nodes with an "infinite" stiffness



T

Boundary Conditions



- Dampers, base isolators, compression-only element, tension-only element, plastic hinges, soil springs
 - Used as linear and nonlinear elements
 - Element type: Spring, Dashpot, Spring and Dashpot
 - Force type: Viscoelastic Damper, Hysteretic System, Seismic isolators (Lead Rubber Bearing Isolator, Friction Pendulum System Isolator)

🖵 Inelastic Hinge Property 🛛 🚽	Linear P	roperties —				Nonlinear	Properties	-	$\stackrel{L}{\longleftrightarrow}$	
Name :	DOF	Effective S	tiffness	Effective D	amping	DOF				
	▼ Dx	55997397	kips/in	0	kips•sec/in	Dx 🔽	Properties	-		\mathbf{i}
Z Ref.	🔽 Dy	21.5	kips/in	0	kips•sec/in	🔽 Dy	Properties		ax ax	
	▼ Dz	21.5	kips/in	0	kips•sec/in	▼ Dz	Properties		$ < c_{yi}L < c_{yj}L $	
y	🗆 Rx	0	in kips/[rad]	0	in kips sec/[rad]	🗖 Rx	Properties			
N1	🗌 Ry	0	in kips/[rad]	0	in kips sec/[rad]	🗖 Ry 🛛	Properties		$\sim \kappa_{dy}$	
	🗌 Rz	0	in kips/[rad]	0	in kips sec/[rad]	🗖 Rz	Properties	-	$\leftarrow c_{zi}L \qquad c_{zj}L \qquad \leftarrow c_{zj}L \qquad \rightarrow \leftarrow c_{z$	
Reference Coordinate System Global					Coupled					
Input Method							ioint i			ioint i
Beta Angle							joini i			joini j
C Ref. Point										
C Ref. Vector								-		
0 🔽 [deq]										
2 Nodes :							z			
Copy General Link						У	· ~ 1	-		
○ Node Inc.							$\searrow x$			
Axis: • x C y C z						local	coordinate axis			
Distances: in								Ì		\checkmark
(Example: 5, 3, 4.5, 3@5.0)										

Midas Superstructure Design

2016

Midas

Training Series

> midas Civil

PSC Composite Design check & Load rating



PSC Composite Design check

matterna	ii List					
ID	Name	Conc. (Girder)	Main-bar(Gi	Sub-bar(Gir	Conc.(Slab)	
1	Concrete	Grade C4500	Grade 60	Grade 60	Grade C4500	
•					Þ	
Girder –						
Concr	ete Material Sele	ection				Tatasfasa Shaar
Code	: ASTM(RC)	•	Grade :	Grade C4500		
Specifi	ed Compressive	Strength (fc fck)		648	kips/ft^2	Option
📃 Liq	ht Weight Concr	ete Factor (Lambo	la) :	1		Add/Replace O Del
Rebar	Selection					Both end parts(i & j) have the
Code	: ASTM(RC)	•				T 1
Grade	of Main Rebar :	Grade 60	Fy	: 8640	kips/ft^2	- Surface Classification (E. 9. 4.2
Grade	of Sub-Rebar :	Grade 60	Fys	: 8640	kips/ft^2	Deurobened(CIP dab)
Slab						Monolithically
Concr	ete Material Sele	ection			_	Intentionally roughened(L)
Code	: ASTM(RC)	•	Grade :	Grade C4500		Intentionally roughened(N
Specifi	ed Compressive	Strength (fc fck)		648	kips/ft^2	Not intentionally roughene
📃 Liq	ht Weight Concr	ete Factor (Lambo	la) :	1		
Rebar	Selection					Anchored
Code	: ASTM(RC)	•				Interface Shear
Grade	of Main Rebar :	Grade 60	Fy	: 8640	kips/ft^2	Bvi 0 ft
Grade	of Sub-Rebar:	Grade 60	Fys	: 8640	kips/ft^2	Avf 0 ft^2
						Fy 0 kips/ft^2

Material selection

• ...

Separate material definition girder and slab

Midas Training Series

Light concrete factor -

Interface shear consideration

- Surface classification by 5.8.4.3
- Shear reinforcement _ definition

Design result table

Image: Result Tables Image: Check stress for cross section at a construction stage... Image: Check tensile stress for Prestressing tendons... Image: Check stress for cross section at service loads... Image: Check stress for cross section at service loads... Image: Check stress for cross section at service loads... Image: Principal stress at a construction stage... Image: Principal stress at service loads (excluding torsional shear stress)... Image: Principal stress at service loads... Image: Check crack width at service loads... Image: Check Flexure Strength... Image: Check Combined Shear and Torsion Strength....

- Strength
- Flexure
- Shear
- Combined shear and Torsion
- Stress
- Sectional & Principal stress
- Per construction stage
- Under service load case
- Tendon tensile stress
- Crack width under service load

Elem	Part	Positive/ Negative	LCom Name	Туре	СНК	Muy (ft*kips)	Mcr (ft*kips)	Mny (ft*kips)	PhiMny (ft*kips)	Ratio (Muy/PhiMny)	PhiMny/ min(1.33Muy,Mcr)
84	[[11]	Negative	cLCB1	FX-MIN	ОК	0.0000	-2307.5010	23.9942	17.9956	0.0000	2159474.8861
84	[[11]	Positive	cLCB1	FX-MAX	ОК	26.5598	12754.2249	13540.6330	13540.6330	0.0020	383.3216
84	J[534]	Negative	cLCB1	FX-MIN	ОК	-11.5115	-2310.6930	23.9942	17.9956	0.6397	1.1754
84	J[534]	Positive	cLCB1	FX-MAX	ОК	20.9491	12774.9135	13540.6330	13540.6330	0.0015	485.9838
85	[534]	Negative	cLCB1	FX-MIN	ОК	0.0000	-2322.7463	23.9942	17.9956	0.0000	2159474.8861
85	[534]	Positive	cLCB1	FX-MAX	ОК	58.3551	12770.0263	13540.6330	13540.6330	0.0043	174.4650
85	J[25]	Negative	cLCB1	FX-MIN	ОК	0.0000	-2741.8921	23.9942	17.9956	0.0000	2159474.8861
85	J[25]	Positive	cLCB1	FX-MAX	ОК	561.1422	12770.9129	13540.6330	13540.6330	0.0414	18.1432
86	[25]	Negative	cLCB1	FX-MIN	ОК	0.0000	-2741.9097	23.9942	17.9956	0.0000	2159474.8861
86	[25]	Positive	cLCB1	FX-MAX	ОК	555.7808	12770.9179	13540.6330	13540.6330	0.0410	18.3182
86	J[535]	Negative	cLCB1	FX-MIN	ОК	0.0000	-3521.2853	23.9942	17.9956	0.0000	2159474.8861
86	J[535]	Positive	cLCB1	FX-MAX	ОК	1376.3223	12759.6580	13540.6330	13540.6330	0.1016	7.3972

Midas Training Series

Design result Report



Midas Substructure Design

2016

Midas

Training Series

> midas Civil

Design as per AASHTO LRFD

2016

Midas

Training Series

> midas Civil

Substructure Design



Preview Window		Mida
No : 6	🔻 🎒 Print 🕼 Print All 🕼 Close 🔒 Save	
1 Design Cond	dition	
Design Code		
Unit System	kips in	
Member Number	r 338 (PM), 338 (Shear)	
Material Data	fc = 4.5, fy = 60, fys = 50 ksi	
Column Height	72 in	
Section Property	P1 (No: 6)	
Rebar Pattern	Total Rebar Area Ast = 41.224 in ² (pst = 0.0101)	
2 Applied Load	ds ^r	
Load Combination	and the AT (I) Boint	
Pu = -0.00	$M_{T} = AT(3) Point$ $M_{T} = 19162.0, M_{T} = 19162.0, M_{T} = 19162.0, M_{C} = 27099.2 in-kips$	
3. Axial Forces	s and Moments Capacity Check	
Concentric Max. A:	Axial Load Pr-max = 10733.6 kips P-M Interaction Curve Dialog	
Axial Load Ratio	Pu/Pr = -0.00000 / 0.00675 = 0.000 < 1.000	Unit: N , mm
Moment Ratio	M_{Oy}/M_{Py} = 19162.0 / 47995.1 = 0.399 < 1.000	Member 206 V
	$Mcz/Mrz = 19162.0 / 47995.1 = 0.399 < 1.000 \dots P$	Section Type SDCT
	Mc/Mr = 27099.2 / 67875.4 = 0.399 < 1.000	As = 16380.0
4 P-M Interaction	tion Diagram	PM Curve Result :
	9.727	Pt-max = 23£+07 Pu = +2.1E+7
P(kips)		Pr = +2.9E+7 Bxt.P = 0.7222
17760	0=45.00° Pr(kips) Mr(in-kips)	Mc = +8.3E+7
16500	13416.95	Mr = +1.4E+8 Bat-M = 0.5845
18250		Rat-My = 0.5864
107011999	7055.63 1157	Hat-Mz = 0.5845 Eccentricity: mm
8750	5858.08 1218	Mc/Pu = 3.88448
8500	5148.63 1270	Rotation : Deg. Mcz/Mcy = 87.597
4050	4580.43 1289	Prist Press A
4200	4058.30 1293	Prink Piesuk
2000	3464.38 1281	Close
4250	1(3,2000) (0,67876) M(in-kips) 2575.01 119114.30	
-2500		
°		

Strength Reduction Factor

Enter the strength reduction factors, which are a form of safety factors to account for the difference between the nominal and real strengths of the materials; the difference in member strengths between the design and manufacturing or construction; uncertainties related to inaccuracies in the design equations; and the ductility and importance of the member.



×

Modify Concrete Materials

Use this function to modify a part of the steel rebar and concrete material property data, entered during the creation of the analysis model, or to change the material property data. Modifications that are made here will not affect the analysis results, but will only be used for automatic design and strength verification

Modify Concrete Materials



Limiting Maximum Rebar Ratio

Enter the maximum allowable rebar ratio of Reinforced Concrete

Limiting Maximum Re	ebar Ratio	×	
Design Code :	AASHTO-LRFD12		
Column Design (Rho Brace Design (Rhor)	c)	: 0.08 : 0.08	
	OK	Cancel	

Beam Section Data for Design

Enter the section dimensions including the covers and rebar data for RC beam members to be applied to section design.

ection	n List					Section Sh	ape					
ID	Name	i-Node	middle	j-Nod	e				z			
5	P1_C	x	x	x			-				У	
Sect	iion Data		i-Noc	de mid	dle j-No	ode						
Shap	e Rectangle		As	sTop	0	in^2	Rebar Dat	ta				
	Z Ho	: 60 in	A	sBot	0	in^2	Top		La	yer 1		~
Ī	F I Dt Bc	: 60 in	Stir	rrups			Layer	Num	Size1	Size2	Dt	<u>^</u>
Hc -	y	0 in	S	Size		~		0			0	
	TTD DE	0 in	Sp	acing	0	in						
	-Bc→		Nu	mber	2							¥
			A	ngle	90	[deg]	Dattan		1.5			
Crad	k Checking			Bent Up	Bar		Bottom	News	Cined		DL	* 1.
● Cl	ass 1 exposure co	ndition	9	bize		\sim	Layer	Num	Size1	SIZEZ	DD	î
Oc	ass 2 exposure co	ndition	Nu	mber	2			0			0	
			A	ngle	0	[deg]						
					Redraw							¥
				Torsion	al Reinfo	rcement						
			E ^s	5tirrup =								
				Size		\sim	Spacing	0		in		
				Bund	lled Stirru	Ips	Number	2				
				.ongitud	inal Reinf	orcement						_
							Number	4				
				bize			namoor					

Beam and Column Section Data for Design

Enter the section dimensions including the covers and rebar data for RC beam members to be applied to section design.



Beam and Column Section Data for Checking

Enter the section dimensions, exposure condition and rebar data for reinforced concrete beam members to check for strength and section cracking.



Beam Design

Using the results obtained from the analysis of the entire structure and additional design data, automatically design concrete beam members according to the following design codes: American Association of State Highway and Transportation Officials, Section 5 - Concrete Structures (AASHTO-LRFD02), American Association of State Highway and Transportation Officials (AASHTO-LFD96), Concrete Structure Design Code of the American Concrete Institute (ACI318-02), (CSA-S6-00).

AASHTO-LI	RFD12	RC-Bei	am Desi	g —		X		🔳 Pr	eview Wi	ndow														-	×
Code : AAS	SHTO-I	LRFD12		Unit: kip	os,	in		No:3	16		v A	Print	A	Print All	5	Close		Save							
Sorted by	۲	Member									4														
	0	Section																							
MEMB		Se	tion	fc	B 0	CH		1. De	esign i	ntorm	ation														
SECT	SEL	Bc	Hc	fy	s	K		Me	mber Nu	mber	: 316														
Span		bf	hf	fys				De	sign Cod	e	: AASHT	O-LRFD1	2												
315	_	P1	_C	4.50000	1	ок		Un	it System		: kips, in														
5		60.00	60.00	60.0000	M	ок		Ma	terial Dat	ta	: fc = 4.5	, fy = 60,	fys = :	50 ksi											
89.906		0.000	0.000	50.0000	J	OK		Be	am Span		: 8.88 in														
316		P1	_0	4.50000	1	OK		Se	ction Pro	pertv	: P1 C (No : 5)													
8 8800		0.000	0.000	50,0000	- m - 1	OK																			
317		P1	C	4.50000		ок		2 Se	ection I	Diadr	am														
5		60.00	60.00	60.0000	M	ОК				g.															
89.907		0.000	0.000	50.0000	J	ок				(E)	ND-I)					[MID]					END	0			
318		P1	_C	4.50000	1	ОК		· ·	T 🗊			-		1					1	: 1			,		
5	Г	60.00	60.00	60.0000	М	ОК			-					-						-					
36.000		0.000	0.000	50.0000	J	ок								0					。						
320	_	P1	_c	4.50000	1	ок		0						9					ø						
5		60.00	60.00	60.0000	M	ок																			
39.120		0.000	0.000	50.0000	J	OK			⊥‡					1						_ ×1			,		
321	E.	60.00	_0	4.50000	I M	OK					60				1	60						50	1		
36.099		0.000	0.000	50,0000	- m-	OK			1	•		-1			†					t			1		
<						>			TOP : 4.522	2 In^2				TOP : 2.2	8 In^2				1	OP:3.3811	In^2				
Copper	t Mode	al View					1		BOT: 2.509	12 in^2				BOT:4.5	222 In^2					IOT : 4.5223	1n^2				
Coloct /		Uncolo	-+ All	Dec	فحاد واحد	line			SIRVOPS	. 2.0~#3 @	80.4			STROOP	0.2.0~	3 60.4				incore.	2.0-#3 @07	-			
Selectiv	-11	Unsele		Ken	calculat	uon																			
Graphic.		Summa	ry	Summary	y By LC	B >>		3. Be	ending	Morr	ient Ca	apacity													
Detail	•	C:\User	s\e.sant	os\Docume	nts\MI	DAS\				_			_				_		_	_					 ~
Option fo	or Deta	ail Print P	osition					IIDAS/C	vil [🞑.	Elastic	Link														
🗹 End I.		Mid. [End J		Clo	ose		low																	
	anauca		-					r Regu	+ •	16 0	£ 1/	6													

Column Design

Using the results obtained from the analysis of the entire structure and additional design data, automatically design concrete column members according to the following design codes: American Association of State Highway and Transportation Officials, Section 5 - Concrete Structures (AASHTO-LRFD02), American Association of State Highway and Transportation Officials (AASHTO-LFD96), Concrete Structure Design Code of the American Concrete Institute (ACI318-02), (CSA-S6-00).

AASHTO-LRFD12 RC-Column De — 🗌 🗙	💽 Preview Window – 🗆 🗙
Code : AASHTO-LRFD12 Unit : kips , in	No : 324 🗸 🚭 Print 🚭 Print All 📲 Close 🔒 Save
Sorted by Osection	
MEMB SECT Section fc fy CHK 324 4.50000 60.0000 4.5000 60.0000 4.5000 60.0000 4.5000 60.0000 4.5000 60.0000 4.5000 60.0000 4.5000 60.0000 4.5000 60.0000 4.5000 60.0000 4.5000 60.0000 4.50000 60.0000 4.50000 60.0000 4.50000 60.0000 4.50000 60.0000 4.50000 60.0	1. Design Condition Design Code AASHTO-LRFD12
6 I P1 62.400 50.0000 OK	Unit System kips, in
6 P1 4.50000 60.0000 OK	Member Number 324
335 P1 4.50000 60.0000 OK	Column Height 62.4 in
336 F P1 4.50000 60.0000	Section Property P1 (No : 6)
6 6 62.400 50.0000 0K	Rebar Pattern Total Rebar Area Ast = 41.224 in^2 (Rhost = 0.0101)
6 P1 4.3000 80.000 OK	2. Applied Loads
338 6 P1 4.50000 60.0000 62.400 50.0000 OK	Load Combination 1- AT (I) Point
<u>339</u> 6 Р1 <u>4.50000 60.0000</u> ОК	Pu = 2785.93 kips, May = -2.7e+004, Maz = -4.3e+004, Ma = 50754.5 in-kips
340 P1 4.50000 60.0000 OK	3. Axial Forces and Moments Capacity Check
6 72.000 50.0000 341 4.50000 60.0000	Concentric Max. Axial Load Pr-max = 10733.6 kips
6 P1 72.000 50.0000 OK	Axial Load Ratio Pu/Pr = 2785.93 / 6038.80 = 0.461 < 1.000 O.K
342 P1 4.50000 60.0000 OK	Moment Ratio Mo//Mry = -2.7e+004 / 58831.4 = 0.461 < 1.000 O.K
	Mcz/Mrz = -4.3e+004 / 92981.1 = 0.461 < 1.000 O.K
Connect Model View	Motor = 50/54.5/1.1e+005 = 0.401 < 1.000 O.K
Craphic Summary Summary RVLCB	4. P-M Interaction Diagram
Detail C:\Users\e.santos\Documents\MIDAS\	
Draw PM Curve Close	AIDAS/Civil C. Elastic Link

Midas Training Series

Beam and Column Checking

Using the results obtained from the analysis of the entire structure and additional design data, verify the strengths of concrete beam members according to the following design codes: American Association of State Highway and Transportation Officials, Section 5 - Concrete Structures (AASHTO-LRFD02), American Association of State Highway and Transportation Officials (AASHTO-LFD96), Concrete Structure Design Code of the American Concrete Institute (ACI318-02), (CSA-S6-00).







2016

Midas

Training Series

Soil Structure Interaction

Midas Training Series





MIDAS Technical Support http://globalsupport.midasuser.com/

Thank you