AASHTOWare BrDR 7.5.0 Advanced Concrete Beam Tutorial 1 Simple Span Advanced Concrete RC I Beam Example

## AASHTOWare Bridge Design and Rating Training

### AC1 – Advanced Concrete RC I Beam Example

### Topics Covered:

- Advanced Concrete RC Member Alternatives
- Effective supports and critical shear locations (applies to all concrete member alternatives in BrDR, not just advanced concrete)
- LRFR Rating

### Overview of Advanced Concrete Beam features:

- Advanced concrete beams implemented in BrDR version 7.1.0 in September 2021
- Advanced concrete RC: LRFD/LRFR/LFR/ASR
- Model girders in a multi-girder system or individual webs in a multi-cell box.
- Model schedule based non-symmetric RC Beams
- Post-tensioned/reinforced concrete regions
- Different stages of post-tensioning

This tutorial describes the data entry for a reinforced concrete I beam with schedule based reinforcement using the Advanced Concrete beam alternative in BrDR version 7.5.

# Advanced Concrete RC Member Alternatives

Br	nd Rating ?	×		
BRIDGE EXPLORER BRIDGE FOLD	DER RATE	TOOLS VIEW		
New Open Batch ~	y Paste Co To	py Remove Delete From		
Bridge	Manag	je		{
Favorites Folder	BID	Bridge ID	Bridge Name	Dist
Recent Bridges	1	TrainingBridge1	Training Bridge 1(LRFD)	Unkno
All Bridges	2	TrainingBridge2	Training Bridge 2(LRFD)	Unkno
Templates	3	TrainingBridge3	Training Bridge 3(LRFD)	Unkn
	4	PCITrainingBridge1	PCI TrainingBridge1(LFR)	
	5	PCITrainingBridge2	PCITrainingBridge2(LRFD)	
	6	PCITrainingBridge3	PCI TrainingBridge3(LFR)	
	7	PCITrainingBridge4	PCITrainingBridge4(LRFD)	
	8	PCITrainingBridge5	PCI TrainingBridge5(LFR)	
	9	PCITrainingBridge6	PCITrainingBridge6(LRFD)	1
	10	Example7	Example 7 PS (LFR)	
	> 11	RCTrainingBridge1	RC Training Bridge1(LFR)	
	12	TimberTrainingBridge1	Timber Tr. Bridge1 (ASR)	
	13	FSve GFS TreiningBridge1	FloorSystem GFS Training Bridge 1	- Unke

Open the **Bridge Workspace** for **BID 11** in the sample database delivered with BrDR as shown below.

Expand the **Bridge Workspace (BWS)** tree to show the member alternative for **G2** in the first superstructure definition:



Member G2 already contains a cross-section based RC Tee beam member alternative. In this training example, a new advanced concrete RC I beam member alternative will be created where the beam shape is defined by cross sections, but the reinforcement is entered in a schedule based fashion.

#### Member Alternatives

Double click on the **MEMBER ALTERNATIVES** tree node for member **G2** to open the following window to create a new member alternative.

laterial type:	Girder type:
Post tensioned concrete	Advanced Concrete RC
Prestressed (pretensioned) concrete	Reinforced Concrete I
Reinforced concrete	Reinforced Concrete Tee
Steel	,
Þ	

For **Reinforced concrete** material type, there are 3 girder types available.

The **Reinforced Concrete I** girder type is a cross-section based reinforced concrete member. With a cross-section based RC member alternative, the cross sections are assumed to contain fully developed reinforcement. The AASHTO engines will not compute the reinforcement development lengths for cross-section based RC member alternatives. The user is responsible for determining the development lengths of the longitudinal reinforcement and entering the appropriate developed percentage of reinforcement in each cross section.

Selecting the **Advanced Concrete RC** girder type permits the creation of a reinforced concrete I beam where cross sections are used to describe the beam shape, but the reinforcement is entered as a schedule. Entering the reinforcement in a schedule fashion will allow the AASHTO engines to compute the reinforcement development lengths and determine the developed percentage of reinforcement at each analysis point.

Select **Reinforced concrete** and **Advanced Concrete RC**. Click **OK** to close this window and create the new member alternative.

The **Member Alternative Description** window will open as shown below. Enter a name for the member alternative and switch the default rating method to **LRFR**. The default rating method set here is the method that will be used if **Member Alternative** is selected as the rating method on the **Analysis Settings** window.

A Member Alter	native Des	cription							-		×
Member alterna	tive: Adv	anced RC I	Beam								
Description	Specs	Factors	Engine	Import	Control options						
Description:					Material type: Girder type: Modeling type:	Reinforced Concrete Advanced Concrete RC Multi Girder System					
					Default units:	US Customary V					
Girder pro	perty input dule based s-section ba	t method									
Self load					Default rating me	thod:					
Load case:	: Leolf loadu	Engine As	signed		LRFR	<u> </u>					
Additional	I self load:		%								
- Crack cont	trol parame	stor (7)		Evporu	ra factor						
Top of bea	am:	(Lei (L)	kip/in	Top of	beam:						
Bottom of	beam:		kip/in	Bottom	n of beam:						
							OK	Арр	ly	Cance	el

Navigate to the **Control options** tab and uncheck the **Ignore design & legal load shear** checkbox for **LRFR**. Note that the **Points of interest** selection does not include support points but does include support face & critical shear points. Support points are the centerline of bearing locations. The centerline of bearing is considered as the support face unless an **Effective Support location** is entered in the **Cross Section Ranges: Effective supports** tab. This will be discussed again later in this example.



Click **OK** to apply the data and close the window.

The partially expanded **BWS** tree is shown below.



#### Default Materials

Open the **Default Materials** window. Select the **Top flange concrete** and click on the **Create new material** option.

🕰 Default Materials			_		×
Member alternative n	ame: Advanced RC I Beam				
Deck concrete:	Class A (US)	~			
Deck reinforcement:	Grade 60	~			
Top flange concrete:	Class A (US)	~			
Beam concrete:	Class A (US)				
Reinforcement:	None				
Stirrups:	Create new material				
	ОК	Appl	<b>y</b>	Cance	el

Enter the following data down to the **Compute** button. Click the **Compute** button to have the remaining data calculated.

🕰 Bridge Materials - Concrete						×
Name: 5 ksi concrete						
Description:						
Compressive strength at 28 days (f'c):	5		ksi			
Initial compressive strength (f'ci):	4		ksi			
Composition of concrete:	Normal	$\sim$				
Density (for dead loads):	0.15		kcf			
Density (for modulus of elasticity):	0.145		kcf			
Poisson's ratio:	0.2					
Coefficient of thermal expansion ( $\alpha$ ):	0.000006		1/F			
Splitting tensile strength (fct):			ksi			
LRFD Maximum aggregate size:			in			
Compute						
Std modulus of elasticity (Ec):	4074.28068	8	ksi			
LRFD modulus of elasticity (Ec):	4291.18612	5	ksi			
Std initial modulus of elasticity:	3644.14743	1	ksi			
LRFD initial modulus of elasticity:	3986.54846		ksi			
Std modulus of rupture:	0.53033		ksi			
LRFD modulus of rupture:	0.536656		ksi			
Shear factor:	1					
Сору	to library	Copy f	rom library	OK	Apply	Cancel

Click **OK** to apply the data and close the window. This will create a new concrete material for this bridge.

🕰 Default Materials	🕰 Default Materials —									
Member alternative n										
Deck concrete:	Class A (US)	~								
Deck reinforcement:	Grade 60	~								
Top flange concrete:	5 ksi concrete	× ]								
Beam concrete:	5 ksi concrete	~	J							
Reinforcement:	Grade 60	~								
Stirrups:	Grade 60	~								
	ОК	Apply	′	Canc	el					

Select this new **5** ksi concrete as the default **Beam concrete** as well. Click **OK**. Now the 5 ksi concrete will be the default top flange and beam material when a new cross section is created.

#### **Cross Sections**

Double click on the **Cross Sections** folder in the tree. The **Cast In Place** cross section type is a robust cross section that allows the entry of a wide variety of cross sections including non-symmetric sections. The **Precast I** cross section type permits copying the cross section dimensions from a PS I beam shape in the Library or BWS. Once copied, any dimension can be modified as needed. For this example, the dimensions will be input and not copied from the library.



#### Select Cast In Place and click OK.

The following window appears:



Check the **Symmetric** checkbox and enter the following data. Click the **Compute** button to compute the section properties.



Click **OK** to apply the data and close the window.

#### Cross Section Ranges

Open the **Cross Section Ranges** window and enter the data shown below. Be sure to enter the left and right end projections. These projections are the extension of the beam beyond the first and last centerline of bearings in the structure. Entering this data will permits the entry of longitudinal reinforcement as per the design plans starting and ending in this region. This will allow the AASHTO engines to compute a small percentage of reinforcement developed at the centerline of bearings. Having reinforcement developed at the centerline of bearings. Having reinforcement developed at the centerline of bearings is required to compute the LFD/ASD critical shear distance d and LRFD/LRFR critical shear distance d<sub>v</sub> if spec checking is performed at the support points. If this information is not available, the reinforcement can be specified as being fully developed in the **Flexural Reinforcement** window that will be examined shortly.

In this example, spec checking is not performed at the support points, but this topic is explained in detail to help users gain a fuller understanding of the program.

4	<b>à</b> C	ross	Section Rar	nges						_	٢	כ	×
	С	ross	sections	Effe	ective supports								
		Left	end project	ion:	9 ir	n Right ei	nd projectio	on: 9	in				
			Start secti	on	End section	Depth vary	Support number	Start distance (ft)	Length (ft)	End distance (ft)			
		>	Section 1	$\sim$	Section 1 $$	None 🗸	1 ~	0	40	40			
												4	
								New	Dup	olicate	Dele	te	
								OK		Apply		Cancel	

Switch to the **Effective Supports** tab and enter the following data. This tab allows the shifting of the analysis point at the centerline of bearing to the location entered in the table. The critical shear distance is then measured from this effective support location. The critical shear distance will be computed in the flexural resistance article at the effective support location based on the cross section properties and developed reinforcement at that location.

Cro	ss Sectio	on Rang	es						_		×
Cro	ss sectio	ons E	ffective	supports							
			r								
	Span	start (in)	end (in)								
>	1	18	18								-
						(	DK	Ap	oply	Cano	.el

Click **OK** to apply the data and close the window.

### Flexural Reinforcement

### Open the **Flexural Reinforcement** window and enter the following data in each of its tabs:

Top Hange       Bottom flange         Set       Material       Reference point       Direction       distance       Length       distance       Cener       Space       Sode	4	Flex	ural Reinf	forcement														- 0	×
Set       Material       Reference point       Direction       Gistance       length       End       Ofbars       Size       Clear       Bar       Side       Sizet       End/y         > 1       Grade 60        Support 1        Left        0.5       4.1       40.5       11       5 <		Тор	flange	Bottom flange															
>       1       Grade 60       Support 1       ∨       Left       ∨       0.5       41       40.5       11       5       ∨       2.5			Set	Material		Reference	point	Direction	Start distance (ft)	Length (ft)	End distance (ft)	Number of bars	Bar size	Clear cover (in)	Bar spacing (in)	Side cover (in)	Start fully developed	End fully developed	
New       Duplicate       Delete         OK       Apply       Cancel         Image: Solid State       Length       End       Number       Bar       Clear       Stat       End         Image: Solid State       Length       End       Number       Bar       Clear       Stat       End         Image: Solid State       Material       Reference point       Direction       distance       Number       Bar       Clear       Sart       End         Image: Solid State       Image: Solid State       Image: Solid State       Image: Solid State       End       Number       Bar       Clear       Sart       End         Image: Solid State       Image: Solid State       Image: Solid State       Image: Solid State       End       Number       Bar       Clear       Sart       End         Image: Solid State       Image: Solid State       Image: Solid State       Image: Solid State       End       Fold       <		>	1	Grade 60	~	Support 1	$\sim$	Left 🗸	0.5	41	40.5	11	5 ~	2.5					-
Top flange       Bottom flange         Set       Material       Reference point       Direction       Start (ft)       Length (ft)       End (ft)       Number of bars       Bar size       Clear (over (in)       Bar (in)       Side developed       Start fully developed         > 1       Grade 60       Support 1       Left       0.5       41       40.5       8       9       2       Image: Start fully       End fully       Image: Start fully       Image: Start fully <td< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>N</th><th>ew OK</th><th>Duplicate Apply</th><th>Delete</th><th>e ncel</th></td<>															N	ew OK	Duplicate Apply	Delete	e ncel
Set       Material       Reference point       Direction       Start distance (ft)       Length (ft)       End distance (ft)       Number of bars       Bar size       Clear cover (in)       Bar spacing (in)       Side cover (in)       Start fully developed       End fully developed         > 1       Grade 60 v       Support 1 v       Left v       0.5       41       40.5       8       9 v       2       0       0       0       0         V <t< th=""><th>•</th><th>Flex</th><th>ural Reinf</th><th>forcement</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>- 0</th><th>×</th></t<>	•	Flex	ural Reinf	forcement														- 0	×
> 1       Grade 60 ∨ Support 1 ∨ Left ∨ 0.5       41       40.5       8       9 ∨ 2	•	Flex Top	ural Reinf flange	forcement Bottom flange														- 0	×
Vew Duplicate Delete	•	Flex	ural Reinf flange Set	forcement Bottom flange Material		Reference	point	Direction	Start distance (ft)	Length (ft)	End distance (ft)	Number of bars	Bar size	Clear cover (in)	Bar spacing (in)	Side cover (in)	Start fully developed	End fully developed	×
OK Apply Cancel		Flex Top	ural Reinf flange Set 1	forcement Bottom flange Material Grade 60	~	Reference Support 1	point ~	Direction Left V	Start distance (ft) 0.5	Length (ft) 41	End distance (ft) 40.5	Number of bars 8	Bar size 9 ~	Clear cover (in) 2	Bar spacing (in)	Side cover (in)	Start fully developed	End fully developed	×

Click **OK** to apply the data and close the window.

#### Advanced Concrete Shear Reinforcement Ranges

The BWS tree contains a **Deck Profile** window and a **Haunch Profile** window to provide the greatest flexibility in defining a member alternative. This example does not contain a reinforced concrete deck so these windows will be skipped. Open the **Shear Reinforcement Ranges** window and enter the following data.

dvan	nced Concrete Shear	Reinforcem	ent Ranges						_		
4	Start Distance	Spacing									
/ertica	al Horizontal	Ι.	I								
	Name	Extends into deck	Support number	Start distance (ft)	Number of spaces	Spacing (in)	Length (ft)	End distance (ft)			
;	#5 Shear Reinf. $$		1 ~	0	1	0	0	0			A
;	#5 Shear Reinf. $$		1 ~	0	16	6	8	8			
;	#5 Shear Reinf. $$		1 ~	8	24	12	24	32			
> ;	#5 Shear Reinf. 🖂		1 ~	32	16	6	8	40			
Sti	irrup wizard						New	Duplicate		Delete	
							ОК	Appl	у	Canc	el

Click **OK** to apply the data and close the window.

Note, in this example, no data will be entered on the **Live Load Distribution** window and instead allow the AASHTO engine to compute the live load distribution factors during the analysis.

#### Schematic – Member alternative

With member alternative **Advanced RC I Beam** selected in the BWS tree, click on the **Schematic** button from the **WORKSPACE** ribbon as shown below to view the schematic.

8	ANALYSIS	Bridge Workspace - RCTrainingBridge1
BRIDGE WORKSPACE WORKSPACE TOOLS VIEW	DESIGN/RATE	$\frown$
Check Out Check In Validate Save Revert Close Export Refr	esh Open Net	Copy Paste Duplicate Delete Schematic
Bridge		Manage
Workspace	# ×	Schematic * ×
Bridge Components		Advanced concrete profile
Framing Plan Detail     Bracing Deterioration     BSC Bracing Spec Check Selection     Superstructure Loads     Superstructure Loads     Share Reinforcement Definitions     Bar Mark Definitions     MEMBERS     I G2     I G2     I G4     I G4     I Interior 36* RC Fase Beam (E)     I Advanced RC I Beam (E)     I Advanced RC I Beam (E)     I Interior 36* RC Fase Beam (E)     I Advanced RC I Beam (E)     I Interior 36* RC Fase Beam (E)     I mpact/Dynamic Load Allow:     Cross Section 1     Cross Section 1     Cross Section Ranges	ince	Image: ConstrainingBridge1         RC Training Bridge1         Vert. Shear Reinf. Spacing         Vert. Shear Reinf. Spacing         Vert. Shear Reinf. Spacing         16 SPA @ 6"=8'-0"         24 SPA @ 1'-0"=24'-0"         16 SPA @ 6"=8'-0"         17 Span Lengths

#### Schematic – Cross Section

Similarly, the schematic of the cross section can be viewed by clicking on the **Schematic** button from the **WORKSPACE** ribbon with **Section 1** selected in the **BWS** tree.



Similarly, the following schematics are available for advanced concrete beams.



Schematic	1 ×
Advanced concrete profile Advanced concrete cross section Advanced concrete cross section ranges	<del>-</del> ×
Image: ConstrainingBridge1       RC Training Bridge1       RC Training Bridge1       RC Training Bridge1       IV12/2009    Cross Section Transitions       48"x40"-0"    Span Lengths       #	÷
	Advanced concrete profile       Advanced concrete cross section ranges         Advanced concrete profile       Advanced concrete cross section ranges         RC TrainingBridge1       RC Training Bridge1(LFD) - Advanced RC I Beam 10/12/2009         Cross Section Transitions       48"x40"-0"         Span Lengths       40"-0"

#### Schematic – Flexural Reinforcement



### LRFR Analysis

The member alternative can now be analyzed. To perform an LRFR rating, select the **Advanced RC I Beam** alternative in the BWS tree, open the **ANALYSIS DESIGN/RATE** tab on the ribbon, and select the **Analysis Settings** button.

Bridge Workspace - RCTrainingBridge1			ANALYSIS	REPORTS	?	_	$\times$
BRIDGE WORKSPACE	WORKSPACE TOOLS	VIEW	DESIGN/RATE	REPORTING			
a 🚌	2 🖪						
Analysis Analyze Analysis Settings Events	Tabular Specification Er Results Check Detail Ou	ngine Resu utputs Gra	Ilts Save ph Results				
Analysis Results							

The **Analysis Settings** window will open. Click the **Open template** button and select the **LRFR Design Load Rating** to be used in the rating and click **Open**.

۵	Open Template					×
	Templates	Description	Analysis	Owner	Public / Private	
	HL 93 Design Review	HL 93 Design Review	LRFD		Public	
	HS 20 LFR Rating	HS 20 LFR Rating	LFR		Public	_
	> LRFR Design Load Rating	LRFR Design Load Rating	LRFR		Public	
	LRFR Legal Load Rating	LRFR Legal Load Rating	LRFR		Public	
	Delete				Open	Cancel

			-	
Design review <b>O</b> Rating	Rating method:	LRFR	~	
ysis type: Line Girder 🗸				
e / Impact loading type: As Requested V	Apply preference setting:	None	~	
hicles Output Engine Description				
raffic direction: Both directions ~	Refresh	Temporary vehicles	Advanced	
ehicle selection	Vehicle summar	У		
-EV2 -EV3 -H 15-44 -H 20-44 -HL-93 (SI) -HL-93 (US) -HS 15-44 -HS 20 (SI) -HS 20 (SI) -HS 20-44 -Lane-Type Logal Load -LRFD Fatigue Truck (SI) -LRFD Fatigue Truck (US) -NRL -SU4 -SU5 -SU6 -SU7 -Type 3 -Type 3	Add to	gn load rating nventory HL-93 (US) Dperating HL-93 (US) atigue LRFD Fatigue Truck (US I load rating Routine specialized hauling nit load rating	5)	

The Analysis Settings window will be populated as shown below. Click OK to close the window.

#### Click **Analyze** on the ribbon to launch the rating.



#### Tabular Results

When the rating is finished results can be reviewed by clicking the **Tabular Results** button on the ribbon.



The window shown below will open. Select **Single rating level per row** as the display format to display the output in single rows as shown below. Other Report Types such as **Dead Load** and **Live Load** analysis results can also be viewed in this window.

<b>A</b> ,	Analysis Res	ults - Advanced R	C I Beam								— C	]	×
	Print Print												
Repo	ort type:		Lane/Impact	loading typ	e	Display Forma	t						
Rati	ng Results S	ummary V	O As rec	uested	Detailed	Single rating	level per ro	w ~					
	Live Load	Live Load	Rating Method	Rating	Load Rating	Rating Factor	Location	Location	Limit State	Impact	Lane		
	HI -93 (US)	Truck + Lane	LRER	Inventory	47.62	1,323	20.00	1 - (50.0)	STRENGTH-L Concrete Elevure	As Requested	As Reques	ted	
	HL-93 (US)	Truck + Lane	LRFR	Operating	61.73	1.715	20.00	1 - (50.0)	STRENGTH-I Concrete Flexure	As Requested	As Reques	ted	
	HL-93 (US)	Tandem + Lane	LRFR	Inventory	46.75	1.299	20.00	1 - (50.0)	STRENGTH-I Concrete Flexure	As Requested	As Reques	ted	
	HL-93 (US)	Tandem + Lane	LRFR	Operating	60.60	1.683	20.00	1 - (50.0)	STRENGTH-I Concrete Flexure	As Requested	As Reques	ted	
AASI Analy	HTO LRFR En	gine Version 7.5.0 ce setting: None	).3001										v
												Clos	e

Review the **Analysis Progress** log shown below. The **Effective Support** locations that were entered are listed first in the report of analysis points. The critical shear distance dv is measured from these effective support locations as shown below.

Analysis			– 🗆 ×
Analysis - Advanced RC I Beam			~ ×
Analysis Event	- L - L - ST - E - E - L - L - L - L - L - L - L - L - L - L	beation - 28.0000 (ft) beation - 32.0000 (ft) beation - 36.0000 (ft) AGE 3 ff. Support Location - 1.5000 (ft) Critical shear distance dv = $3.7203$ (ft) to right of this support. Shear will be checked at $5.2203$ (ft) ff. Support Location - $38.5000$ (ft) Critical shear distance dv = $-3.7203$ (ft) to left of this support. Shear will be checked at $34.7797$ (ft) beation - $4.0000$ (ft) beation - $12.0000$ (ft) beation - $16.0000$ (ft) beation - $24.0000$ (ft) beation - $24.0000$ (ft) beation - $24.0000$ (ft) beation - $28.0000$ (ft) beation - $32.0000$ (ft) beation - $32.00000$ (ft) beation - $32.00000$ (ft) beation - $32.000000$ (ft) beation - $32.000000000000000000000000000000000000$	
	i 🙆 Erro	ors 🗥 Warnings	
	Туре	Description	
		Warning - Superstructure definition humidity and System	<b>^</b>
		Warning - The Haunch Load entered on the Advanced Co	
		Warning - The Haunch Load will not be applied!	-
		Warning - By Tributary Area was selected for Stage 1 dea	
	A	Warning - The Parapet load of a Parapet location entered	•
			Close

#### Specification Check Detail

Click Specification Check Detail on the ribbon to review the detailed spec checks.



Note that the 0' and 40' locations are not included in the spec checking. That is because data was entered for the effective supports. The first point spec checked is located at the effective support location at 1.5'. Only flexural articles are evaluated at this point. The critical shear distance  $d_v$  is computed from this location.

A Specification Checks for Advan	ced RC I Beam - 12 of 286			-		×
Properties Specification filter	Articles       All articles     ✓       Format					
<ul> <li>Superstructure Component</li> <li>Stage 1</li> <li>Stage 2</li> <li>Stage 3</li> <li>Advanced RC I Beam</li> <li>Span 1 - 1.50 ft.</li> <li>Span 1 - 4.00 ft.</li> <li>Span 1 - 5.22 ft.</li> <li>Span 1 - 5.22 ft.</li> <li>Span 1 - 16.00 ft.</li> <li>Span 1 - 20.00 ft.</li> <li>Span 1 - 28.00 ft.</li> <li>Span 1 - 32.00 ft.</li> <li>Span 1 - 36.00 ft.</li> <li>Span 1 - 38.50 ft.</li> </ul>	Specification reference       Limit         ✓ 5.4.2.1 Compressive Strength         ■ 5.4.2.5 Poisson's Ratio         ■ 5.4.2.6 Modulus of Rupture         ■ 5.4.2.8 Concrete Density Modification Factor         NA 5.5.3.2 Reinforcing Bars and Welded Wire Reinforcement         ■ 5.5.4.2 Strength Limit State - Resistance Factors         ■ 5.6.2.2 Rectangular Stress Distribution         ✓ 5.6.3.2 Flexural Resistance (Reinforced Concrete)         ✓ 5.6.3.3 Minimum Reinforcement         NA 5.6.7.Crack Control of Cracking by Distribution of Reinforcement         ✓ 6A.4.2.1 General Load Rating Equation - Concrete Flexure         ■ Cracked_Moment_of_Inertia Section Property Calculations	it State	Flex. Sense N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	Pass/Fail Passed General C General C Not Requi General C Passed Passed Not Requi Passed General C	omp. omp. omp. omp. omp.	

Scrolling through the analysis points shows that shear does not get evaluated until the analysis point at 5.22'. Shear is then evaluated at analysis points until we reach the critical shear location at 34.78' at the right end of the beam.

🕰 Specification Cl	hecks for Advan	ced RC I Beam - 12 of 286		- 🗆	×
		Articles			
$\sim$		All articles V			
Properties	Generate	Format Bullet list V			
Specification filter		Report			
🔺 🚞 Superstructu	ire Component	Specification reference Limit State	Flex. Sense	Pass/Fail	
🕨 🚞 Stage 1		5.4.2.6 Modulus of Rupture	N/A	General Comp.	
🕨 🚞 Stage 2		5.4.2.8 Concrete Density Modification Factor	N/A	General Comp.	
a 🚞 Stage 3		5.5.4.2 Strength Limit State - Resistance Factors	N/A	General Comp.	
a 🚞 Advar	nced RC I Beam	5.6.2.2 Rectangular Stress Distribution	N/A	General Comp.	
🚞 Sp	oan 1 - 1.50 ft.	✓ 5.6.3.2 Flexural Resistance (Reinforced Concrete)	N/A	Passed	
Sp Sp	an 1 - 4.00 ft.	✓ 5.6.3.3 Minimum Reinforcement	N/A	Passed	
Sp	an 1 - 5.22 ft.	✓ 6A.4.2.1 General Load Rating Equation - Concrete Shear	N/A	Passed	
i Sp	an 1 - 8.00 ft.	6A.4.2.1 Shear-5.6.3.3 Minimum Reinforcement	N/A	General Comp.	
j sp	an I - 12.00 ft.	✓ 6A.4.2.1 Shear-5.7.2.5 Minimum Transverse Reinforcement	N/A	Passed	
i sp	an I - 16.00 ft.	✓ 6A.4.2.1 Shear-5.7.2.6 Maximum Spacing of Transverse Reinforcement	N/A	Passed	
Span 1 - 20.00 ft.		6A.4.2.1 Shear-5.7.3.3 Nominal Shear Resistance	N/A	General Comp.	
i Span 1 - 24.00 ft. i Span 1 - 28.00 ft.		6A.4.2.1 Shear-5.7.3.4 Procedures for Determining Shear Resistance	N/A	General Comp.	
i So	an 1 - 32.00 ft.				
i So	an 1 - 34.78 ft.				
i Sp	an 1 - 36.00 ft.				
🛅 Sp	an 1 - 38.50 ft.				