



# RCDC (SACD) V23.0.2

## Release Notes

**RCDC V23.00.02** is herewith now available with the following new features and design capabilities. The newly introduced features are:

No	Module	Description
1	Beam	Beam Ductile detailing Enhancement – All design code
2	Column	Column effective length factor Enhancements in auto and redesign tools
3	General	Defects Resolved



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## Beam

## Beam Ductile detailing Enhancement – All design code

Various design codes provide the ductile detailing requirement for the top and bottom reinforcement of the beam. Example: As per the ACI code, the positive moment strength at the joint face shall be at least one-half the negative moment strength provided at that face of the joint. Here, the Moment strength is to be calculated as per the provided reinforcement in the beam. The moment strength cannot be calculated as per the required reinforcement as provided reinforcement can be much more than the required reinforcement

RCDC is performing ductile detailing for the top and bottom reinforcement of the beam as per code requirements. The area of reinforcement provided at the section is used for the ductile detailing. However, due to some limitations in a few cases, instead of using the provided area of reinforcement, the area of reinforcement required was used to satisfy the ductile detailing requirements. It is now made consistent in all cases and the area of reinforcement provided is used.

The design calculation report is also enhanced by adding a new row to give more clarity about the area of reinforcement required as per ductility criteria. Corresponding code criteria are also added in the note section for easy reference.

<b>For Longitudinal Reinf</b>						
	<b>Beam Bottom</b>			<b>Beam Top</b>		
	<b>Left</b>	<b>Mid</b>	<b>Right</b>	<b>Left</b>	<b>Mid</b>	<b>Right</b>
Critical L/C - RCDC	8	2	9	5	8	4
Mu (kNm)	48.05	185.88	20.9	312.32	17.45	369.2
As (flex) (sqmm) (C)	175.42	694.02	76	1191.94	63.4	1423.71
Asc (flex) (sqmm) (A)	-	-	-	-	-	-
Tu (kNm)	-	-	-	-	-	-
Tcr/4 (kNm)	-	-	-	-	-	-
AI, min(sqmm)(Tor.) (D)	-	-	-	-	-	-
AI (sqmm) (Tor.) (E)	-	-	-	-	-	-
AI (Dist) (sqmm) (D)	-	-	-	-	-	-
Ast (sqmm)	379.6	923.05	379.6	1191.94	379.6	1423.71
AstDuctile (sqmm) (F)	619.8	380.03	760.06	380.03	380.03	380.03
AstFinal (Max(Ast, AstDuctile)) (sqmm)	619.8	923.05	760.06	1191.94	380.03	1423.71
AstPrv (sqmm)	633.4	1013.44	886.76	1239.6	380.04	1520.13
Reinforcement Provided	5-#13	5-#13 3-#13	5-#13 2-#13	3-#19 3-#13	3-#13	3-#25



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### Note: Calculation of Ast

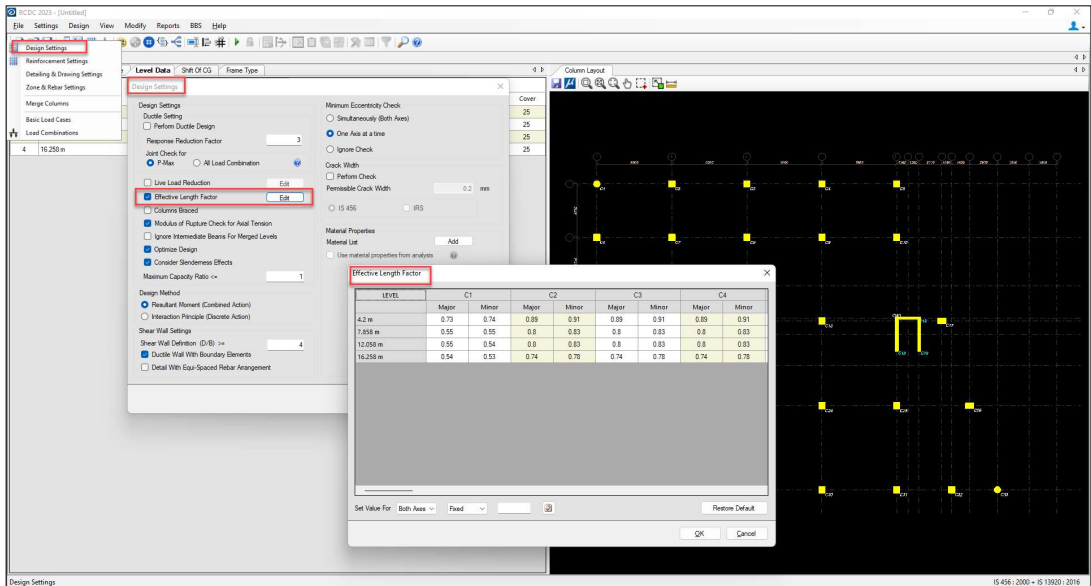
Ast	=	Max {B, C+D, A+D}	(for Mu > 0 and C x 1.33 > B)
Ast	=	Max{B', C x 1.33 + D, A+D}	(for Mu > 0 and C x 1.33 < B)
Ast	=	Bn	(for Mu = 0)
Where,			
A	=	Asc (flex)	= Compression reinforcement required for bending moment
B	=	As,min (flex)	= Min area of flexural reinforcement
Bn	=	As,nominal	= Nominal area of reinforcement
C	=	As (flex)	= Total area of longitudinal reinforcement calculated at a given section
D	=	A1 (Dist)	= Distributed longitudinal torsional reinforcement at section considered
E	=	AstCrack	= Area of reinforcement required for Crackwidth
F	=	AstDuctile	= Area of reinforcement as per Ductile detailing requirements
Ast (Dist) (sqmm)	=	Max(A1,min (Tor), A1 (Tor)) x ((2B) / (2B + 2D))	
<b>Ductile Detailing - Special Frame</b>			
AstDuctile - Bottom (left & Right)	=	Max(50% of Ast provided at top, 25% of max Ast provided from all zones)	
AstDuctile - Top (left & Right), Bottom (Mid) & Top (Mid)	=	25% of max Ast provided from all zones	

## Column Effective length factor Enhancements in auto and redesign tools

In the column design, an effective length factor is calculated which is required to perform the slenderness check. As per the type of frame (Sway and Non-sway), section size, and material properties of the column and beam, the effective length factor is calculated for the column.

RCDC provides options to change the material grades and member sizes at various stages of the design and redesign. RCDC now recomputing the effective length factor if the user has changed the column size or material properties at various design and redesign stages.

Recompute effective length factor prior to the Auto design stage:  
Users compute the effective length factor from the design setting screen.



Now, if the user changes the column size, and concrete grade at the input stage, RCDC will show a below warning message to the user.



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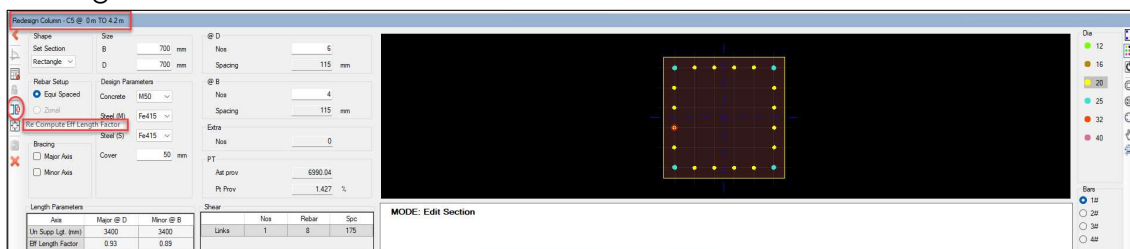
It is expected that the user will update the effective length factor after modifying data like column shape, column size, and concrete grade on the input screen. The warning message will be displayed once to the user. If the user does multiple changes on the input screen, it is the user's responsibility to recompute the effective length factor after updating all the changes. The re-computations can be done by selecting restoring default values on the screen of the effective length factor of design settings.

LEVEL	C1		C2		C3		C4	
	Major	Minor	Major	Minor	Major	Minor	Major	Minor
4.2 m	0.73	0.74	0.89	0.91	0.89	0.91	0.89	0.91
7.858 m	0.55	0.55	0.8	0.83	0.8	0.83	0.8	0.83
12.058 m	0.55	0.54	0.8	0.83	0.8	0.83	0.8	0.83
16.258 m	0.54	0.53	0.74	0.78	0.74	0.78	0.74	0.78

It is suggested that the user should do all the changes first and then compute the effective length factor. If the user does the changes on the input screen first and then moves to the design setting to calculate the effective length factor, RCDC will take the latest data to compute the effective length factor. At this stage, no warning message will be displayed to the user.

Recompute effective length factor post to the auto design stage:

Redesign section:



If the user changes the column shape or width of the section, depth of the section, or concrete grade, the user can recompute the effective length factor using the 'recompute effective length factor' button.



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Redesign column:

Redesign Column - C7

Level	Shape	B	D	Designed As	Column/Wall				Beam			Eff Lgt Fac Major	Eff Lgt Fac Minor	Bracing Major	Bracing Minor
					Concrete	Steel (M)	Steel (S)	Cover	Concrete	Steel	Cover				
0 m to 4.2 m	Rectangle	700	700	Equi	M50	Fe415	Fe415	50	M25	Fe415	25	0.88	0.87	<input type="checkbox"/>	<input type="checkbox"/>
4.2 m to 7.858 m	Rectangle	700	700	Equi	M40	Fe415	Fe415	50	M25	Fe415	25	0.79	0.77	<input type="checkbox"/>	<input type="checkbox"/>
7.858 m to 12.058 m	Rectangle	700	700	Equi	M40	Fe415	Fe415	50	M25	Fe415	25	0.78	0.76	<input type="checkbox"/>	<input type="checkbox"/>
12.058 m to 16.258 m	Rectangle	700	700	Equi	M25	Fe415	Fe415	50	M25	Fe415	25	0.73	0.71	<input type="checkbox"/>	<input type="checkbox"/>

Ductile Design

Reset Compute Eff Lgt Fac Redesign Accept Cancel

If the user does changes in any of the marked values, RCDC will activate the 'compute effective length factor' button to recompute the effective length factor.

Redesign level:

Redesign Levels

Select	Description	Description	Column/Wall				Beam		
			Concrete	Steel (M)	Steel (S)	Cover	Concrete	Steel	Cover
<input type="checkbox"/>	4.2 m	4.2 m	M50	Fe415	Fe415	50	M25	Fe415	25
<input type="checkbox"/>	7.858 m	7.858 m	M25	Fe415	Fe415	50	M25	Fe415	25
<input type="checkbox"/>	12.058 m	12.058 m	M40	Fe415	Fe415	50	M25	Fe415	25
<input checked="" type="checkbox"/>	16.258 m	16.258 m	M25	Fe415	Fe415	50	M25	Fe415	25

Reset Compute Eff Lgt Fac Redesign Accept Cancel

If the user does changes in any of the marked values, RCDC will activate the 'compute effective length factor' button to recompute the effective length factor.

Redesign section (for combined wall):

Redesign Combine Wall - CW1 @ 0 m TO 4.2 m

Design Parameters

Concrete: M50  
Steel (M): Fe415  
Steel (S): Fe415  
Cover: 50 mm

Re Compute Eff Length Factor

Column/Wall	Main Reinforcement
C12	22-T10 + 10-T8
C18	22-T10 + 16-T10 + 10-T8
C19	22-T10 + 16-T10 + 10-T8



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If the user does change the concrete grade, RCDC will activate the 'recompute effective length factor' button to recompute the effective length factor. Redesign Combined wall:

Grp	Level	Concrete	Steel (M)	Steel (S)	Cover
1	0 m to 4.2 m	M40	Fe415	Fe415	50
2	4.2 m to 7.858 m	M25	Fe415	Fe415	50
3	7.858 m to 12.058 m	M40	Fe415	Fe415	50
4	12.058 m to 16.258 m	M25	Fe415	Fe415	50

The effective length factor for the walls that are part of the combined wall is considered 0.1 as default. Thus, recompute button is not provided here.

## General Defects Resolved

Following is the list of Defects resolved in this release.

- **ADO ID – 675415 – issue in calculating the unsupported length if structural steel beams are supported on the RC column.**

The unsupported length of the column is calculated as per the floor-to-floor height deducting the depth of the beam resting on it. The beam resting on the column can be RC or structural steel. The unsupported length of the column is calculated along both directions of the column.

### Issue:

When the structural steel beam is supported on the RC column, the incorrect unsupported length was calculated for that column. The wrong structural steel beam depth was considered for the calculation of the unsupported length.

### Solution:

Actual structural steel beam depth is now considered to calculate the unsupported length of the column.

- **ADO ID - 1042993 – Beam-Preferred rebar spacing validation is provided if the Maximum aggregate size is changed.**



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The preferred rebar spacing in the beam is dependent on the beam size, rebar diameter, and maximum aggregate 2 (Metal) size given by the user.

Beam Width	Rebar Nos (Rebar<=16)	Spacing	Rebar Nos (Rebar>=20)	Spacing
230	3	51	2	110
400	5	60	4	80
450	5	72	4	97

Skip maximum spacing criteria between rebar for zero bending moment.

OK Cancel

General And Reinforcement Settings	
<b>Design Settings</b>	
<input type="checkbox"/> Ignore Torsion	
Value Less Than	0 kNm
<input checked="" type="checkbox"/> Ductile Design (Select Frame Types)	
<input checked="" type="radio"/> Special	<input type="radio"/> Intermediate
$\Phi$ 0.6	
<input type="checkbox"/> Flanged Beams	
<input type="radio"/> Secondary Only	<input type="radio"/> All Beams
<b>Material Properties</b>	
Concrete Grade	C20 Add
Steel Grade (Main)	Fy420 Add
Steel Grade (Shear)	Fy420 Add
Bottom/Top Clear Cover	40 mm
Side Clear Cover	40 mm
Max Aggregate 2 size	25 mm

## Issue:

The preferred rebar spacing is calculated using the maximum aggregate 2 sizes available in the general and reinforcement settings screen. The input for maximum aggregate 2 sizes is available prior to the calculation of preferred rebar spacing. If the maximum aggregate size is changed after calculating the preferred rebar spacing, the rebar numbers were not updated on the rebar spacing screen. It was causing issues with the redesign tools. The number of rebars should be recalculated as per the updated maximum aggregate 2 size.

## Solution:

When the user changes the maximum aggregate 2 sizes, the preferred spacing is updated on the backend and updated the rebar numbers are used in the further auto and redesign steps. The below snaps show the rebar numbers are updated after changing the Max. Aggregate 2 sizes to 75mm as compared to size of 25mm in the previous snap.

Beam Width	Rebar Nos (Rebar<=16)	Spacing	Rebar Nos (Rebar>=20)	Spacing
230	2	118	2	110
400	4	85	4	80
450	4	102	4	97

Skip maximum spacing criteria between rebar for zero bending moment.

OK Cancel

General And Reinforcement Settings	
<b>Design Settings</b>	
<input type="checkbox"/> Ignore Torsion	
Value Less Than	0 kNm
<input checked="" type="checkbox"/> Ductile Design (Select Frame Types)	
<input checked="" type="radio"/> Special	<input type="radio"/> Intermediate
$\Phi$ 0.6	
<input type="checkbox"/> Flanged Beams	
<input type="radio"/> Secondary Only	<input type="radio"/> All Beams
<b>Material Properties</b>	
Concrete Grade	C20 Add
Steel Grade (Main)	Fy420 Add
Steel Grade (Shear)	Fy420 Add
Bottom/Top Clear Cover	40 mm
Side Clear Cover	40 mm
Max Aggregate 2 size	75 mm

- ADO ID – 1083595 – Tank structures – issue in reading STAAD file if a slab of the tank is modeled with an opening in it.



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Presently RCDC reads the opening in the tank wall, however, for the design and detailing opening is not considered. The standard reinforcement details around openings are provided in the detailed drawings.

Issue:

If the user has modeled the tank slab with an opening in it, RCDC was unable to read the tank model. There was no issue reading STAAD file if the opening is in the tank wall.

Solution:

The reading tank structure is now handled if there are slabs with openings in them.

- **ADO ID – 1166877 – Issue in updating higher rebar diameter for shear design**

Generally, the shear force is higher at the ends and lesser at the mid-zones of the beam. Similarly shear due to sway action (Sway left and sway right action for ductile beams) gives a higher shear force at ends and less shear force at mid-zones.

Issue:

In a few cases specifically at mid-zone where area of shear reinforcement required due to sway action is higher than the end zones, RCDC was not trying the rebar diameter to a higher diameter to satisfy the shear detailing requirements. It was taking the diameter of end zones for the mid zone and if it was not satisfying, it was showing detailing failure at mid zone.

Solution:

At the mid zone, if the shear rebar diameter required is higher than the end zones, RCDC is now increasing the diameter to satisfy the area of shear reinforcement required.

- **ADO ID – 1206007 – Load combination –An error message was missing if any load combinations don't consist of a single dead load case in it.**

Generally, each load combination must be created with at least one dead load case. If load cases are present in the load list but it is not used in any of the load combinations, RCDC is used to show an error of "at least one dead load case should be present in the load combinations".

Issue:

When the user imports the load combination definition directly from analysis and there is no dead load case present in any of the load combinations, RCDC was not showing an error in the latest released version. When load combinations are created through standard templates available in RCDC, it takes care of creating



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load combinations with at-least one dead load case specified in the code requirement.

Solution:

If there is no dead load case present in any of the load combinations, RCDC is now showing an error of missing dead load cases in the load combination.

- **ADO ID – 1207034 – ACI code – slenderness check presentation issue in cases where there is only axial force in column (no Bending Moments)**

In the ACI codes column design, the effect of the end bending moment includes in the calculation of the permissible slenderness check value. The direction of the end bending moment plays an important role to identify whether the column is bent in single or double curvature based on which the permissible slenderness value is calculated.

Issue:

In a case where the column is experiencing only axial forces without any bending moment, there was an issue in the presentation of permissible slenderness value in the design calculation report. There was no issue with the design of the column as correct final bending moments are calculated based on the slenderness checks.

Solution:

The design calculation report presentation is updated with all possible cases and correct permissible slenderness values are presented.

- **ADO ID – 1236141 – ACI code – Beam design – Inconsistent result of auto design and redesign if the beam is designed with axial force and biaxial moments**

RCDC allows to design of the beams with axial force and biaxial bending moments. Users can select this option of beam design from the design settings screen.

Issue:

In one of the cases, the beam with axial force and biaxial moments shown passed in the auto design. but it was showing it as failed on the redesigned screen using the same design settings as auto design. The issue occurred as different rebar layers were used in the auto and redesign step.

Solution:

The auto design and redesign steps are made consistent now. If any beam failed in the auto design will now show a similar type of failure on the redesigned screen.