RCDC (SACD) V10.00

Release Notes

RCDC V10.00.00 is here with new features enhancing the design capabilities. The newly introduced features are:

No	Module	Description
1	General	Addition of NSCP (Philippines) Code for all Elements
2	Water Tank	Water Tank Structure design – Complete Design and Detail Version
3	Beam	Calculation of Sway shear at Supports for Euro Code.
4	General	Enhancements
5	General	Defects Resolved

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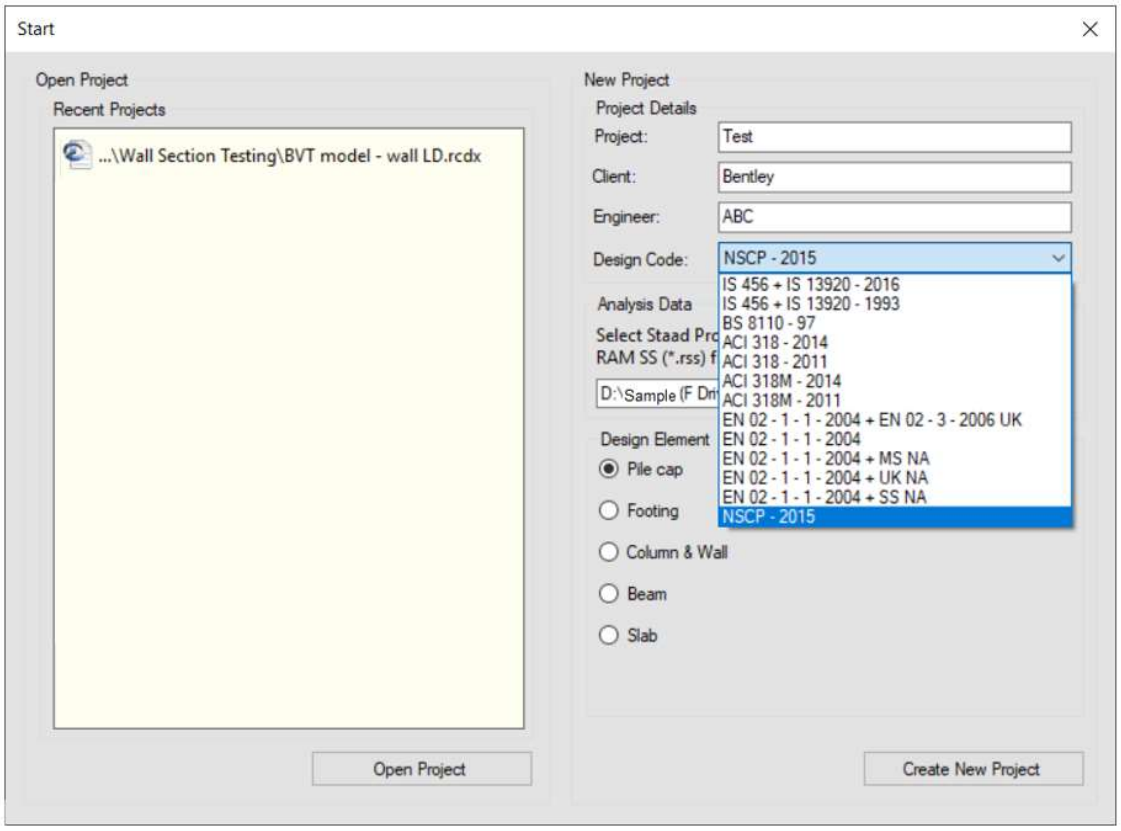
General — Addition of NSCP Code for all Elements

NSCP – 2015 – (National Structural Code of the Philippines) is added in RCDC. With the addition of this code, all the structural elements can now be designed for NSCP – 2015:



Water Tank — Water Tank Structure design – Complete Design and Detail Version

Structures having liquid retaining walls can be designed and detailed using the new RCDC V 10.0 version with BS EN code.

All the detailed reports and drawings as per the list below, can be generated for all the structural elements present in model. The model must be created using STAAD and walls as well as slabs containing liquid have to be created using parametric surface definition and analysed with FEM modelling.

It may be noted that the entire structure for the tanks would be handled in a single RCDC file. There would be individual modules for design of beams and columns.

Tank Wall Design Reports:

- Design Calculations
- Design Summary

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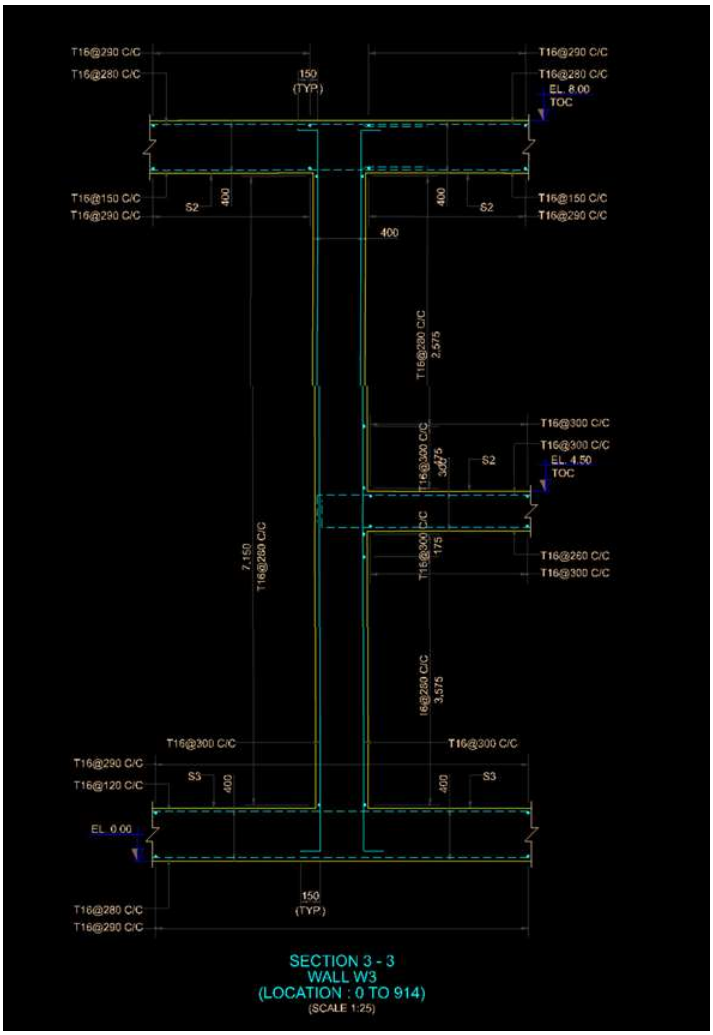
- Design for all Stations
- Project Settings.
- Flexural Crack Width Check.
- Dry Shrinkage & Thermal Crack Check
- Failure Diagnostics
- Bill of Quantities
    - Summary
    - Reinforcement type wise (Main steel, Shear reinforcement, Face bars)
    - Reinforcement diameter wise

Wall section Drawing:



The section forces used for design of Walls can be viewed in the 'Tank wall' module under the menu for the 'Section Forces'.

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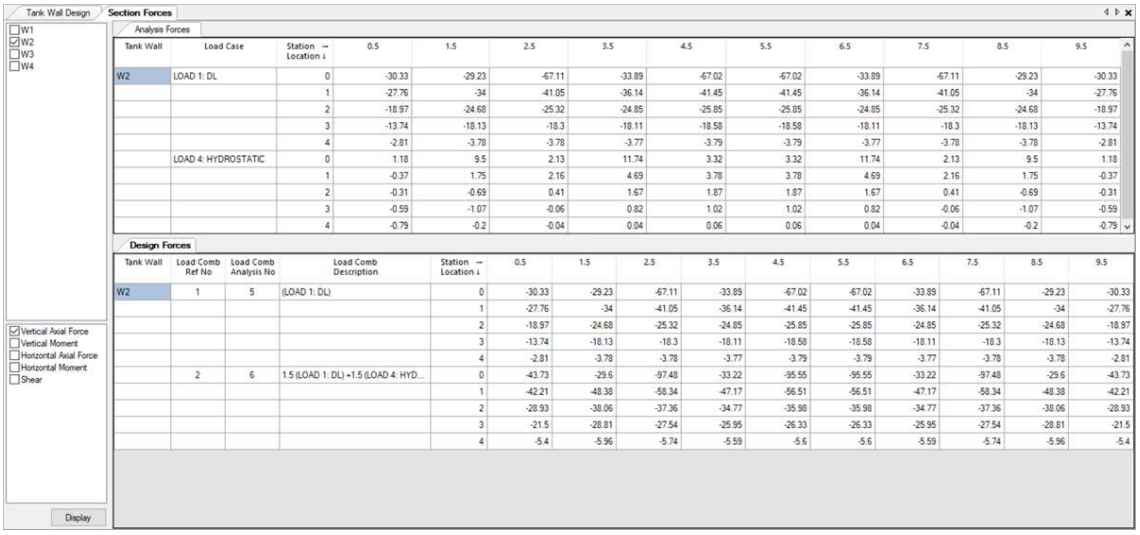
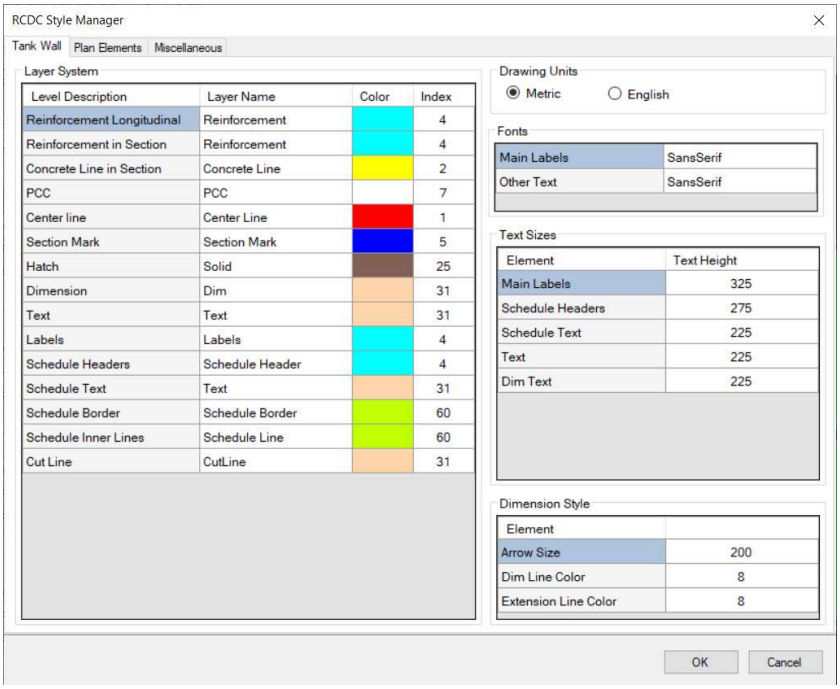


Separate drawing style settings are available for 'Tank Wall' under menu of 'Drawing Style'.



Tank Slab Design Reports:

Following is the list of various reports available for 'Tank Slabs'

- Text Schedule
- General Arrangement Plan
- In-Plan Detailing
- Slab Section.

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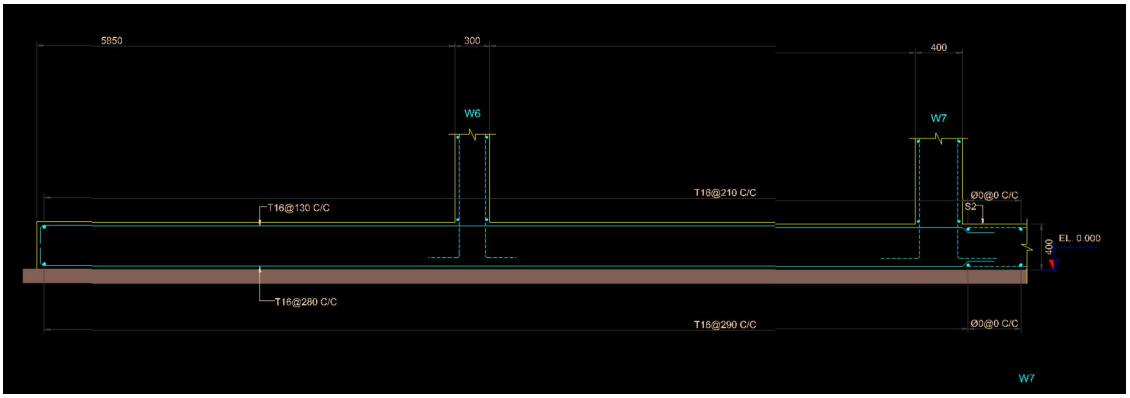
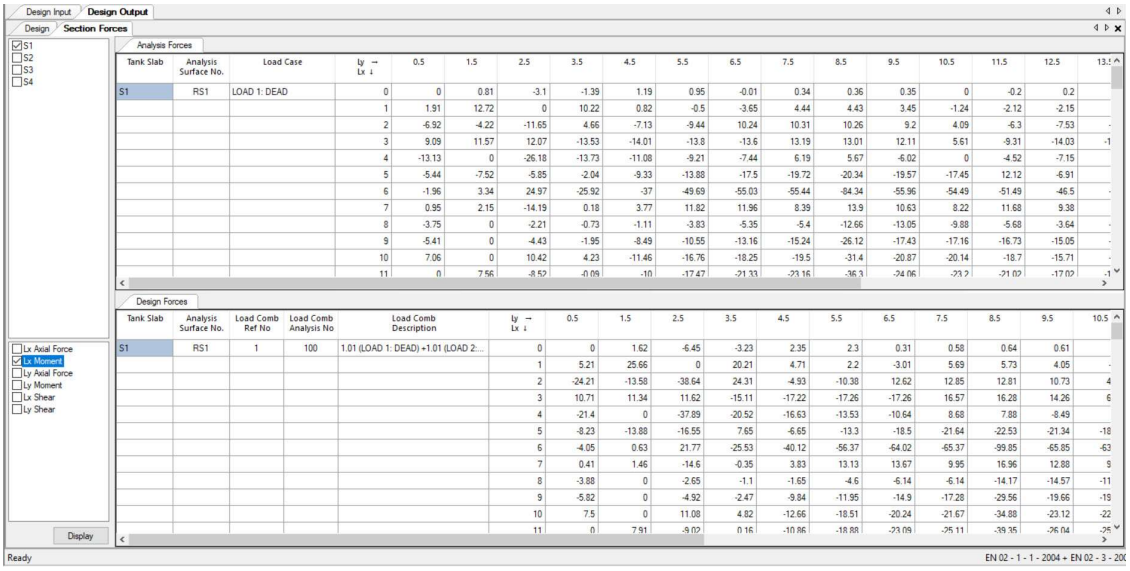
- Design Calculations
- Design Summary
- Design for all Stations
- Project Settings
- Flexural Crack Width Check.
- Dry Shrinkage & Thermal Crack Check
- Failure Diagnostics
- Bill of Quantities
    - Summary

Slab Section Drawing:



The section forces used for design of slabs can be viewed in the 'Tank Slab' module under the menu for the 'Section Forces'.



Beam and Columns present in Water Tank Structure:

If the overall structure for water-tanks has beams and columns, then they would be read as per normal method in RCDC. The design and detailing would be handled as per the relevant settings for those elements.

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Design, Detail Drawing and other reports for Columns and Beams are generated as per the existing Module of Beams and Columns.

Note:
All the design calculation and reports that are available, are verified based on the output of FEM analysis of the current STAAD version. Based on the enhancements in STAAD for presentation of these results, there may be a slight variation in the final calculations. Hence, we recommend that users should corelate the values of bending moments and shear forces used in design with the FEM results.

Beam	Calculation of Sway shear at Supports for Euro Code

For ductile (seismic requirement) beams of both High-class and Medium type, clause number 5.4.2.2 from EN 08 – 1 -2004 has been implemented. As per this clause shear force is calculated considering the sway at beam ends and shear links are designed as required. Please check the snapshot of calculation report.

Shear Design			
	Left	Mid	Right
Critical L/C - Analysis	17	11	16
Critical L/C - RCDC	7	1	6
PtPrv (%)	0.528	0.27	0.528
V_{Ed} (kN)	225.24	79.78	228.41
T_{Ed} (kNm)	0	0	0
θ (Degree)	21.8	21.8	21.8
$V_{Ed} + V_t$ (kN)	225.24	79.78	228.41
v_{Ed} (N/sqmm)	0.76	0.27	0.77
$v_{Rd.c}$ (N/sqmm)	0.49	0.31	0.49
$V_{Rd.c}$ (kN)	145.39	93.05	145.39
$v_{Rd.max}$ (N/sqmm)	2.86	2.28	2.86
$V_{Rd.max}$ (kN)	849.37	679.5	849.37
A_{sw} (sqmm/m)	350.484	298.142	355.414
Sway Shear			
$V^{D+L (kN)}$	106.06	53.05	106.09
Mh (kNm)	629.95		629.95
Ms (kNm)	333.27		333.27
V_{Ed} SR (kN)	27.11	186.22	239.26
V_{Ed} SL (kN)	239.23	80.12	44.76
V_{Ed} S = max (V_{Ed} SR, V_{Ed} SL) (kN)	239.23	186.22	239.26
v_{Ed} Sway (N/sqmm)	0.8	0.63	0.8
$v_{Rd.c}$ Sway (N/sqmm)	0.49	0.39	0.49
$V_{Rd.c}$ Sway (kN)	145.39	116.31	145.39
$v_{Rd.max}$ Sway (N/sqmm)	2.86	2.86	2.86
$V_{Rd.max}$ Sway(kN)	849.37	849.37	849.37
A_{sw} Sway (sqmm/m)	372.25	298.14	372.3
A_{sw} Final = max (A_{sw} , A_{sw} Sway) (sqmm/m)	372.25	298.142	372.3
Legs	2	2	2
$Ø_{sv}$ (mm)	8	8	8
$s_{reqd.}$ (sqmm/m)	100	300	100
s_{prov} (sqmm/m)	100	300	100
$A_{sw.prov.}$ (sqmm/m)	1005.4	335.13	1005.4

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General Enhancements

Following are the Enhancements made in this release.

- **ADO ID – 456880 – Display Note for Slender columns when Mslndr is higher than 1.4 Mu for ACI Code.**

As per the clauses 10.10.2.1 (ACI 318 – 2011 & ACI – 318M – 2011) & 6.2.6 (ACI 318 – 2014 & ACI – 318M – 2014), the slenderness moment can be restricted to 1.4 Mu. This has been implemented in RCDC for design. A specific note clarifying the same has been added in the calculation report.

For Sway Frame:		
Along D		
δns x M1s	= -237.33	kNm
δns x M2s	= -59.33	kNm
M1ns	= -170.12	kNm
M2ns	= 4.48	kNm
δns	= 1.11	
M1sldr	= -407.45	kNm
1.4 MuxT	= -392.82	kNm
M1sldr	= Min (-407.45, -392.82)	kNm
	= -392.82	kNm
M2sldr	= -54.85	kNm
1.4 MuxB	= -68.89	kNm
M2sldr	= Min (-54.85, -68.89)	kNm
	= -54.85	kNm

Note: The Slenderness Moment (M1sldr) is greater than 1.4 Mu. Hence 1.4Mu is considered for Design.

- **ADO ID – 454591 – Limitation of adding at least one combination with Gravity Loads only.**

  Enhancement has been made in this release where addition of at least one load combination of Gravity Loads is handles as mentioned below:

  1. ACI – 318 (2011&2014), ACI – 318M (2011&2014), IS 456 + IS 13920 – 2016 – Ductile column design

     It will be mandatory to add at least one Combination with Gravity Loads.
  2. Beams, Footing and Pile Cap (For all Design Codes):

     It is not mandatory add at least 1 Combination with Gravity Loads.
  3. Columns and Walls for Euro Code & Euro Code with all its National Annex:

     It is not mandatory add at least 1 Combination with Gravity Loads.

- **ADO ID – 457996 –Diameter List for Euro Code revised.**

  The rebar with diameter 13, 14 and 18 are removed from Rebar Diameter List for Euro code with all its National Annexures. The revised list is as follows:

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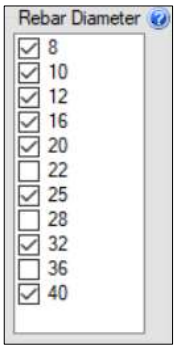

- **ADO ID – 474688 – Increased the Maximum SBC that can be entered to 3000 kN/sqm.**
  Enhancement is made in RCDC so that it can take an input of Net SBC up to 3000kN/sqm. Earlier the maximum value restriction was 2000kN/sqm.
  This is applicable for all Design Codes in Footing Module.

- **ADO ID – 515326 – Consideration of any Language set in System.**
  RCDC is enhanced so that it will be able to work and read any language changes in the local system region settings.

General Defects Resolved

Following are the list of Defects Resolved in this release.

- **ADO ID – 492789 - Display Bar Mark option does not work as intended in RCDC**

  In the slab module, when the in-plan detailed drawing is generated and 'Display Bar Mark Option' is selected, the bar mark should be displayed drawing. There was a defect related to this bug which is resolved.

- **ADO ID – 501470 – Cantilever Beam with Zero bending moment at bottom location and if user selects the option of "Provide 2 rebars in zone with Zero bending Moment" was not handled in RCDC.**
  Above mentioned defect was occurring only for zones with 'zero' bending moment at bottom location for cantilever beams. The above defect is resolved and option of providing two rebars with zero bending moment is now doesn't applicable to cantilever beam bottom reinforcement.

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Flexure Design						
	Beam Bottom			Beam Top		
	Left	Mid	Right	Left	Mid	Right
Critical L/C - Analysis	209	50	50	209	209	209
Critical L/C - RCDC	41	1	1	41	41	41
Mu (kNm)	0.02	-	-	6.37	27.64	42.5
Tu (kNm)	4.6	3.62	3.62	4.6	4.6	4.6
M_{Tu} (kNm)	8.13	6.4	6.4	8.13	8.13	8.13
Mud (kNm)	8.14	6.4	6.4	14.49	35.76	50.63
MuLim (kNm)	296	296	296	296	296	296
R	0.091	0.072	0.072	0.163	0.401	0.568
Ptmin (%)	0.2	0.2	0.2	0.2	0.2	0.2
Ptclc (%)	0.2	0.2	0.2	0.2	0.2	0.2
Pcclc (%)	0.021	0.017	0.017	0.005	0	0
PtPrv (%)	0.208	0.208	0.208	0.208	0.208	0.208
AstCalc (sqmm)	327	327	327	327	327	327
AstPrv (sqmm)	339.3	339.3	339.3	339.3	339.3	339.3
Reinforcement Provided	3-T12	3-T12	3-T12	3-T12	3-T12	3-T12

- **ADO ID – 505270 – Modification in Euro Code Naming Pattern.**
  The Code-naming pattern of Euro Code is changed as following:

  EN 02 - 1 - 1 - 2004 + EN 02 - 3 - 2006 UK
  EN 02 - 1 - 1 - 2004
  EN 02 - 1 - 1 - 2004 + MS NA
  EN 02 - 1 - 1 - 2004 + UK NA
  EN 02 - 1 - 1 - 2004 + SS NA

- **ADO ID – 514543 – Issue found in the Group/Ungroup window in Pile Cap Module.**
  There was an issue related to Pile cap Grouping. Initially when Pile Cap is grouped for the first time, a few pile caps were not getting displayed in the group / ungroup form. Another issue found in the Group Ungroup form was, instead of the actual diameter of Pile Cap selected during the Pile Configuration stage, the initial Pile Diameter that was selected by RCDC was getting displayed. Both these issues are now resolved in the RCDC V10.0 version.

- **ADO ID – 521374 – Mis printing of Ast value for Ptmin in Beam Design Calculation Report for EN – 02 – 1 – 1 – 2004 and all Annex of EN – 02 – 1 – 1 – 2004.**
  Modification in Design calculation report is made while displaying the value of Ast min as per User provided Pt-min.
  Ast min as per Code Formulation is multiplied with Overall depth of Beam and Ast min as per Pt min provided by user is multiplied with Effective depth of the beam. Correction was required in the report presentation only.

- **ADO ID – 522794 – if load case tile contains "false" term, RCDC was unable to identify the load case name due to database issue**
  If any load case title contains "false" term in it (example: false ceiling load), database was throwing error to RCDC. The false term in the database language passing as "0" to RCDC causing issue fetching member forces for that load case. This is now handled in RCDC.
- **ADO ID – 525536 – Crash found while re-designing Step footing:**

This issue was occurring in a specific case, where Crack width check is selected but Load combinations for Stress Check are not selected, the program crashed during the re-design. The crash is now handled.

- **ADO ID – 526246 – Crash found while Designing Pile cap of Odd shape (T and L shape) column:**
  Pile cap auto-design was crashing for T and L shape columns which is now been solved.

- **ADO ID – 528651 – Incorrect value of Nominal shear stress was printed in the Slab Design Calculation:**

  There was misprinting of the 'Nominal shear stress' value in the design calculation report due to wrong area of reinforcement was considered. The actual nominal shear stress considered in the design engine was correct and hence correction in report is only made.

- **ADO ID – 529270 – Crash Found when adding Load Combinations for Irregular Structure for Crack width check:**
  Crashing issue found while adding the 'Load combinations' for structure type 'irregular' for crack width check is in RCDC V 10.0.

- **ADO ID – 541900 – For Euro code, the maximum permissible Shear stress ($v_{Rd,max}$) was not presented with factor of 0.9 in presentation only:**
  The Maximum Shear resistance was calculated and presented properly for all elements, however the 'Maximum shear stress' presented in report was without the factor of 0.9. Now the report is updated with correct permissible stress value. Snap from beam design calculation is added here,

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Shear Design			
	Left	**Mid**	**Right**
Critical L/C - Analysis	11	11	11
Critical L/C - RCDC	1	1	1
PtPrv (%)	0.419	0.302	0.654
V_{Ed} (kN)	228.66	92.66	259.29
T_{Ed} (kNm)	1.66	1.66	1.66
θ (Degree)	21.8	21.8	21.8
$T_{Rd,c}$ (kNm)	48.9021	48.9021	48.9021
t_{Ed} (N/sqmm)	0.0351	0.0351	0.0351
$t_{Rd,max}$ (N/sqmm)	5.0756	5.0756	5.0756
$T_{Rd,max}$ (kNm)	120.3105	120.3105	120.3105
$(T_{Ed} / T_{Rd,max}) + (V_{Ed} / V_{Rd,max})$	0.3475	0.1491	0.3922
V_t (kN)	0	0	0
$V_{Ed} + V_t$ (kN)	228.66	92.66	259.29
v_{Ed} (N/sqmm)	0.76	0.31	0.86
$v_{Rd,c}$ (N/sqmm)	0.37	0.33	0.43
$V_{Rd,c}$ (kN)	110.87	99.37	128.66
$v_{Rd,max}$ (N/sqmm)	2.28	2.28	2.28
$V_{Rd,max}$ (kN)	685.21	685.21	685.21
A_{sv} (sqmm/m)	403.255	340.734	457.265
Legs	2	2	2
$Ø_{sv}$ (mm)	8	8	8
$s_{reqd.}$ (sqmm/m)	245	295	215
s_{prov} (sqmm/m)	245	295	215
$A_{sw,prov.}$ (sqmm/m)	410.37	340.81	467.63

- **ADO ID – 542375 – Issue found in determining the link spacing for Gravity Columns with IS 456 + IS 13920 – 2016 Code:**

  There was issue related to spacing calculation in Gravity columns. The actual spacing calculated for gravity column can be as per clause number 11.1.1. Lesser spacing was considered in the design than required. Now it is updated as per correct spacing.

Check for Links			
Critical Load Combination	=	[14] : 3 (LOAD 1: LOAD CASE 1) +3 (LOAD 2: LOAD CASE 2) +3 x Drift- (LOAD 3: LOAD CASE 3 EQ-X)	
Pu	=	4952.5	kN
Actual Axial Stress	=	Pu / (B x D)	
	=	10.11	N/sqmm
Threshold Axial Stress	=	0.4 x fck	
	=	10	N/sqmm
	=	10.11 > 10 Ductile links are applicable	
Special confining reinforcement as per IS 13920 - 2016			
6 x Smallest Longitudinal Bar Dia	=	6 x 32	
	=	192	mm
Maximum Spacing	=	150	mm
Hence Link Spacing S,	=	150	mm
Hoop dimension, h	=	123.2	mm
Gross area of column, Ag	=	B x D	
	=	490000	sqmm
Core area of column, Ak	=	(B- 2 x cover to Link) x (D- 2 x cover to Link)	
	=	379456	sqmm
Area of special confining link, Ash1	=	(0.18 x S x h x (Fck/Fy) x (Ag/Ak-1))	
	=	58.38	sqmm
Area of special confining link, Ash2	=	(0.05 x S x h x (Fck/Fy))	
	=	55.66	sqmm
Area of special confining link, Ash	=	Maximum (Ash1,Ash2)/2	
	=	29.19	sqmm
Diameter of special confining link	=	8	mm
	=	> Max. longitudinal bar dia / 4	
	=	8	mm
Links to be Provided along full height of Column			