

BUILD-MASTER 2005

Version 2008 Revision F, December 2008 Release Note

A Complete Package for RCC Building Analysis, Design, Drawing and Estimation

New features added in Build-Master 2005, as compared to previous Revision, are highlighted here.

New Earthquake Code

The Method of Earthquake Load calculation is changed as per new earthquake code IS 1893-2002. Wind Load calculations revised as per IS 875-1987 code of practice. Load Combination safety factors (1.5, 0.9, 1.2) are now multiplied during Space Frame Analysis itself. Frame Analysis Forces and Moment results will therefore be now factored values and not working values as earlier.

Program calculates **Center of Gravity** (i.e. center of mass) and **Center of Rotation** (i.e. center of stiffness) at each floor level and considers the design eccentricity while applying Earthquake forces. Since wind forces act on the face of building, program calculates **Center of Width** (i.e. center of sides) of each floor while applying the wind loads.

Program now generates 11 load cases. Depending on whether Building is Orthogonal or Not and Earthquake Eccentricity is Considered or Not, Program generates various load combinations automatically. For detail refer Leaflet on "**Earthquake Analysis Features of Build-Master 2005**".

DESCRIPTION OF LOAD CASES			LOADING COMBINATIONS FOR DL, IL, WIND & EARTHQUAKE LOADS	
1	DL	Dead Load	1 COMBINATION OF DL + IL	12 COMBINATIONS OF WIND
2	IL	Imposed Load		
3	RIL	Reduced Imposed Load		
4	EPX	Earthquake Parallel to +ve X Direction	ORTHOGONAL BUILDING WITHOUT ECCENTRICITY	
5	TPX1	Torsion Case 1 for EQ +ve X Direction	12 COMBINATIONS OF EARTHQUAKE	(Total 25)
6	TPX2	Torsion Case 2 for EQ +ve X Direction		
7	EPZ	Earthquake Parallel to +ve Z Direction	ORTHOGONAL BUILDING WITH ECCENTRICITY	
8	TPZ1	Torsion Case 1 for EQ +ve Z Direction	48 COMBINATIONS OF EARTHQUAKE	(Total 61)
9	TPZ2	Torsion Case 2 for EQ +ve Z Direction		
10	WPX	Wind Parallel to +ve X Direction	NON-ORTHOGONAL BUILDING WITH ECCENTRICITY	
11	WPZ	Wind Parallel to +ve Z Direction	192 COMBINATIONS OF EARTHQUAKE	(Total 205)

(Horizontal forces in -ve Axis direction are of same magnitude of +ve Axis direction but with -ve sign.)

Ductile Detailing

The provisions of "Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces" Code of Practice IS 13920-1993, are incorporated in Build-Master 2005 Revision D. Procedure for RCC design & detailing of Beams and Columns is changed accordingly.

Following are few of the important Clauses of this Code considered while designing RCC Beams. (All clauses not listed here.)

1. Beam Design Program will give a Warning if Width-to-Depth ratio of Beam is less than 0.3
2. Minimum tension steel ratio on any face of beam will be kept as $0.24 (\sqrt{f_{ck}}) / f_y$ as per code.
3. Maximum allowed tension steel ratio on any face of the beam will be restricted to 0.025.
4. Positive Steel at the Support face will be kept more than half the negative steel at that face.
5. Steel provided at each of the top and bottom face of beam at any section along the length is kept more than one-fourth of maximum negative moment steel at the face of either joint.
6. Spacing of Stirrups over a length of 2d at either end of a beam is restricted to d/4 or 8 times diameter of smallest longitudinal bar. This spacing value will not be less than 100 mm.
7. Spacing of Stirrups in the remaining portion is restricted to d/2 (for Rest Strirrups).

Following are few of the important Clauses of this Code considered while designing RCC Columns. (All clauses not listed here.)

1. Column Design Program will give a Warning if Width-to-Depth ratio of column is less than 0.4
2. Spacing of the Links is restricted to half the column width or 150 mm which ever is less.
3. Special Confining Reinforcement is provided at each end of the column between the floors.

User can select whether Reinforcement Detailing shall be only as per IS 456-2000 code or both as per IS 456-2000 and Ductility Code IS 13920-1993.

DAT2STD Conversion Utility

This third party utility can convert Build-Master Analysis Data file to STD file format. It will read a DAT file and write it in STD format. Build-Master Space Frame 3D model data can also be converted. When Build-Master design outputs are submitted to third party (Proof Consultants) who do not have Build-Master, this utility can be used to convert Build-Master 3D model data in STD file format for submission. Thus user can get the benefit of entering all the data floor wise with Build-Master, which will generate the 3D model geometry as well as loads on each member, also calculate the earthquake and wind loads with all desired load combinations.

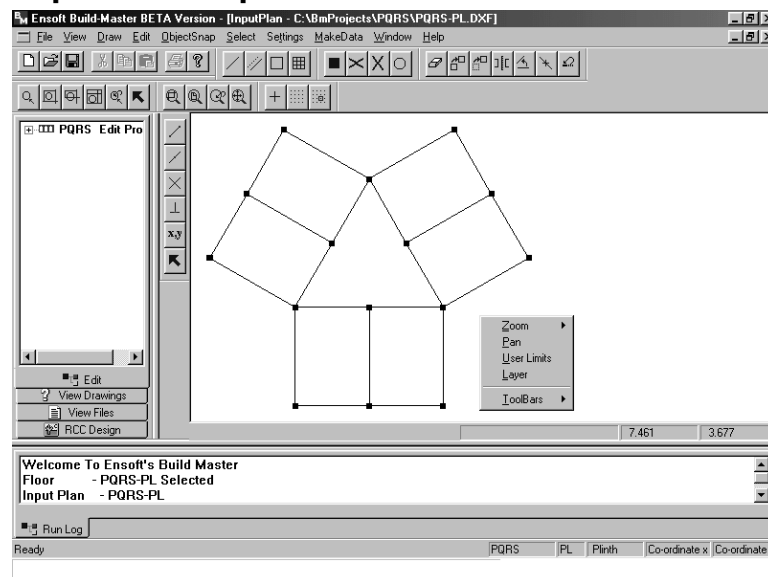
Detail Drawings Improved

The program generating Beam Sectional Elevation Details is improved. The distances of Bars are now shown in Schematic Sketch. Beam schedule drawing now has separate text strings for each column, which will help user in modifying beam schedule drawing easily.

Assign Schedule Sizes

A new command is added in Tools Menu. The sizes of beams, columns and slab thickness calculated during Design may be different from those assumed in the data. If user wishes to reanalyze the Structure with the designed sizes, then he has to reassign these sizes in the data. Instead of changing them manually at each floor level, this utility can be used to assign the design sizes in the schedule output, to the respective RCC data file at each floor.

Improved Graphical Editor



Many commands like Copy, Move, Mirror, Offset, Rotate are now added in in-built Graphical editor. Any odd shape of floor plan can be now drawn with Input Plan option. Single Line plans drawn in AutoCAD and saved in AutoCAD 2000 DXF file format can also be read directly.

When single line plan is edited repeatedly, with retaining the data, some beam numbers may get numbered as B2a, B2b etc. to avoid duplicate numbering. All beams and slabs can now be renumbered serially with **Renumber Beams/Slabs** option from the Modify RCC menu of Edit Plan data.

Drawing Files with Unique names

In previous versions, the Drawings were stored in scratch files namely RCCPLAN.DXF, BM.DXF, SF.DXF etc., thereby causing the overwriting of these files. In this new version, Project Code and Floor Code are added even in Temporary file names. For e.g.: RCC floor plan of plinth level is stored with a file name as \$RCCPLAN-TEST-PL.DXF and that of first floor is stored with file name as \$RCCPLAN-TEST-1st.DXF. (All Temporary file names now start with \$ character).

Program Limitations Relaxed

Floor Plans now can have up to 900 Beams, 900 Slabs and 900 Columns at each level. Maximum number of Floor Levels for a Building is increased to 50. There is no limitation on the number of grid lines on a particular floor. The Space Frame Analysis program now virtually does not have any limitations on number of members and nodes (90,000 is the limit).

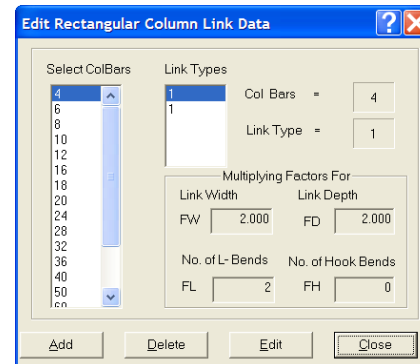
Set Bar Combinations

Two new Utilities are added in Build-Master 2005, namely, **BarCOMB.exe** & **SetCLink.exe** for configuring standard data files for storing User Defined Bar Combinations. RCC Beam Design program, reads the Bar Combinations to be provided against various required areas of bars from two files, namely, BeamBotB.dat for beam bottom bars and BeamTopB.dat for beam top bars. Since at a beam support lesser number of bars are desired to avoid congestion, separate files are provided for storing different combinations. RCC Column design program, similarly read bar combinations from ColBars.dat file for providing Main Vertical Bars in column.



BarCOMB program can be used to customize the Number of Bars to be provided for different required Bar Areas.

Arrangements of Column Links for different number of Vertical bars can also be defined for accurate estimation of Column Links. These arrangements are stored in file BmLinks.dat. A new program **SetCLink** is added with which various types of Link arrangements can be defined easily.



Column quantity estimation program will now work out the weight of Links more exactly.

RCC Individual Design Programs

Beam, Slab, Column and Footing design programs now have a new look. The main screen is divided into 3 windows, namely: Input, Output and Design Sketch. Whenever any Input Parameter is changed the Output and the Sketch is automatically updated.

Factored Loads and moments (Not Working loads) shall be entered in input data for the design.

These programs run independently without any drawing plan layout. In the earlier Versions Input parameters like bearing capacity of Soil were to be entered each time you execute Footing design program. But now the new programs use MS-Access compatible database files for storing input data as well as the output details.

Simplified Editing of Design Schedules

Design schedules can now be edited with three ways.

- 1.Using Tree Control
- 2.Using Grid Control
- 3.Using Plan Layout

TreeControl displays Explorer type user interface.

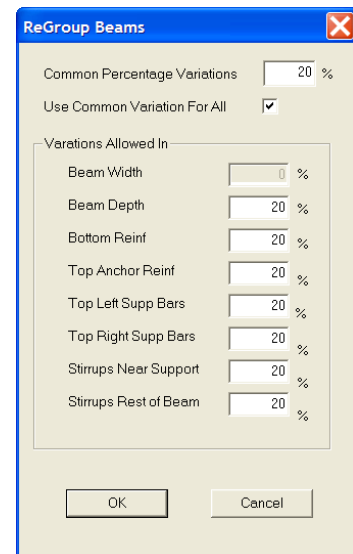
GridControl displays Spreadsheet like easy to edit format.

Grp No	Beam Nos.	Width	Depth	NBS	DBS	NBC	DBC	N1A	D1A
Grp1	B1	150	200	2	16	1	16	2	12
Grp2	B2 B3 B4 B28 B29	150	300	2	16	1	12	2	10
Grp3	B5	150	250	3	12	2	12	2	10
Grp4	B6	230	900	5	20	3	20	6	25
Grp5	B7	230	900	5	20	3	20	6	25
Grp6	B8	230	900	5	20	3	20	6	25
Grp7	B9	230	900	5	20	3	20	6	25
Grp8	B10	230	600	3	16	1	16	2	10
Grp9	B11	150	450	2	16	1	12	2	10

A new concept of Auto Regrouping is added for editing design schedule.

For example when there are large number of beams in a schedule, and he wishes to decrease the number of groups (rows) of schedule, he User can specify Percentage of variation allowed in Design parameters, (e.g. 20%). Program will first find a beam with max. size & max. Steel, it will then find other beams whose size and steel is within 20% range. Those beams will be grouped with first one. The process is continued.

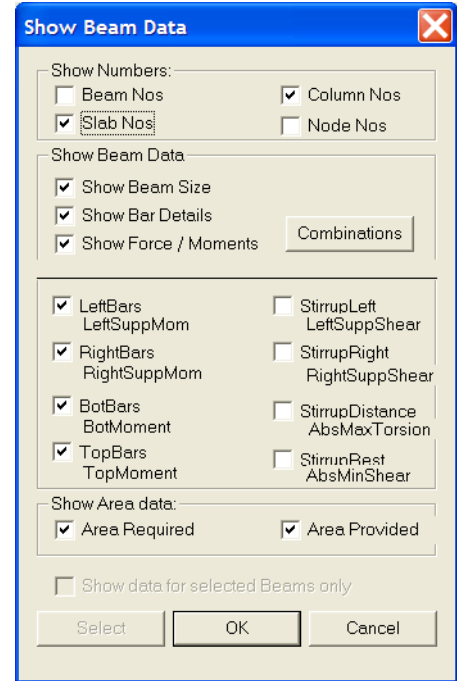
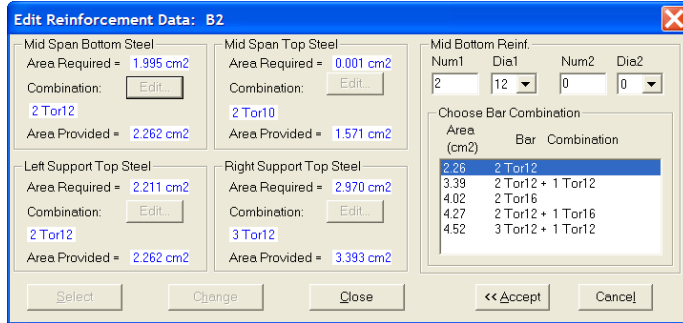
Auto Regrouping



Modify Schedule Using Plan Layout

A new concept of displaying and editing RCC Design Schedules on plan layout itself is added in this Version. To provide reinforcement appropriately across adjoining beams and slabs, some designers write the required Area of Reinf. on plan, prior to providing numbers and diameters of bars.

Since this utility will now display the bar details of beam, slab, column and footings on plan, as shown below, valuable time of designers will be saved. Forces and moments can also be displayed simultaneously, with the required bar areas. The bar combinations can also be edited directly on the plan, by selecting desired beam, slab or column. Changes made will be saved in the database files at backend. Schedule drawings in DXF formats will also get revised automatically.



Sample Plan Showing Design Details on Plan

