International Journal of Application or Innovation in Engineering & Management (IJAIEM)
Web Site: www.ijaiem.org Email: editor@ijaiem.org
Volume 8, Issue 3, March 2019 ISSN 2319 - 4847

Planning , Analyzing And Designing Of Super Market Building By Using STAAD Pro

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Abstract

Planning analysis and designing of Super Market Building is our project which is proposed at Salem. The super market consists of a, In ground floor, Vegetables shop, Fruits shop , Home provisions .In first floor, Baby kits shop , Stationary things & books shop Flower shop , Bakery ,Staffs rest room . In second floor Gift shop , Watch showroom ,Foot wears showroom . In Third Floor, Head room. Drafting method for design the plan is by Auto cad. The framed type of construction is used for the construction and the designing of structure is carried out by limit state method with the IS 456: 2000 code book. The plan and structural elements such as slab, beam, column and footings are designed using limit state method in STAAD Pro and the reinforced details has been designed using the above software. This project helps us in exploring knowledge about planning, analyzing and designing a Super market Building.

Keywords: Planning, Analysis, Designing and Super Market.

1. INTRODUCTION

A supermarket, a form of grocery store, is a self-service store offering a wide variety of food and household merchandise, organized into departments. It is larger in size and has a wider selection than a traditional grocery store, also selling items typically found in a convenience store, but is smaller and more limited in the range of merchandise than a hypermarket or big-box store. The supermarket typically comprises meat, fresh produce dairy, and baked goods departments, along with shelf space reserved for canned and packaged goods as well as for various non-food items such as household cleaners, pharmacy products and pet supplies. Most supermarkets also sell a variety of other household products that are consumed regularly, clothes, and some stores sell a much wider range of non-food products. The traditional suburban supermarket occupies a large amount of floor space, usually on a single level. It is usually situated near a residential area in order to be convenient to consumers. Its basic appeal is the availability of a broad selection of goods under a single roof, at relatively low prices. Other advantages include ease of parking and frequently the convenience of shopping hours that extend far into the evening or even 24 hours a day. Supermarkets usually allocate large budgets to advertising, typically through newspapers. They also present elaborate in-store displays of products. The stores are usually part of corporate chains that own or control other supermarkets located nearby - even transnational - thus increasing opportunities for economies of scale. The growth in the popularity of supermarkets has transformed the marketplace in which buyers and sellers of fresh produce essential to everyday life - meet face-to-face. These days, supermarkets as sellers commonly highlight their selling points using shop floor layout. Among the many factors that underlie store design, this study analyses store layout; in terms of what to display in a shop and where to place the items. A satisfying shopping experience entails an ease with which products are found and the ability to check for freshness and price; some customers also regard low shopping time as satisfying shopping experience.

2. SPECIFICATIONS

2.1 Materials

All materials shall be as per standard specifications. Coarse aggregate shall be of hard, well-burnt brick ballast of 40 mm gauge. It shall be clean, free from dust, dirt, and other foreign matters. Brick ballast shall pass through square mesh of 52.5 mm and not more than 20 per cent shall pass through a mesh of 25 mm.

2.2 Proportions

The concrete shall consist of 1 m3 of brick ballast, 0.32 m3of surkhi (sand and cinder) and 0.16 m3of white lime in the proportion of 100: 32: 16 by volume.

2.3 Mixing

Mixing shall be done on clean water tight, masonry platform of sufficient size. Brick ballast shall be stacked in a rectangular of uniform thickness usually 30 cm high and well soaked with clean water for a period of at least three hours.
Lime and surkhi shall be measured with wooden box in the proportion in 1: 2 and mixed thoroughly dry to have uniform colour.

2.4 Foundation And Plinth

Foundation and plinth shall be used Ist class brickwork in 1: 6cement mortar over 1: 4: 8 cement concrete. The footing size as 3200 mm x 4800 mm.

2.5 Sand Filling In Basement

The basement filled up with clean sand to a depth of 30mm and it should be compacted with water as per standard specifications.

2.6 Damp Proof Course

Damp proof course shall 200 mm thick cement concrete 1: 11/2: 3, mixed with standard water proofing materials as specified and painted with two coats of bitumen.

2.7 Super Structure

Super structure shall be of I st class brickwork with 1: 6 cement mortar. The height of all walls will be 13716 mm above floor level. Parapet walls 230 mm thick and 1219 mm high will be provided all around. The beams sizes as 300 mm x 600 mm and columns sizes as 500 mm x 600 mm will be provided all around.

2.8 Roofing

Roof shall be of R.C.C. slab with an insulation layer and lime concrete terracing above, supported over R.C.C. beams as required. Height of all rooms will be 4.7 m.

2.9 Flooring

Floors of all rooms shall be of mosaic. Bath rooms and rest rooms shall be coloured and polished of cement concrete over lime concrete.

2.10 Finishing

Inside and outside walls shall be of 12 mm cement lime plastered 1: 1: 6. Bath rooms and rest rooms are inside white washed 3 coats.

2.11 Wheathering Course

A Weathering course using brick jelly concrete will be provided average 75 mm thick over the slab and finished with two course of hydraulic pressed Mangalore flat tiles using cement mortar 1:5 mixed with 10% of crude Oil.

2.12 White Washing

One primer coat and two coats of colour wash to be done for all plastered wall including inside and outside of all around.

2.13 Steps

The step will be in brick work in cement mortar 1:5,

Rise = 150mm,
Tread = 300mm.

3. STRUCTURAL DESIGN

3.1 Design Of Slab

fck = 25 N/mm^2
fy = 415 N/mm^2
Room size = 10 x 11 m
Support = 230 mm
Thickness of slab =150 mm

3.1.1 Type Of Slab

ly /lx = 11/10 = 1<2
Hence designed as two way slab

3.1.2 Load Calculation

Consider 1m width of slab
Live load = 2 KN/m^2
Self -weight of slab = 1 x b x D x unit weight
=1 x 1 x 0.30 x 25
= 7.5 KN/m^2
Weight of floor finish =1x 1 x 0.05 x 20= 1.0 KN/m^2
Total load = 10.5 KN/m
Design load = 10.5 x 1.5 = 15.75 KN/m

3.1.3 Main Reinforcement

M_x = 0.87 fy A_{st} d (1- fyA_{st} / fckbd)
88.74 x 10^6 = 0.87 x 415 x A_{st} x 130 (1- 415 x A_{st} / 25 x 1000 x 130)
5.99A_{st}^2 – 46.93 x $10^3$$A_{st}$ + 48 x 10^6 = 0
A_{st} min = 928.96 mm^2

3.1.4 Spacing

Assume 10 mm dia bars
S = ast/A_{st} x b = 314.16/928.96 x 1000 = 340 mm
3d = 3 x 180= 840 mm
300 mm c/c
Provide 20 mm dia bars @ spacing 300 mm c/c distance.

3.1.5 Distributor Reinforcement

A_{st} min = 0.12 / 100 x B x D
= 0.12 /100 x 1000 x 300
= 360 mm^2

3.1.6 Spacing

Assume 8mm dia of distribution steel
S = ast /A_{st}min x b = (78.54/180) x 1000
= 220 mm
5d = 5 x 150 = 1400 mm
450 mm
Provide 10 mm dia bars @ spacing 220 mm c/c
Figure 1 shows the Cross Section of One way slab.

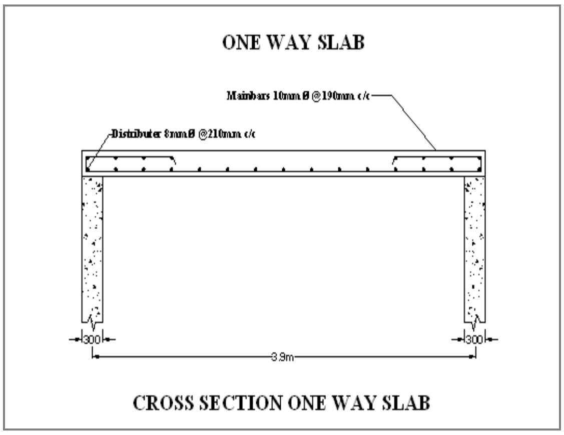

Figure 1 Cross Section of One way slab

3.2 Design of Beams

Center to center distance leff =11.23 m
B =300 mm
d = 560 mm
D = 600 mm (assumption)
Fy = 415 N/mm2
fck = 25 N/mm2
Q =3.45
% Ast = 1.197 %

3.2.1 Load Calculation

Self weight of beam = b x D x unit wt
= 0.3 x 0.6 x 25 = 4.5 KN/m
Slab floor finish = perpendicular distance x tk x unit wt
= 5.5 x 0.05 x 20 = 5.5 KN/m
Slab self wt = 5.5 x 0.30 x 25 = 41.25 KN/m
Wall load = 0.23 x 4.5 x 19 = 19.70 KN/m
Total load = 71 KN/M
Factored load = 71 x 1.5
Fd = 106.5 KN/m

3.2.2 Type of Section

Mulim = Qu b d2 = 3.45 x 300 x 8102
Mulim = 679.06 × 106 N.mm
Mulim < Mu

Hence the section shall be designed as doubly reinforced section.

3.2.3 Area of Reinforcement

Provide 14 nos of 25 mm dia bars as tension reinforcement
Provide 5 nos of 12 mm dia bars as compression reinforcement
Figure 2 shows the simply supported beam.

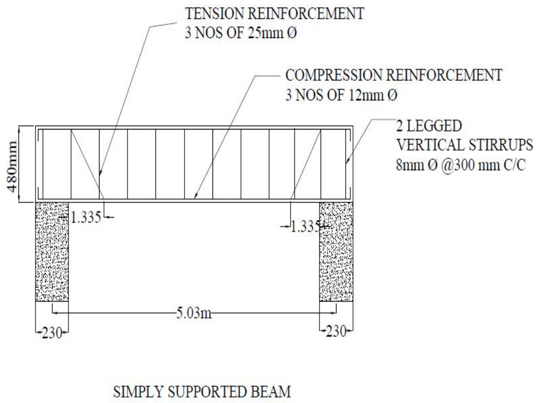

Figure 2 Simply supported Beam in Area of Reinforcement

3.3 Design of Rectangular Column

Size of column = 500 X 600 mm
fck = 25 N/mm^2
fy = 415 N/mm^2

3.3.1 Load Calculation

3.3.1.1 Slab

Wt of slab (1) = L x B x D x unit wt
= 5.0 x 5.5 x 0.3 x 25 = 206.25 KN
Wt of slab ff (1) = L x B x D x unit wt
= 5.0 x 5.5 x 0.05 x 20 = 27.5 KN
Live load (1) = 2.0 x 5.0 x 5.5 = 55 KN
Wt of slab (2) = L x B x D x unit w = 5.0 x 2.4 x 0.3 x 25 = 90 KN
Wt of slab ff (2) = L x B x D x unit wt
= 5.0 x 2.4 x 0.05 x 20 = 12 KN
Live load (2) = 2.0 x 5.0 x 2.4 = 24 KN

3.3.1.2 Beam

Beam (1) = L x B x D x unit wt
= 5.5 x 0.3 x 0.85 x 25 = 35.06 KN
Beam (2) = 5.0 x 0.3 x 0.85 x 25 = 31.87 KN
Beam (3) = 2.4 x 0.3 x 0.85 x 25 = 15.3 KN

3.3.1.3 Wall

Wall load (1) = L x B x H x unit wt
= 5.5 x 0.23 x 4.5 x 19 = 108.15 KN
Wall load (2) = 5.0 x 0.23 x 4.5 x 19 = 98.325 KN
Wall load (3) = 2.4 x 0.23 x 4.5 x 19 = 47.20 KN

3.3.1.4 Column

Self-weight of column = L x B x H x unit wt
= 0.5 x 0.6 x 4.5 x 25 = 33.75 KN
Sum of all above loads = 784.4 KN
No of floor consideration = 785 x 3= 2355 KN

3.3.1.5 Result

Size of column = 500 x 600 mm
Longitudinal reinforcement = 6nos of 25 mm dia bars
Transverse reinforcement = 6mm dia at 195 mm c/c

Figure 3 shows the R.C.C Column.

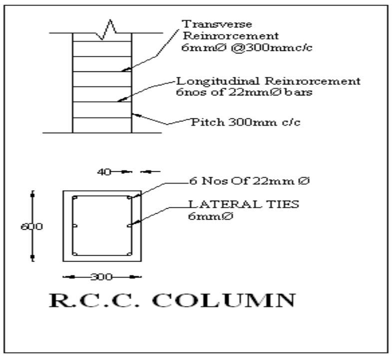

Figure 3 R.C.C Column

3.4 Design of Footing

Size of column = 500 x 600 mm
Safe bearing capacity = 200 KN/m^2
fck = 30 N/mm^2
fy = 415 N/mm^2
Axial load of footing = 2355 KN

Assume the self wt of footing as10%of the column load

W1 =10/100 x 2355 = 235.5 KN
Total load on soil =2355+235.5 =2590.5 KN
Area of footing required = total load /sbc
= 2595 / 200
= 12.975 m^2

Since it is a Rectangular column

3.4.1 Tension Reinforcement

3.4.1.1 In Long Direction

Provide 8 nos of 32 mm dia bars in long direction at uniform spacing

3.4.1.2 In Shortered Direction

Provide 12 nos of 32 mm dia bars at central band.
Figure 4 shows the Reinforcement of the column.

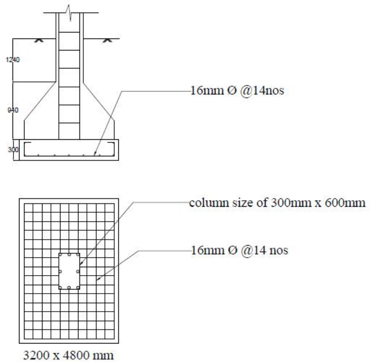

Figure 4 Reinforcement of the Column

4. STAAD REPORT

Figure 5 shows the Whole Structure.

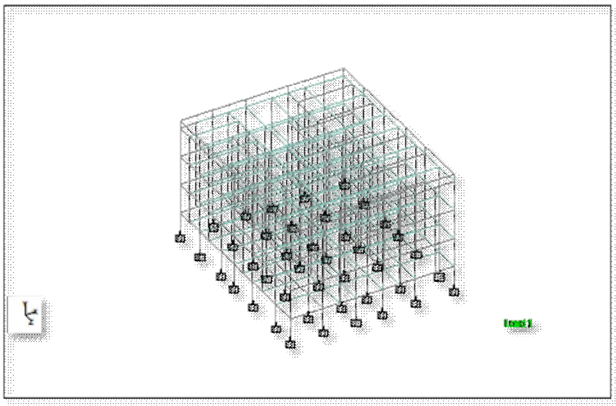

Figure 5 Whole Structure

Figure 6 shows the 3D Rendered View.

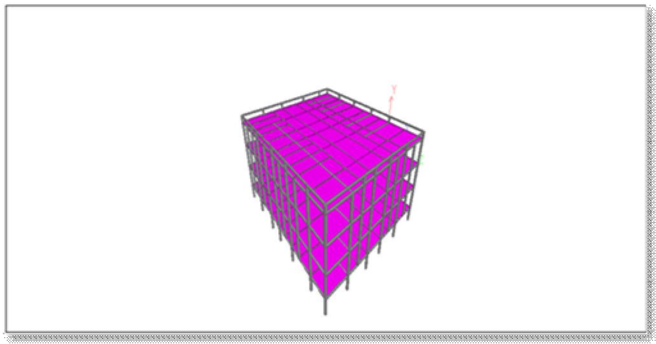

Figure 6 3D Rendered view

Figure 7 shows the Bending moment diagram.

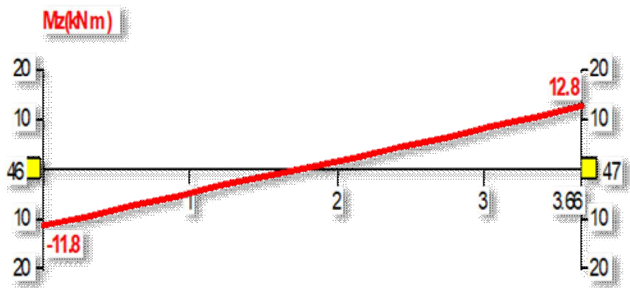

Figure 7 Bending Moment diagram

Figure 8 shows the Shear force diagram.

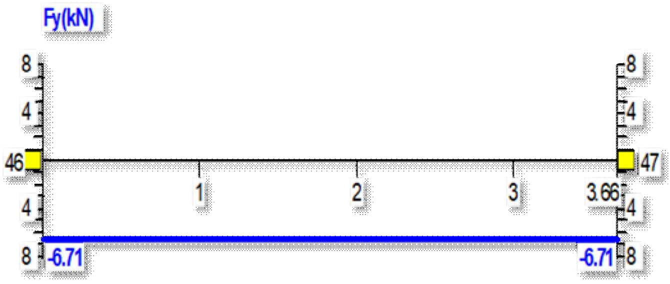

Figure 8 Shear Force Diagram

Figure 9 shows the Max BM at Critical Beam.

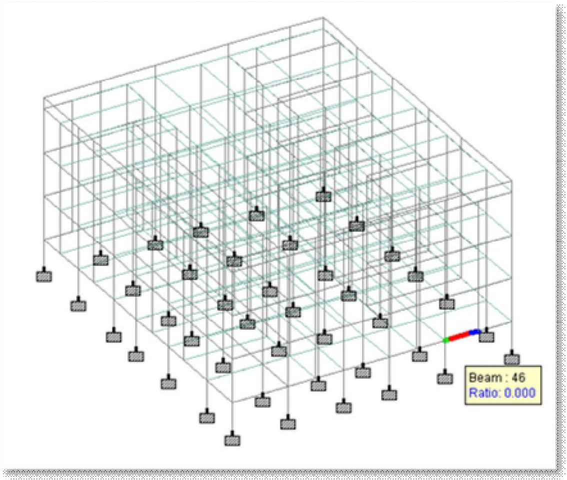

Figure 9 Max BM at Critical Beam

4.1 B E A M N O. 297 D E S I G N

M25 Fe415 (Main) Fe415 (Sec.)

LENGTH: 3657.6 mm SIZE: 228.6 mm X 228.6 mm COVER: 25.0 mm

SUMMARY OF REINF. AREA (Sq.mm)

---SECTION 0.0 mm 914.4 mm 1828.8 mm 2743.2 mm 3657.6 mm

--TOP 624.65 244.04 92.52 98.55 197.39

REINF. (Sq. mm) (Sq. mm) (Sq. mm) (Sq. mm) (Sq. mm)

BOTTOM 176.95 92.52 92.52 243.88 432.59

REINF. (Sq. mm) (Sq. mm) (Sq. mm) (Sq. mm) (Sq. mm)

SUMMARY OF PROVIDED REINF. AREA

SECTION 0.0 mm 914.4 mm 1828.8 mm 2743.2 mm 3657.6

TOP 2-20í 2-20í 2-20í 2-20í 2-20í

REINF. 1 layer(s) 1 layer(s) 1 layer(s) 1 layer(s) 1 layer(s)

BOTTOM 2-12í 2-12í 2-12í 3-12í 4-12í

REINF. 1 layer(s) 1 layer(s) 1 layer(s) 1 layer(s) 1 layer(s)

SHEAR 2 legged 6í 2 legged 6í 2 legged 6í 2 legged 6í 2 legged 6í

REINF. @ 80 mm c/c @ 80 mm c/c @ 80 mm c/c @ 80 mm c/c @ 80 mm c/c

SHEAR DESIGN RESULTS AT DISTANCE d (EFFECTIVE DEPTH) FROM FACE OF THE SUPPORT

SHEAR DESIGN RESULTS AT 396.8 mm AWAY FROM START SUPPORT
VY = 21.82 MX = -0.62 LD= 2
Provide 2 Legged 6í @ 80 mm c/c

Figure 10 shows the Reinforcement details for beam.

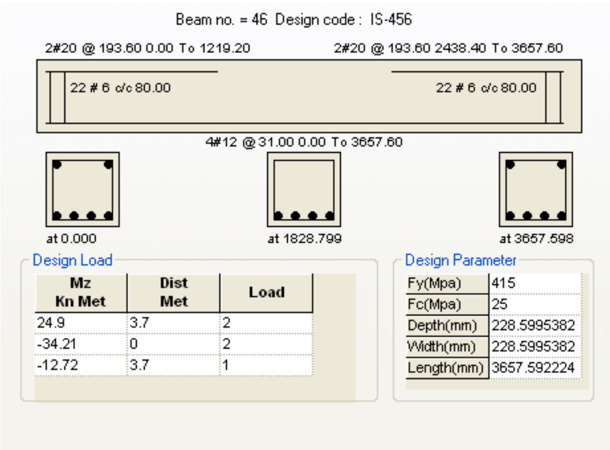

Figure 10 Reinforcement Details for Beam

Figure 11 shows the Maximum BM at Critical Column

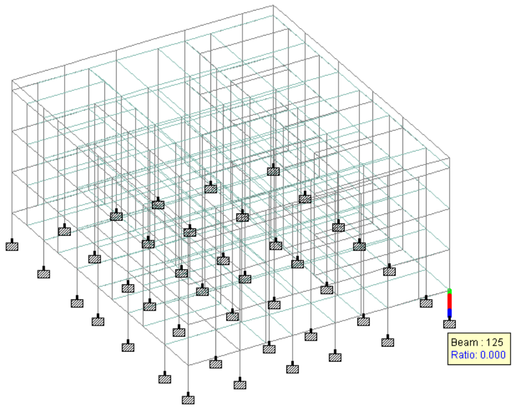

Figure 11 Maximum BM at Critical Column

4.2 C O L U M N NO.398 D E S I G N R E S U L T S

M25 Fe415 (Main) Fe415 (Sec.)
LENGTH: 3048.0 mm CROSS SECTION: 304.8 mm X 406.4 mm COVER: 40.0 mm
** GUIDING LOAD CASE: 1 END JOINT: 92 SHORT COLUMN
REQD. STEEL AREA : 931.50 Sq.mm.
REQD. CONCRETE AREA: 122939.21 Sq.mm.
MAIN REINFORCEMENT : Provide 12 – 12 dia. (1.10%, 1357.17 Sq.mm.)
(Equally distributed)
TIE REINFORCEMENT : Provide 8 mm dia. Rectangular ties @ 190 mm c/c
SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)

Puz : 1673.00 Muz1 : 63.59 Muy1 : 45.62
INTERACTION RATIO: 1.00 (as per Cl. 39.6, IS456:2000)
SECTION CAPACITY BASED ON REINFORCEMENT PROVIDED (KNS-MET)

WORST LOAD CASE: 1
END JOINT: 92 Puz : 1800.70 Muz : 86.74 Muy : 61.11 IR: 0.73

Figure 12 shows the Reinforcement details for column.

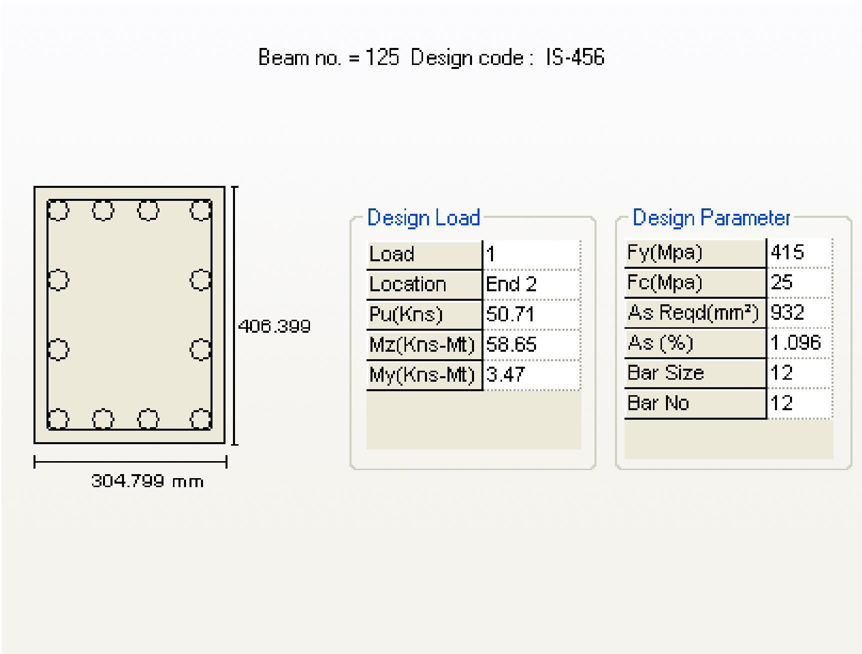

Figure 12 Reinforcement Details for Column

4.3 Concrete Take Off

(FOR BEAMS AND COLUMNS DESIGNED ABOVE)

TOTAL VOLUME OF CONCRETE = 41.40 CU.METER

BAR DIA (in mm)	WEIGHT (in New)
6	42477.23
8	25335.42
10	35374.86
12	102967.85
16	65587.08
20	35143.26
25	8364.92
32	746.47

TOTAL=	315997

5. DRAWING

Figure 13 shows the Blue plan of the project.

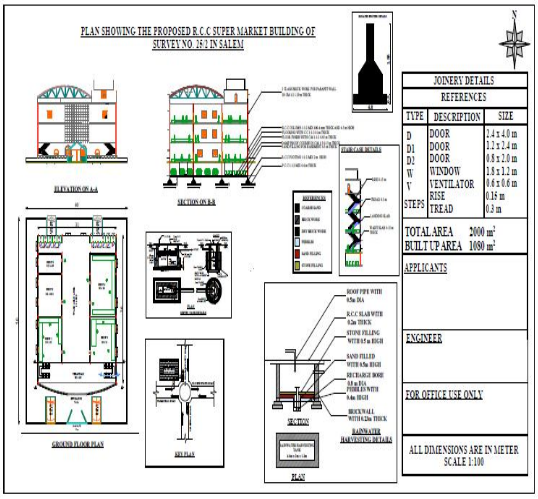

Figure 13 Blue print

6. CONCLUSION

People with lower income want to go to retail shops to buy good of day to day. But middle class and people with higher income buy there most well from hyper markets every month and but it collectively so that they do have to go to buy daily bases. If people are not worried about little more to pay in return they will but good products. Hence we conclude that application of software in our field is quite good and efficient for further study of structural parameter. Through our project we conclude that application of software in civil industry plays an important role in our study. In our project Super Market Building we adopt planning in archi cad and limit state method for analysis and design of our structure STAAD Pro and also used grade of concrete as M25 and grade of steel as Fe415. Time taken for doing this project is very less due to the application of the software. We bring extra accuracy in dimension and analysis part through our project.

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