isrjournals

International Journal of Advanced Research in Civil,Structural,Environmental and Infrastructure Engineering and Developing

Volume: 3 Issue: 1 Apr,2018,ISSN_NO: 2320-723X

PLANNING, ANALYSIS AND DESIGNING OF POLICE STATION BUILDING

NEHA TIRKEY Reg.no:191741004

Asst.Professor, Civil engineering (structural). Mr Manoj Nallanathel, M.tech.,(Ph.D)

Saveetha school of engineering, Chennai – 602105

ABSTRACT

In this project, an attempt has been made to prepare a report regarding **"PLANNING, ANALYSIS AND DESIGNING OF POLICE STATION BUILDING"** in Kovilpalayam, Coimbatore district. I have planned in such a way to make it as more economical. This project having appropriate plans, designs and also the provision for water supply , sanitary and electricity arrangement . We have used Limit state design method for design .All slabs have been designed as both in the conditions & simply supported slabs as per IS code recommendation .A septic tank with soak pit is also designed. Estimation work is also carried out and the results are properly shown in the tabular format.Then we have analyzed our building using STAAD pro, which is one of the design software .The building plans of various purposes are shown in this project by using AUTOCADD. Our building 3D view is drawn by ARCHICAD, which is architectural software.The recommended Indian codes are IS -456:2000, SP-16, IS 875-1987 (PART2) M25 grade concrete & FE-415 steel grades are for designing.

1) INTRODUCTION

The duty of civil engineer is not only to design the building but also to design the aspect of aesthetic appearance and interior decoration.The design of landscaping and interior rending is the most important aspect to the design and to give good appearance to the building. The architectural effect improves the elevation of the structure. Preparing of interior decoration depending on actual use of different rooms and areas inside the building are very important in the space planning of a building.We have choose this project specially to follow the principle of interior decoration and landscaping for the design of a Civil Engineering block.

2) METHODOLOGY

2.1) LIMIT STATE METHOD:

A Civil Engineering Designer has to ensure that the structures and facilities he Designs are (i) fit for their purpose (ii) safe and (iii) economical and durable. Thus safety is one of the paramount responsibilities of the designer. However, it is difficult to assess at the design stage how safe a proposed design will actually be. There is, in fact, a Great deal of uncertainty about the many factors, which influence both safety and Economy. The uncertainties affecting the safety of a structure are due to

· Uncertainty about loading

· Uncertainty about material strength and

· Uncertainty about structural dimensions and behavior.

These uncertainties together make it impossible for a designer to guarantee that A structure will be absolutely safe. All that the designer can ensure is that the risk of Failure is extremely small, despite the uncertainties.

Bending moments (B.M.) produced by loads are first computed. These are to be Compared with the resistance or strength (R.M.) of the beam. But the resistance (R.M.) It self is not a fixed quantity, due to variations in material strengths that might occur Between nominally same elements. The statistical distribution of these member Strengths (or resistances)

Similarly, the variation in the maximum loads and therefore load effects (such as Bending moment) which different structural elements (all nominally the same) might

Here is both due to variability of the loads applied to the structure, and also due To the variability of the load distribution through the structure.
Particularly weak structural component is subjected to a heavy load which exceeds the Strength of the structural component, clearly failure could occur.

Unfortunately it is not practicable to define the probability distributions of loads and strengths, as it will involve hundreds of tests on samples of components. Normal design calculations are made using a single value for each load and for each material property and taking an appropriate safety factor in the design calculations. The single value used is termed as "Characteristic Strength or Resistance" and
"Characteristic Load".

Characteristic resistance of a material (such as Concrete or Steel) is defined as that value of resistance below which not more than a prescribed percentage of test results may be expected to fall. (For example the characteristic yield stress of steel is usually defined as that value of yield stress below which not more than 5% of the test values may be expected to fall). In other words, this strength is expected to be exceeded by 95% of the cases.
Similarly, the characteristic load is that value of the load, which has an accepted probability of not being exceeded during the life span of the structure.
Characteristic load is therefore that load which will not be exceeded 95% of the time.

Most structural designs are based on experience. If a similar design has been built successfully elsewhere, there is no reason why a designer may not consider it prudent to follow aspects of design that have proved successful, and adopt standardised design rules. As the consequences of bad design can be catastrophic, the society expects designers to explain their design decisions. It is therefore advantageous to use methods of design that have proved safe in the past.

Standardized design methods can help in comparing alternative designs while minimizing the risk of the cheapest design being less safe than the others. The regulations and guidelines to be followed in design are given in the Codes of Practices which help in ensuring the safety of structures. The development of linear elastic theories in the 19th century enabled indeterminate structures to be analysed and the distribution of bending and shear stresses to be computed correctly. In the Working Stress Method (WSM) of design, the first attainment of yield stress of steel was generally taken to be the onset of failure as it represents the point from which the actual behaviour will deviate from the analysis results. Also, it was ensured that non-linearity and buckling effects were not present. It was ensured that the stresses caused by the working loads are less than an allowable

Stress obtained by dividing the yield stress by a factor of safety. The factor of safety Represented a margin for uncertainties in strength and load. The value of factor of safety in most cases is taken to be around 1.67.
Allowable Stress Yield Stress
Factor Of Safety
In general, each member in a structure is checked for a number of different combinations of loads. Some loads vary with time and this should be taken care of. It is unnecessarily severe to consider the effects of all loads acting simultaneously with their full design value, while maintaining the same factor of safety or safety factor. Using the same factor of safety or safety factor when loads act in combination would result in Uneconomic designs. A typical example of a set of load combinations is given below, which accounts for the fact that the dead load, live load and wind load are all unlikely to act on the structure simultaneously at their maximum values:

(Stress due to dead load + live load) ≤ allowable stress

(Stress due to dead load + wind load) ≤ allowable stress

(Stress due to dead load + live load + wind) ≤ 1.33 times allowable stress.
In practice there are severe limitations to this approach.
The major limitation stems from the fact that yielding at any single point does not lead to failure. This means that the actual factor of safety is generally different from the assumed factor of safety and varies from structure to structure. There are also the consequences of material nonlinearity, non-linear behavior of elements in the post-buckled state and the ability of the steel components to tolerate high local stresses by yielding and redistributing the loads. The elastic theory does not consider the larger safety factor for statically indeterminate structures which exhibit

redistribution of loads from one member to another before collapse. These are addresses in a more rational way in Limit State Design

3) ANALYSIS OF TEST RESULT:-

The various tests are conducted as follows:

1. Standard penetration test.
2. Grain size analysis.
3. Determination of specific gravity.

An analysis of the results of these tests is presented in this section of report. Since the soil layer meet with were essentially choosiness in nature undisturbed sample were not collected and test pertaining to cohesive soil were not conducted.

3.1)STANDARD PENTERATION TEST:-

The test were conducted at change of layers and at specified intervals, completing the test at 1.5m below ground level the relative density of the cohesion less layer obtain from the N-Value are also given in the Borolo's chart.

3.2) GRAINS SIZE ANALYSIS:-

Combined sieve and hydrometer analysis were conducted on the various sample conducted. Based on the proportion of the different soil constituents, the soil is classified using the triangular chart.

3.3) DETERMINATION OF SPECIFIC GRAVITY:-

The specific gravity of the soil grains were determined from the various samples collected. No abnormal value in noted in the test result.

4) FOUNDATION ANALYSIS:-

For the proposed structure shallow foundation can be give at a depth of 1.5m below ground level. The foundation would be resting on the send layer the ultimate bearing capacity could be computed using formula.

Qult = 0.5 x B x N + Df Nq

Where

B	= Width of footing
Y	= Submerged unit Wt. Of soil taken as 1 gm 1 cc
DF	= Depth of surcharge
N7 & Nq	= Bearing capacity factors based on the N - Value

For the purpose of computation, the depth correction should be applied to the observed should be applied to the observed N-Value using the formula.

$$N\ (\text{Corrected}) = N\ (\text{Observed}) \times 3.5 \left\{ \frac{}{P+0.7} \right\}$$

P - The effective over burden pressure in Kg / cm^2 the corrected N-Values should how ever be not more than twice the observed N-Value.

The minimum N-Value is 14 applying the depth correction, the corrected.

N-Value becomes 28.From the corresponding beams capacity factors.

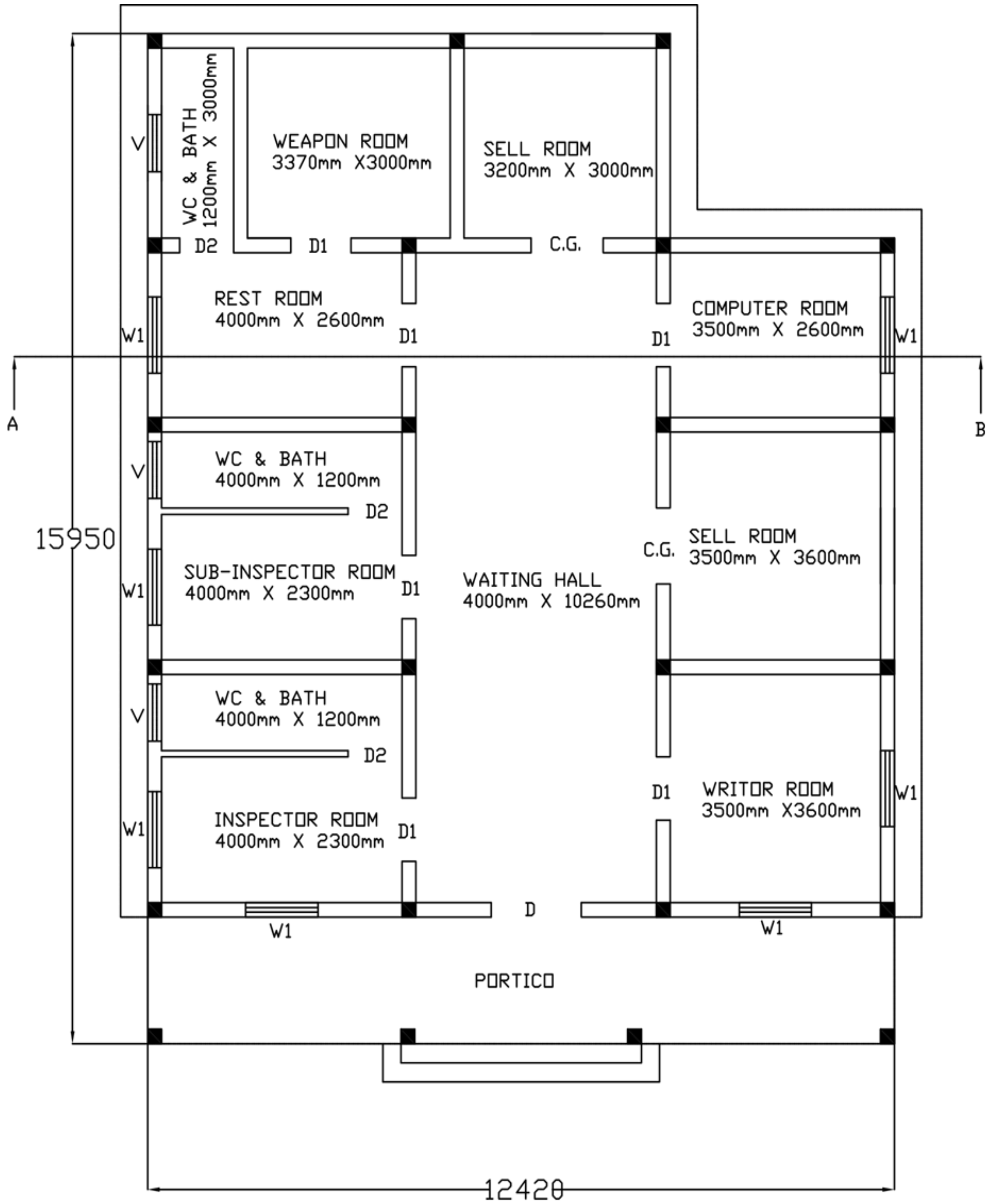
Where

Nr = 26 & Nq = 26.

The minimum width of footing of 1 m and a depth of surcharge of 1 m or considered for the analysis. To allow for a deduction in bearing capacity due to submergence of the soil, the submerged unit weight of soil 1 gm / cc is taken for analysis giving a factor of safety 2.5 the allowed load.

Q = (0.5 x1x1x100x26) + (1.5x100x26) / 2.5 =2Kg / cm^2

isrjournals
International Journal of Advanced Research in Civil,Structural,Environmental and Infrastructure Engineering and Developing
Volume: 3 Issue: 1 Apr,2018,ISSN_NO: 2320-723X



5) PLAN

DESIGNING OF CELL ROOM:

DATA:

Clear size = 3.2x3m   Fck = 20N/mm²   Fy = 415 N/mm²   Wall thickness = 230mm

SIDE RATIO:

Ly/Lx = 3.2/3

1.07<2 (two way slab)

EFFECTIVE DEPTH:

d (pro) = 3000/ (40 x 1.5)

= 85.71mm (say 100mm)

OVERAL DEPTH (D) = 100+20 = 120mm

LOAD CALCULATION:

Imposed load = 0.63 KN/m²

Self-weight of slab = D X B X25 = 3 KN/m²

Weight of weathering course = 1 KN/m²

Total load = 4.63KN/m²

Design load = 6.945 KN/m²

EFFECTIVE SPAN:

SHOTER SPAN:

Clear span + effective depth = 3.1m

C/C distance at supporter = 3.23m

LONGER SPAN:

Clear span + effective depth = 3.3m

C/C distance at supporters = 3.43m

Ly/Lx = 3.43/3.23 = 1.06

BENDING MOMENT:

αx =0.061 αy = 0.069 (corner not held down)

POSITIVE MOMENT:

Mx = αx w lx^2

= 5.00kN.m

My = αy w lx^2

= 4.42 kN.m

DEPTH CHECK:

d(req) = $\sqrt{Mu}$ / QB

= 42.57 mm< 100mm

HENCE OK

AREA OF STEEL:

SHOTER SPAN

Positive moment:

MU = 0.87 X Fy x Ast (d- Fy Ast / Fck xbxd)

= 142.71mm²

Maximum spacing:

3d = 300mm
300mm
550mm 10mm dia @300mm C/C distance

LONGER SPAN:

Positive moment:

MU = 0.87 X Fy x Ast (d- Fy Ast / Fck xbxd)

= 112.2mm²

Maximum spacing:

3d = 300mm
300mm
700mm

10mm dia @300mm C/C distance

CHECK FOR SHEAR:

Shear stress (Tv) = Vu/bxd

Vu = WuxLe/2

= 6.945x3.23/2

= 10.49kn

Tv = 10490/1000x100

Tv = 0.10N/mm2

Tc,max = 2.8n/mm2

Tv < Tc,max

DESIGNING OF COLUMN

DATA:

M15&Fe415, Axial Load = 450 kn

AREA OF STEEL (Asc):

Asc = 2%Ag

AREA OF CONCRETE (Ac):

Ac = Ag-Asc

= Ag-0.02Ag

= 0.98Ag

DESIGN LOAD:

Pu = Axial load x F.O.S

= 450 x 1.5

= 675 kn

DIMENSION OF COLUMN:

Pu = 0.4 Fck Ac + 0.67 Fy Asc

675000 = (0.4 x 20 xo.98 Ag) + (0.67 x 415 x 0.02 Ag)

675000 = 7.84 Ag + 5.56 Ag

675000 = 13.4 Ag

Ag = 50373.13 mm2

Size of Colum = 370 x 370

LONGITUDIONAL REINFORCEMENT:

Asc = 0.02 Ag

= 0.02x50373.13

Asc = 1007.46 mm2

NUMBERR OF ROD:

Assume 20 dia of rod

Asc = 314.16 mm2

N.O.R = A.S.C/a.s.c

= 1007.46/314.16

= 3.21 Say 4 Nos

Provided 4 Nos of 20mm dia of rod

***LATERAL* TIES:**

1) Dia of rod/4 = 20/4=5mm Say 6mm
2) 6mm

PITCH DISTANCE:

1) Least lateral dimension = 230 mm
2) 16xDia of rod = 16x20 = 320 mm
3) 300mm

PROVIDE 6mm DIA OF LATERAL TIES AT 230 mm

6) REFERENCE

1. REINFORCED CONCRETE STRUCTURE = **B.C.PUNMIA**
2. REINFORCED CONCRETE STRUCTURALS = **VAZHIRENI &RATWANI**
3. TREASURE OF RCC DESIGN = **SUSHIL KUMAR**
4. DESIGN OF REINFORCED CONCRETE STRUCTURE = **RAMA MRUTHUM**
5. REINFORCED CONCRETE DESIGN =**MALLICK & RANGASWAMY**
6. REINFORCED CONCRETE = **MALLICK & GUPTA**
7. CODE OF PRATICE FOR PLAIN AND REINFORCED CONCRETE **I.S.-456-2000**
8. DESIGN AIDS TO **IS = 456-2000**
9. STANDARD DATA BOOK
10. MADRAS DETAILED STANDARD SPECIFICATION
11. QUANTITY SURVEY = **PRATHEEBA PUBLISHER**
12. ESTIMATING & COSTING
13. CURRENT **PWD** SCHEDULE OF RATES

7) CONCLUSION

In general a man's view to build a house requires money, bricks, and cement but beyond this, there are greater technical aspects involved.

This project work has given us an in depth knowledge to all aspects of projects design and development to ensure an economical project (residence) in terms of effective space. Planning, structural stability and cost parameters.

This work has not been restricted to be paper as and academic exercise but has farther been attempted as a proposal to a live project

isrjournals

International Journal of Advanced Research in Civil,Structural,Environmental and Infrastructure Engineering and Developing

Volume: 3 Issue: 1 Apr,2018,ISSN_NO: 2320-723X