DEVELOPING CIVIL ENGINEERING DESIGN SOFTWARE USING MS EXCEL

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Abstract

The development of package for analysis and design of civil engineering structures is a useful work which effectively utilizes MS EXCEL environment. The structure underneath and the interface is a host of versatile and powerful features which can be utilized in teaching data entry and manipulation to a large number of functions, charts, and word processing capabilities. The main objective of developing a computerization system is to reduce the paper work and safe of time in management which increases the efficiency and decreasing the work load. It provides flexibility of generating the required documents on screen when required. It helps in teaching structural engineering concepts. Also use of Excel is to enhance the concept and efficiency of structural analysis and design when designsheet is used.

Keywords: Designsheet, MS EXCEL, civil engineering, structural analysis.

I. INTRODUCTION

Designsheets are earliest software innovations which had a profound effect on the extensive use of personal computers. Among the strong features of designsheets are their in-built cell-based structure and the simple boundary that is easy to use, even for first time users. The development of package for analysis and design of civil engineering structures is a useful work which effectively utilizes MS EXCEL environment. [1].

The main use of Excel designsheet is in teaching civil engineering concepts and creating useful applications. The focus is on concepts related to construction management and structural engineering ranging from a simple cost estimating problem, structural design and analysis to advanced applications like the simulation using PERT [2].

The course in computer programming that is being offered in civil engineering. Typical civil engineering problems are used to present the programming concepts. The paper includes an overview of the course and examples of the designs covered. [3].

II. SCOPE AND OBJECTIVES

•The objective of developing a computerization system is to reduce the paper work and safe of time in management.
•This increases the efficiency and decreasing the work load.
•It provides flexibility of generating the required documents on screen when required.
•Use of design sheets in teaching structural engineering concepts.
•Use of Excel to enhance the concept and efficiency of structural analysis and design when design sheet is used.

III. METH0DOLOGY

For the study, a huge amount of documented data is required. It will be recorded by going through different papers and extracting the values from the same.
Pilot study is carried in order to evaluate reliability, feasibility and validation of data collected.
Analysis and design will extensively employ MS EXCEL environment.

Analysis and design will be done for
[1] Foundations and its types
[2] Slabs and its types
[3] Columns
[4] Beams and its types
[5] Staircases

IV. USING SPREADSHEETS IN TEACHING CIVIL ENGINEERING CONCEPTS

The basic model of an array of rows-and-columns in Excel Designsheets with automatic update and display of results has been extended with archives of mathematical and statistical tasks, flexible graphing and charting services, powerful add-ins such as Microsoft Excel's Solver, attractive and highly handy graphical user boundaries.

Designsheets with these prevailing features and software design capabilities can be used as an active tool for use in civil engineering applications. Examples include construction data management, valuation, simulating and forecast construction activities with indeterminate durations, design and analysis of different steel members such as beams, columns, base plates, etc.

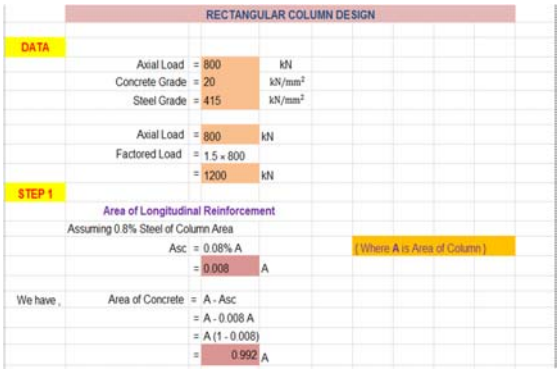
Since the fundamental of any information system is storing of the data and information for management tasks, database skills in designsheet can be used as an operative tool to develop composite data management scheme for construction information. Few simple, but infrequently used, designsheet features need to be known and can be used to develop applied and powerful representations, which can be used for teaching civil engineering concepts.

V. APPLICATION IN STRUCTURAL ENGINEERING

In this paper three cases are presented to reveal the use of designsheets in teaching structural engineering concepts.

The first example illustrates the use of Excel to enhance the design and analysis of Column when designsheet is used. Design of RC Rectangular short column subjected to axial load of 800kN(FIG 1) is used to demonstrate the concept and in order to show that designsheet lessens the math errors and time in doing the tiresome calculation.

The procedure of the method for Column design can be precised as follows: 1.)Given Pu , Mux , Muy, grade of concrete and steel 2.) To Check if the Column is short or Slender using Table 28 of IS 456 :2000.3.) Verify that the eccentricities e x = Mux /Pu and ey = Muy/P u are not less than the corresponding minimum eccentricities as per IS:456-2000 4.) Assume a trial section for the column (square, rectangle or circular). 5.) Determine Area of Steel for longitudinal reinforcement using suitable equation based on minimum eccentricity criteria. 6.) Design of Lateral ties as per clause 25.5.3.2 of IS 456 :2000 7.) detailing.



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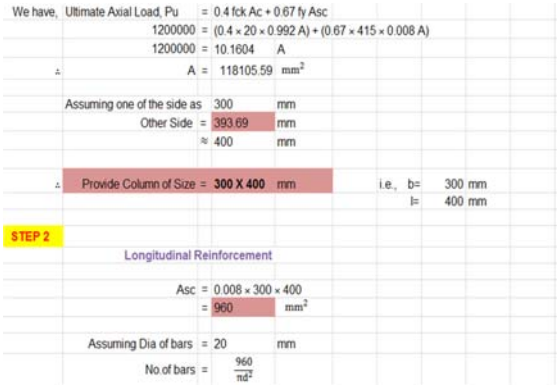

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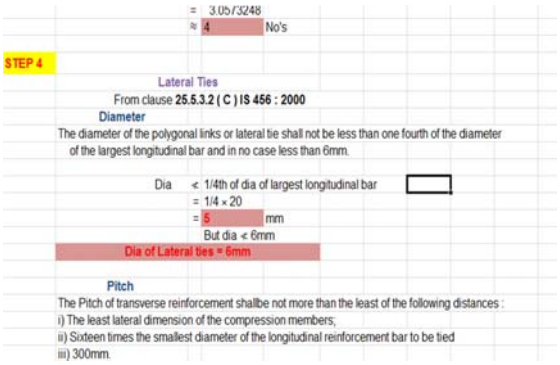

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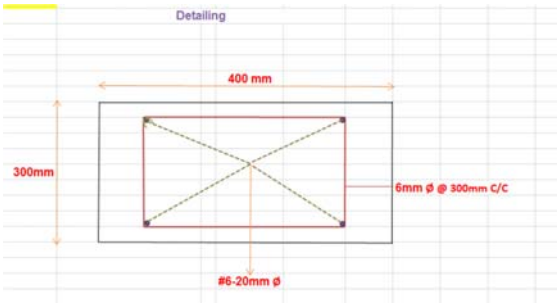

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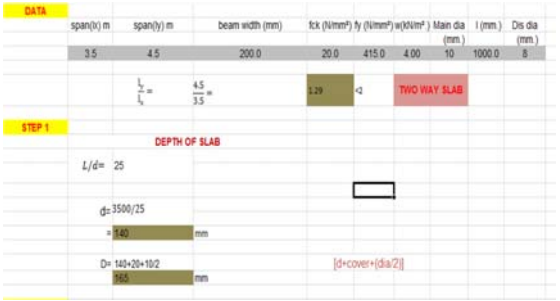
Fig 1Design of Column using Excel

The second case demonstrates the design and analysis of Two-way Slab using a designsheet. Figure 2 shows the step by step procedure of design of Two-way slab. Design a two way slab of dimension 3.5m X 4.5m for office building, with beam width of 200mm Take live load of 4kN/m2 & floor finish as 0.66 kN/m^2 is showed.Using designsheet time can saved and also it almost gives an accurate answer compared to paper work. Detailing can be done accurately without any scale.

Design Steps mainly includes;1) Finding Depth Of Slab 2) Finding Effective Span 3) Calculating Loads 4) Calculating Ultimate Moment & Shear Force 5) Reinforcement along Short Span 6) Reinforcement along Long Span 7) Check For Shear Stress 8) Check For Deflection 9) Torsional Reinforcement 10) Detailing.



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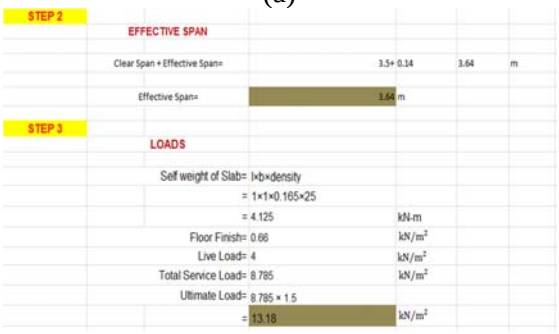

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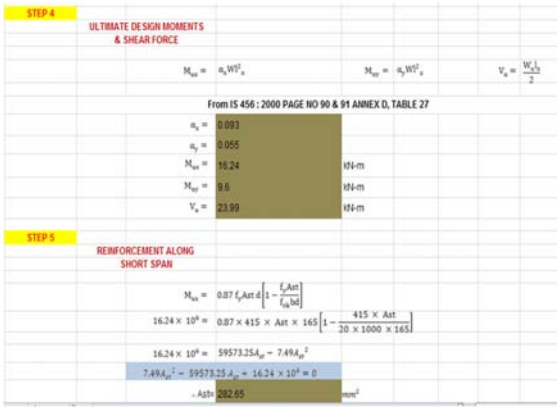

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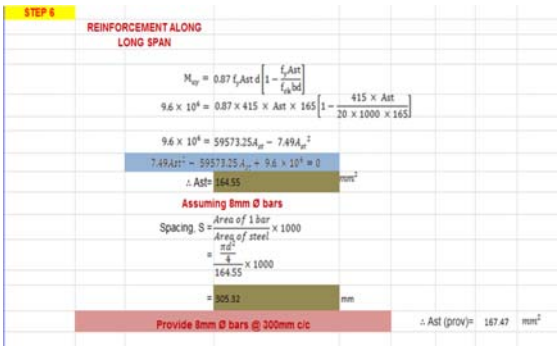

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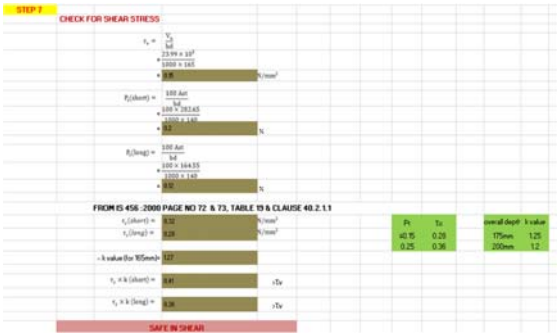

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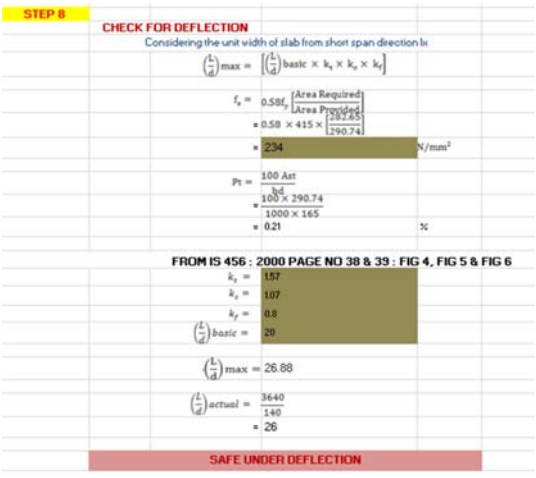

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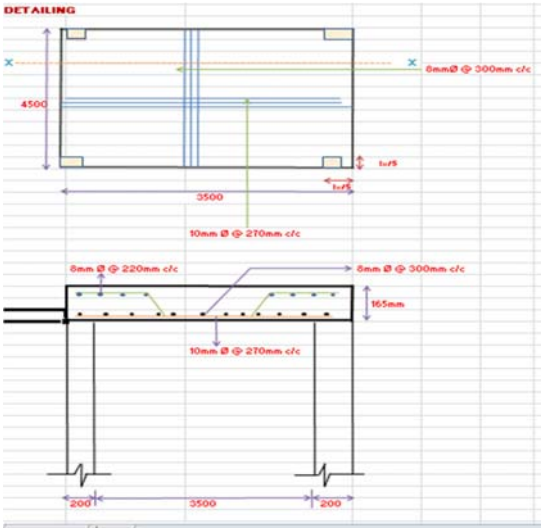

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Fig 2 Design of Two-way slab using Excel

The third case demonstrates the design and analysis of Dog legged Staircase using a designsheet. Figure 3 shows the procedure of design and detailing of Dog Legged Staircase. It shows one flight stairs between landing beams with waist slab with live load of 3kN/m^2 & floor finish as 1.5 kN/m^2. Using this designsheet time can saved and also it nearly gives ansnswer with less math error than in paper work. Detailing showing reinforcement can be done accurately without any scale.

Design Steps mainly includes;1) Finding Effective Span 2) Calculating the thickness of waist slab 3) Calculating Loads 4) Calculating Ultimate Moment & Shear Force 5) Main Reinforcement calculation 6) Calculating Distribution Reinforcement 7) Check For Shear Stress 9) Check For Deflection 9) Detailing.

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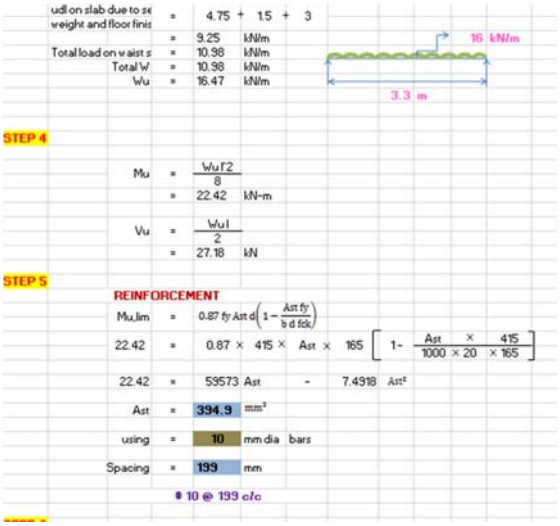

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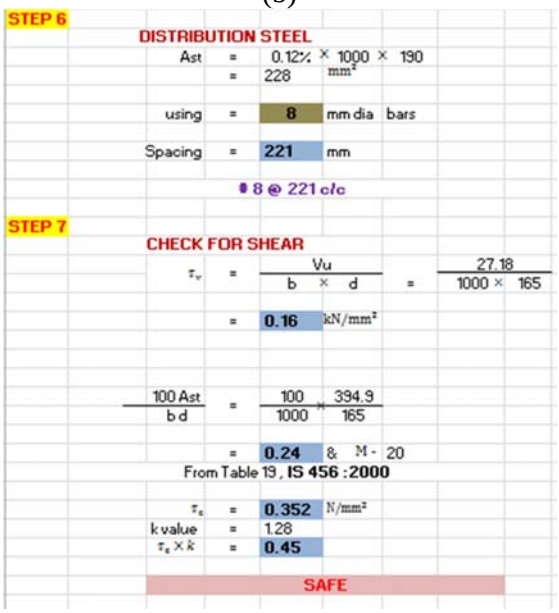

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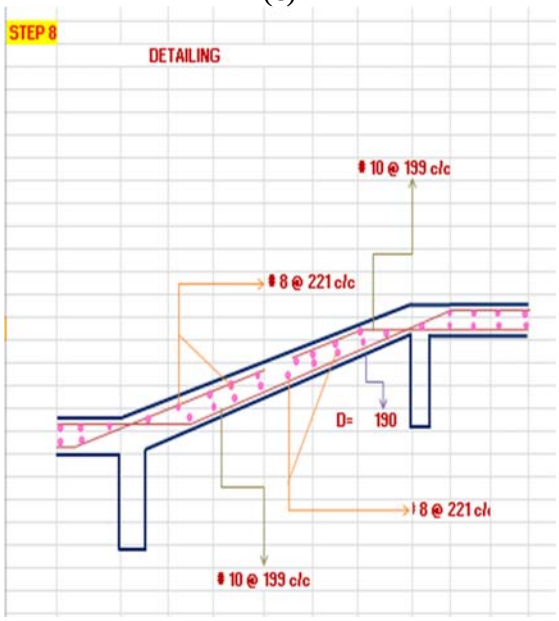

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VI. CONCLUSIONS

- Designsheets are gradually gaining the acceptance to use as a powerful tool and are considered among the initial software innovations that had a reflective upshot on the widespread use of personal computers.
- Amid the strong features of design sheets are their innate cell-based structure and the modest interface that is easy in learning. This is an count to its powerful programming capabilities.
- The development of a computerization system is mainly to reduce the paper work and safe of time in management which in turn increases the efficiency and decreasing the work load.
- The important inferences that can be drawn from this type of study is that there is a noteworthy interest in the application of designsheets in both simple and difficult engineering models and problems.
- Designsheets have assisted an increased empathetic of researchers, students, and faculty members.
- The designsheets is gaining popularity not only because of their value in training learners how to create computer programs but also because they clarify logical belief, analytical processes, and algorithmic intellectual.
- Finally, the accessibility of Excel and its programming abilities makes it a prevailing tool in evolving applications for training civil engineering conceptions and theories related to other engineering castigations.

VII. REFERENCES

[1] P.C.VASANI.,‘‘Development of packages for analysis and design of Civil engineering structures which extensively Utilizes ms excel’’.

[2] Essam Zaneldin.,‘‘Using DESIGN SHEETS and VBA for Teaching Civil Engineering Concepts’’Department of Civil and Environmental Engineering, United Arab Emirates University, P.O. Box 17555, Al Ain,United Arab Emirates.

[3] George List, North Carolina State University.,‘‘Introducing civil engineering analysis through programming’’

[4] Essam K Zaneldin and Bilal El-Ariss.,2015., ‘‘Using DESIGN SHEETS and VBA for Teaching Civil Engineering Concepts’’

[5]Indian Standard code for Plain and Reinforced concrete structures, IS 456 :2000, Bureau of Indian Standards, New Delhi, April 2007.

[6] Indian Standard code for Design aids for Reinforced concrete to IS:456-2000,SP 16 1980 Bureau of Indian Standards, New Delhi, March 2000.