PUTER AIDED STEEL ROOF STRUCTURAL ANALYSIS

BY

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PGD/MCS/98/99/800

A PROJECT SUBMITTED TO THE DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGER STATE.

IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF POST GRADUATE DIPLOMA (PGD) IN COMPUTER SCIENCE.

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DECLARATION

I here by declare that this project work was carried out by me FASOYIRO OLUKAYODE IBIKUNLE PGD /MCS/98/99/800 under the supervisor of MALLAM AUDU ISAH. Department of Mathematics with computer service. Federal University of Technology Minna during the 1998/99 Academic session.

Sign..................................... Date............................

FASOYIRO OLUKAYODE .I.

APPROVAL PAGE

I hereby certify that I have supervised, read and approved this project work which I found to be adequate in scope and quality for the partial fulfillment of the requirement for the award of Post-Graduate Diploma in Computer Science.

....

Mallam Audu Isah — Date

Project Supervisor

....

Dr. S.A Reju — Date

H.O.D

....

External Examiner — Date

DEDICATION

THIS PROJECT IS DEDICATED TO THE BLESSED MEMORY OF MY LATE GRANDMUM, CHIEF (MRS.) EVANGELINE OREDOLA OBADINA (NEE MAJEKODUNMI). (1924 - 1999).

ACKNOWLEDGEMENT

I'm using this medium to appreciate the contribution of those who have made this project and my PGD programme a success.

I 'll like to give thanks to the Almighty God for sparing me up to this moment and also inspiring the writing of this project.

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ABSTRACT

The project is about the development of computer program for use as aid in the multiple decision making process and numerically oriented process. These processes are associated with the analysis of a steel roof structure.

The work can be considered to be design aid which use the power and features of the micro - computer and provide alternative approach to the traditional manual technique used in steel structure analysis.

The scope and management of the project are indicated in the content. Carefully selected references are also included for the benefit of those who might want to improve on the project or have a further study of it.
At the end of the study, the project is expected to come out with a system that;

Produce sketch representation of a steel roof frame structure

Labeled members of the frame structure

Perform analysis of the structure to determine whether its a strut member or a true member.

Produce a tabulated result of the analysis.

CHAPTER ONE

COMPUTER AS A TOOL IN STEEL ROOF STRUCTURAL ANALYSIS

1.1 INTRODUCTION

This project is intended to convey some of the important issue associated with the introduction and successful use of computer in analysis of a steel roof structure. Engineers are well used to manual solution of complex problems and are therefore ideal candidate for the utilization of this relatively new and exciting innovation.

For the benefit of those who will be coming across this project and have no structural analysis knowledge, a simplified introduction will be done to appoint them to the intricacies of structures steel and roof in general

1.2 WHAT IS A COMPUTER?

A computer is a machine that follows instructions in order to process data, solve a specific problem or accomplish a particular task. The instruction that control a computer when it performs a task is referred to as a program. A collection of programs that are made to work together for a specific purpose is called software. Problems solves with the help of computer software are enormous and varies with profession or usage. For the benefit of this project, computer will be used to solve the cumbersome processes involved in the analysis of steel roof structure.

1.3 NEED FOR COMPUTER IN STEEL ROOF STRUCTURAL ANALYSIS

Until recently, computers have not been used to aid in engineering works. Even when they are used it could only run on large mini - computers or mainframe computers. This makes the usage of computer for engineering solution very expensive. Thus, making it affordable for only big companies or government establishment. The non - compatibility of the computer programs with micro-computers also contributed to the non usage of computers by engineers.

With technological advancement in all spheres of profession, improvements were made on the system and programs that run only on main frame can now run on the microcomputer. This singular feat, endear engineers and other professionals to the use of computer. The awareness of computer usage also necessitate the need to aid all sphere of engineering works with the computer

This project is written for, student professionals or organizations who are considering using computer to aid in the analysis of steel roof structure.

It analyzes the present manual mode of analysis and also identified all the constraints encountered in the analysis. These include the cumbersome calculation of some parameters in the cause of analysis. The repeated routine calculations of the force in members of the frame structures. The system also gives the result of the analysis in a tabulated form. This enables the user to determine the force of a particular member at a glance.

1.4 WHAT IS STEEL ROOF STRUCTURE

A steel roof structure is the combination of triangle in a frame made of steel at the upper most part of a building. This is used to with stand certain loads and transferring the loads to the foundation of the building without alteration in the formation of the frame. Alteration in the formation of the frame will result in the collapse of the roof structure.

The loads to be transferred varies. They include the wind load, the dead load (i.e. load caused by the weight of the steel) and imposed load (i.e. load from purlins and the roof coverings).

Steel roof structure is a compound name comprising of steel, roof and structure. Each of this will be treated and explained individually so as to understand and have an insight into structural analysis.

1.4.1 **STRUCTURES.**

A structure can be defined as any system that has the function of transmitting load. Structural materials are the materials used to construct those part of the structure which carry the load and give it strength and stability. The materials include steel, concrete, stone e .t. c. in this project, the structural material to be taken into consideration is steel. From the above statements, we will deduce that strength and stability are the functional requirements of a structural material. Strength is the most important property of a structural material, it is strength which determines the force which the weakest part of a structure can carry before the material at that point fails and the structure as a whole may collapse. The strength (or more precisely the ultimate strength) of a material is the stress (which is defined as load per unit area of cross section) at which usually measured by testing a specimen of the material the material in a structure may fail either in the tension or in compression. Accordingly, the designer needs to know both the tensile and the compressive ultimate strength of the material in use. This project will be analyzing the tensile stress and the compressive stress on each member of the frame structure that form the roof structure.

1.4.2 **STEEL.**

Steel is a structural material. It had been adjudged so for its strength and stiffness. A particularly valuable property of steel is that is more or less isotropic that is, its strength and elastic properties are almost the same in whatever direction it is stressed. The strength of any structural material is measured in E, the modulus of elasticity, it is known that E is related to the attractive force between adjacent atoms in solid materials. For atom of given element - e. g iron - this force has a definite value and E can be calculated with a high degree of accuracy from this knowledge. Since iron account for about 99% of the content of the structural steel, E hardly varies from steel to steel. Heating also, can not be use to increase the value of E in the steel. Next to concrete, steel is easily the most formable (i. e change its form to entire a particular purpose) of the structural materials. It can be rolled in joist form or in variety of other shapes. Plates and sections can be bent and shape cold or with a little heat. There is no doubt that the ability of steel to be shaped and joined has led to its pre- eminence as a structural material couple with many other properties.

1.4.3 **ROOF**

A building roof is its first time of defense against the weather. The roof protects the interior of the building from rain, snow and sun. the roof help to insulate the building from extremes of heat and cold and to control the accompanying problems with condensation of water vapor. And like any other front - line defender, it must itself take the brunt of the attack. A roof is subject to the most intensive solar radiation of any part of a building. At mid day the sun boils a roof with radiated heat and ultra-violet light. On the clear nights, a roof radiates heat to the blackness of space and become colder than the surrounding air. From noon to mid night the surface temperature of a roof can vary from near boiling to below freezing. In cold climates, snow and ice cover a roof after winter. Storms and cycles of freezing and thawing gnaw at the materials of the roof. A roof is vital to the sheltering function of a building and is singular by vulnerable to the destructive force of nature. Roofs can be covered with many different materials. These can be organized conveniently into two groups: those that works on slopping (i. E pitched) roofs and those that works on flat or nearly flat roofs. The distinction is important : a pitched roof drained itself quickly of water, giving wind and gravity little opportunity to the push or pull water through the roofing material. Trusses are supporting the roofing materials. The trusses can be constructed using materials that vary in structural property. e. g bamboo, wood, steel. The choice of truss material depends on the type of roofing material to be used but mainly depends on the span to be covered. The weight of the roof is also relevant in the design of a roof truss. Certain criteria have to be considered to determine the pattern of the roof truss. This includes the span and height of the building to be covered, the architectural aesthetics of the building, the weight of the roofing and truss material and so on. The truss material to be considered in this literature will be steel while the pattern will be the pratt range of truss. A truss can be described as a triangular arrangement of structural members that reduces no axial forces on the truss to a set of axial forces in the members. Steel trusses are generally deeper and lighter than improved beam and can span correspondingly longer distances. They can be designed to carry light or heavy loads.

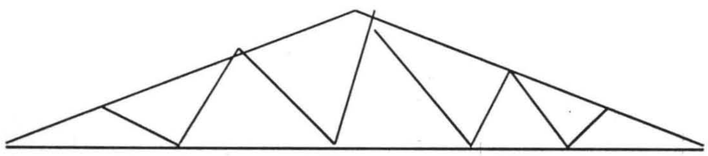
FUNCTIONS OF A ROOF.

a) To keep out rain, wind, snow and dust.
b) To prevent excessive heat loss during cold weather condition like winter.
c) To keep the interior of the building cold during hot weather condition.

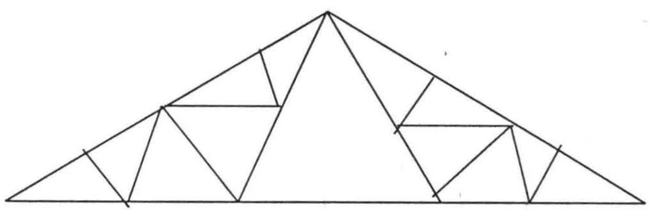
d) Designed to accommodate all stresses encountered
e) Designed to accept movement due to change in temperature and moisture
content.

TYPES OF STEEL ROOF TRUSSES

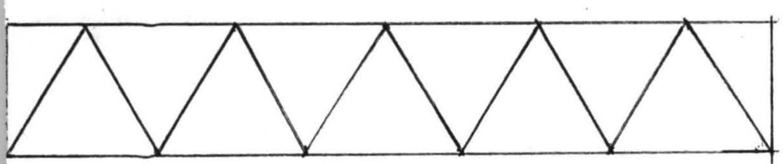
a).



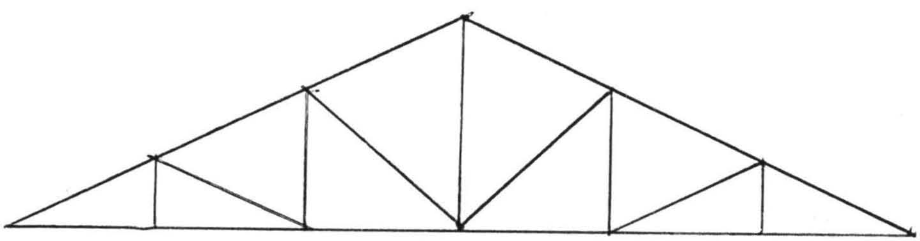
Fink or Belgian Truss



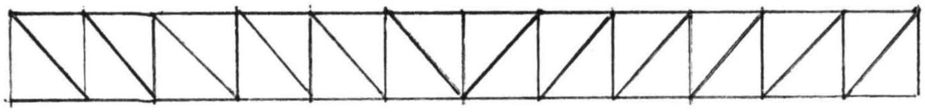
(b) French Truss



(c) Warren Girder



(d) Pitched Pratt Truss



(e) N – Pratt Truss

1.5 CONSTRUCTION PROCESS OF A STEEL ROOF STRUCTURE

A steel roof truss frame begins as a rough sketch on the drafting board of an architect or engineer. As the building design progresses, the sketch evolves through many stages of drawing and calculations to become a finished set of structural drawing. These shows accurate truss location and the shape and sizes of all the members of the frame, but they do not give the exact which each member must be cut to mate with the members it joins. They do not give details of the move routine connections of the frame. This project will take care of the calculation aspect up to the force analysis stage.

1.6 OBJECTIVE OF THE STUDY

The objective of the project is the development of a computer program for use as aid in the multiple decision making process and numerically oriented process. These processes are associated with the analysis of a steel roof structure.

The work can be considered to be a design aid, which uses the power and features of the microcomputer, and provide alternative approach to the traditional manual techniques used in steel structure analysis.

1.7 SCOPE OF STUDY

The user of this system should bear in mind that the scope of the work is limited to steel roof structure analysis and not a general steel analysis package. Specifically the pratt roof structure will earnestly be treated.

This project should not also be referenced as the design of a steel roof structure but as an analysis preceding the design of steel roof structure.

1.8 RESEARCH METHOD

The method adopted by this study truss to make a thorough study into the existing system being used in order to examine how it behaves and operate why at behave that way and what are the consequences of its behaviour. After the above process, the new system is produced. This development process will go through an iterative process of analysis, synthesis and appraisal before the final design solution is given. The analysis stage tries to define the problem by first studying the present mode of operation in the production of designs, it pictures the old expectations in terms of how they failed and the symptoms and causes of the failure. The new system is then designed based on the prior analysis of the old system. At this juncture it should be stated that the system design strategy has pass through a recursive process of determining the best system suitable for the application we want to put it into use with.

1.9 ECONOMIC IMPORTANCE OF THE PROJECT.

The need to produce design of large and often complex structural system within a relative short time to make the use of the computer in the design office essential. This is why the project have put into use the calculative power of the micro- computer to overhead encountered in the manual procedure in design of steel roof structures.

1. Early discovery and reduction of errors- the system results in exhibition of greater efficient early discovery or errors. It reduces errors and enhances greater accuracy. For instance, when doing a repetitive operation manually, the tendency to commit error is very high. It can be due to oversight of some steps. Human factor can also creep in to obey the law of diminishing returns.

Efficiency - (Time reduction) productivity gains for automated, rather than manual process range from 2:1 to 8:1 for most applications. Time savings are also realized by using library and details which result in shorter project span times and in faster detection of problems before they become critical. Both time saving and error reductions can be derived from storing and subsequently selectively retrieving and combining (overlay) these data.

3. Integrated Design: A single central database that is use for both designed and analysis results in a cohesive (integrated) rather than a fragmented (discontinuous) design process. This in turn has the additional advantage of encouraging the use of cost saving repetitive details.
4. It eliminates the tedious and often boring routing of performing repetitive calculations.
5. It leaves the engineer free to channel all mental effort to the philosophy of structural steel design.
6. It produce various design of the same structural system at their best, in terms of economy, strength and serviceability.
7. Training - The operator instruction guild provide for more direct training procedures, since the training involves an explicit pre-established set of method related to system use.

CHAPTER TWO

ANALYSIS OF OLD AND NEW SYSTEM

System analysis and designs are processes similar to problem solving. During this process, analysis of work methods and procedures are done in order to simplify work and to improve work flow. The process of system analysis involves a number of steps that can be applied to any study. These procedures will be treated in relation to this project.

2.1 PROBLEM DEFINITION.

This is the process of determining the nature and scope of the problem. If the problem is incorrectly or incompletely defined, the entire study could address the wrong issues. Before one can really define the problem of the system, one has to be conversant with the procedure or ethics of the system. This can be achieved by sourcing for enough information to enrich one's knowledge of the system. In system analysis, there are several methods of gathering information this include observation, record searching, special purpose records, sampling, questionnaires and interviewing. For this project the approach used to gather information are record searching and sampling for they are appropriate for the situation under consideration.

RECORD SEARCHING

This feat was achieved by going through existing analysis of steel roof frame structure. The analysis was obtained from text books (see references), project works and also practical analysis of constructed structured with records. (e. g the hard copy of the roof analysis of the mechanical engineering student workshop of Ladoke Akintola University of Technology, Ogbomosho, Oyo State). The searching yielded positive result in respect to the consultant encountered during the manual analysis.

SAMPLING.

With the prior knowledge of the analysis of steel roof as an experienced civil engineer, some of the analysis were done manually personally to confirmed the discovered constrains and problem encountered during the record searching process. The sampling really give a confirmation of the prior discovery.

2.1.1 **THE PROBLEMS**

After the thorough study made during the fact-finding process, it was recorded that the methods used for the analysis of frame structures have their peculiar problems. The methods for the analysis can be divided into graphical method make use of line drawing to solve for the forces in the members of the frame. The calculation methods can be analysed in three ways namely:- method of sections, method of resolution of forces at joints and methods of tension coefficient. The method will be expatiated on later in the chapter. The problems of these methods can generally be summarised as follows.

a) Tedious and voluminous repetitive calculations.
b) Time consuming.
c) Deviance from code of practice due to in-accurate calculation or incomplete drawing.
d) Improper storage and retrieval facilities.

2.1.2 **CAUSES OF PROBLEM.**

As the problem definition determines the scope of problems, it also gives indication on the causes of the problems.

PROBLEM A: The conceived cause of the problem is the method of calculations used for the analysis. The problem can be solved manually with the use of the graphical method. The calculation methods is tedious but it makes the engineer know how the member really react individually and why they react .the graphical methods will reduce the stress of tedious calculations and voluminous hard copy of calculation sheet. It will not give the engineer the fully required knowledge of the individual reaction of the members and the reason for their reaction.

PROBLEM B:

The period used in the calculation of steel structure is much. If the calculation period can be reduced, it will enable the engineer channel his intellectual wealth on other aspect of his profession. The graphical method can not solve this problem for on its own, it consumes a little tune too. The initial drawing will be done with pencil, it will then be transferred later into a tracing sheet with ink before it will be printed out for use.

PROBLEM C:

Due to the voluminous and tedious calculation involved in the analysis of steel roof structure, there is the tendency that the system is tenable to errors. The errors can be that of omission or oversight, error of wrong data entry can also be committed. Law of diminishing returns operate on human. This affects the human output with longer duration of tedious repetitive work. This is a very important factor that constitutes the problem of the manual process.

PROBLEM D.

The volume of hardcopy produced during the analysis of a steel roof structure is much. This makes it difficult to refer to a particular aspect of it or even locate the bulk of the work in the cabinet. This makes the storage facilities incompetent to handle the urgent need of retrieving an aspect of the analysis.

2.2 FEASIBILITY STUDY

This is to determine whether a solution to the problem is feasible. This is to prevent many months of wasted efforts and resources. It is also used to determine whether the project is too large, too uncontrollable or simply impossible to carry out.

2.2.1 FEASIBLE SOLUTION TO PROBLEM

SOLUTION A: The computer system with a very good program, handle repetitive task easier and faster. The ratio at which the computer handles a repetitive task to the manual process ranges from 8:1 to 14:1. This shows distinctively that the rate at which the computer handles repetitive works outwits that of the manual process. The voluminous quantity can also be stored in the memory of the computer.

SOLUTION B: With the speed of calculation of a computer, the time used in calculating the analysis will be very minimal. The engineer will be able to channel his time to other professional responsibilities requiring his time.

SOLUTION C: With the use of proper software and correct programming, the problem of inaccuracy will be eliminated. The calculation will be accurate likewise the drawing.

SOLUTION D: The problem of storage and retrieving is not far fetched in most manual systems. This is one of the major advantage which the computerized system has over the manual system. This problem can be solved with the purchase of a computer with large memory capacity or upgrading the ones with less memory.

2.3 OLD SYSTEM ANALYSIS.

The full detailed study of the current system will be treated under this topic. The analysis method we will use in this project is the graphical method and the method resolution of forces at joints. The choice of the graphical method is made because it is the easier of the two methods in analyzing a steel roof structure and that of method of resolution of forces at joints to be able to know how each member react under force.

The procedure of the analysis will be given comprehensively as follows.

2.3.1 GRAPHICAL METHOD PROCEDURE

1] Draw the sketch of the steel roof structure (free-body diagram) to scale

2] Determine the load on the roof. These will be the dead load (self weight of the roof), live load (imposed load at the purlins)and the wind load (wind effect on the roof) . This will be reacting at the nodes (joint where the internal member meet on the rafter) as forces.

3] Determine the reaction at the supports.

4] Label the free-body diagram using the Bow's notation.

5] Transfer lines from the free body diagram must to get the force diagram. The force diagram must be scaled in proportion to the force transferred from the free-body diagram.

6] Determine the forces in the members by measuring the scaled force diagram.

7] Determine the type of force (whether in compression or in tension, if in compression name it strut and if in tension tie). The type of force can be determined from the type of arrow direction at the nodes.

8] Tabulate your result.

2.3.2 **CALCULATION METHOD PROCEDURE [RESOLUTION OF FORCES AT JOINTS]**

1) Draw the sketch of the steel roof structure (free-body diagram) to scale.

2) Determine the load on the roof. This will be the dead load (self – weight of the roof) live load (imposed load by purlins) and the wind load

(wind effect on the roof) this will be reacting at the nodes (joints where the internal member meet on the rafter) as forces

3) Determine the reaction at the support
4) Label the free – body diagram using the Bow's notation.
5) Start calculation from the node on the left side. Make sure that two forces are Known before considering a particular node
6) Determine the forces in the member from the calculation at each node.
7) Determine the types of force (whether compressive forces or tensile force, if compressive force name it strut while if tensile force name it Tie). This can be determined by the direction of the arrow head at each node
8) Tabulate your result

2.4 OBJECTIVE OF OLD SYSTEM

The objective of the current system including the main objective of the steel roof frame structure includes;

-To produce a design analysis with an acceptable probability that the structure will be able to perform the function with which it is put to use,
-Making sure that the structure is stable and robust and can be serviceable throughout the life span of the period of usage ,
-Giving consideration to the aesthetics of the structure in the design procedure.

The above stated objective is practicable and should be what must be obtained in any structural design outfit.

2.5 THE NEW SYSTEM

The computerized system uses the unique feature of the computer to tackle the problem encountered in the former system.

2.5.1 OBJECTIVE OF THE NEW SYSTEM

The objective of the new system apart from the primary objective of analysis of steel roof frame structure includes ;

- Providing proper link between each stage of the process.
- Giving an effective data transfer and storage facility.
- Giving graphical sketches of design on the computer screen
- Producing accurate calculations of the analysis process.
- Produce a comprehensive package that incorporates all the stages involved is
  structural analysis

2.5.2 FEATURES TO BE RESERVED FROM THE OLD SYSTEM

The only feature to be retained from the previous system is the method of calculation in the code of practice employed in producing structural analysis work

2.5.3 CONSTRAINTS AND CAPABILITIES OF THE NEW SYSTEM

At this juncture, it is expedient in defining the constraints and the capabilities of the system we want to produce.

CONSTRAINTS

The constraints include not all computer system, system support computer aided graphics system - This graphic mode aid the production of working drawing and the drawing produced is a skeletal output

The system expect the user to have a prior knowledge of structural engineering as some input require the use of mathematical skills and application of engineering judgement.

CAPABILITIES

Though there exist some constraints, the capabilities of the system far out wits the set -backs. Amongst these capabilities include:-

- The program can be readily modified to cater for the other structural elements design and analysis programs.
- It has a main structure that is navigated by a mouse.
- At the beginning of each module there exist a synopsis and procedure explanation screen giving details of what the package is about to do.
- The system can produce date, time and other useful utilities.

CHAPTER THREE

DESIGN OF NEW SYSTEM

3.1 Design of system output

The output design has to come first in the system design because it is the target output that would determine the type of input and method of processing that ensure the output.

The system output can be inform of

- Hard copy printed report on paper
- That on the computer screen.

The design output is described under the following headings.

- Preparation of output document
- Distribution of the output
- Data retention

3.1.1 Preparation of output document.

This section talk about the

- Outlook of the report
- The context of the report
- Format of report.

OUTLOOK OF THE REPORT

For output on the screen is incorporated with a procedure that set a boundary for the operation of what is to output to the screen so that all output values are configured within this boundary. The outlook of the report in this case will be in form of a table. The table takes in values of the different modules of the program and input it into the table at the designated section.

CONTEXT OF REPORT

The context of the output is divided into

- Actual output
- Derived output

ACTUAL OUTPUT:- Is the value obtained from manipulation or calculation made by the program i.e. it gives the value of the processed input. Given the calculation below

A+B=C

C is the actual output obtained from the input A and B.

DERIVED OUTPUT

The derived output in those outputs that have not been through any processing. These outputs are just there to state what to input to the program. From above, the derived output are A and B.

FORMAT OF REPORT

The output assumes a specified format, each field has a specified location on the screen to enhance readability and clarity.

3.1.2 **Distribution of Output**

The output for each module is unique and it is produced at the end of module. This is then obtained on the screen so that the result is then transferred to the table for further manipulation then the required values can be copied out as needed or produced or hard copy.

The user of the system in terms of can judge the distribution of the output

- How many copies should be produced
- Who is to receive the copy
- By what means should it be received.

3.1.3 **DATA RETENTION**

The data retention techniques incorporated by the work is a delay sub-program, which prompts the user to escape from the screen when applicable. When the output is on hard copy the retention depends on the organization

3.2 **DESIGN OF SYSTEM INPUT**

Having decided the type and format of the output document,. Attention can then the output document, attention can then be paid to the system input. The system input is described based on the slated parameters.

- Determination of input data needed
- Method of data entry.
- Preparation of output data each parameters is described below

3.2.1 **Determination of input data**

The input data needed for the package is unique for each module, but there exist some standard input in each stage. They are listed as follows.

Analysis Stage

- Dead load
- Imposed load
- Wind load parameters.
- Height above see level.

3.2.2 Mode of data entry

The type of data entry used for this input application is either by two options given as

- Key to disk
- Key to diskette unit.

The key to disk suggest that values from the input being directed to the disk unit i.e. the internal stage of facility of the computer.

The second options suggest values being directed to the auxiliary storage facility of the package i.e. the diskette.

Other types of data entry made are

- Key to tape
- Key to cassette unit
- Optimal mark/character reader

But the above stated are not considered for this application.

3.2.3 **Preparation of input data**

This section deals with editing and error correction technique needed by the package.

The editing process will be done via the computer is as to reduce the time and financial cost of the manual editing.

Some of the tests in this computerized editing are

- Missing data test
- Data in error test
- Unreasonable data test.

Missing data Test

This is to ensure that all input are submitted for processing. This is achieved by adapting the input with a carriage return facility such that when no value is given as input, the prompt will come again.

Data In Error Test

This is to ensure that the data confirms with specification appropriate for it.

It will be seen that some value must be configured within a range i.e percentage value must be within 1 - 100 range. This application is made possible by setting range for the value to be tested.

Unreasonable Data Test

The unreasonable data test checks whether the data is within some reasonable limit provided as standard.

This checks the value other than that within a field i.e. giving a string value to a numeric prompt or vice versa. It is achieved by comparing data within a pre-defined range of values.

3.3 DESIGN OF SYSTEM FILES

The system file can be described on hierarchical approach. The file is designed such that all files is called at the main file i.e. the main file serves as the tree while the other modules below it serves as the branches. Below is stated all the file used by the package in its operation.

In all their exist different file for operation of this package. They include

- Main file
- Main truss file
- Flat root file
- Force diagram file
- Bead load file
- Imposed load file
- Wind load file
- Design load file

The main file is master of them all. It serves as the calling file for the other file highlighted above. The files occupying the remaining rows are the analysis file. These files are to perform the analysis of the steel root truss.

3.4 Design Procedure

Each file slated above is incorporated with procedures, which performs the task of processing. These procedures are unique for each file.

The basic assemblance for all this file procedures is that they all come into the system input and the output. This facilitates the time for processing for the package. This is the technique used for the design of the procedure.

CHAPTER FOUR

IMPLEMENTATION OF NEW SYSTEM

4.1 SYSTEM CHANGE OVER

System change over has on its part the file conversion. This is a vital activity which is sometimes underestimated. It involves the conversion of thew old file data into the form required by the new system, and is usually a very expensive stage in the whole project. File conversion is usually regarded as a part of change over, but it can often be regarded as complete and separate system task in itself. It involves fact - finding analysis data capture the design of clerical methods, and computer processes, from design and the production of special training courses.

System change over from the old to the new system may take place after certain standards are attained.

These include:
When the system has been proved to the satisfaction of the system analyst and the other implementation activities have been completed.

When user managers are satisfied with the result of the system test, staff training and references manuals.

When the target data for change over is due.

The system change over may be achieved in a number of ways. The most common method are.

Direct change over, Parallel running, Pilot running and staged change over.

The type of change over that will be recommended for the system is the parallel running.

4.1.1 PARALLEL RUNNING CHANGE OVER

This means processing current data by both the old and new systems to cross check the results. Its main attraction is that old system is kept alive and operational until the new system has been proved for at least one system cycle, using full time data in the real operational environment of place, people equipment and time. It allows the result of the new system to be compared with the old system before acceptance by the user, thereby promoting user confidence.

It main disadvantage is the extra cost, the difficulty and some times the impracticability of the engineer to carry the operation for two system (i.e. the old and the new) in the time available for one.

To minimize or to induce the effect of the disadvantage, the new system is made to solve problems on steel roof analysis, which had already been solved by the system. This will help to know whether the new system works perfectly or not. The result will help to indicate whether the system can fully be relied upon.

4.2 HARD WARE REQUIREMENT

The hard ware requirement for the new system, the required hardware needed to run the system conveniently.

The system was able to achieve these feats with a high speed and has strength environment.

It was also discovered during the cause of writing this project that the user must have been experienced in the manual analysis of steel structures and must also be conversant with the computer and some computer environment like windows '95 and windows '98.

It is worth taking note of that the new system is not an independent method of analyzing steel roof structures. It has to put the code of practice manuals into use. The lists of manuals are in the bibliography.

The system should not be taken or referenced as the design of steel roof structure. It is just the analysis and it still leaves room for improvement and further studies. The system can still be improved on to perform the design proper. It will just be a continuation from where this project stops.

5.2 RECOMMENDATION

The new system will be recommended for student of structural engineering, professional structural engineers and in all structural design office. This is a package that will be useful implement in design of steel roof structure.

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PROJECT REFERENCES

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4.2 HARD WARE REQUIREMENT

The hard ware requirement for the new system, the required hardware needed to run the system conveniently.

This include

a) Micro computer

- At least 4Ac processor
- 2.1 GB hard disk
- 32MB RAM
- 1.44 floppy disk drive
- 14" colored monitor
- Key board

b) Printer (Laser jet)

- Toner
- Paper

c) Mass storage device

- 3.5" diskette.

4.3 SOFTWARE REQUIREMENT

a) Program language - QBasics

- QBasics Compiler
- Windows '95 and '98
- Dr. Solomon Anti virus
- Norton Disk doctor

4.4 LOGISTICS

This is the security attached in terms of password facilities.

Non exist in this system because the programs do calculations and some other graphical manipulation. This system is not involved in any database manipulation that will involve any security restriction.

4.5 TESTING AND MAINTAINANCE

Testing: - Testing is one of the tool needed to check on the quality of new system.

The different test carry out different functions, as it will be highlighted below

a) Test for the system involving code testing and specification test. This is used to examine what the program should do, how it should do it, in time with the result obtained.
b) **Verification Testing**:-By executing the software in simulated environment -This use the help of certain assumptions to test the data for error
c) **Validation Test**:- This refers to the process of running a software life environment for the purpose of spotting errors.
d) **Certification Test:-** this refers to software endorsement for corrections.

MAINTENANCE

Maintenance is a continuos process in system construction. Maintenance will be need after system hand over. This is used to update the system to conform with latest operating system or to allow for other function which were not present initially.

Maintenance can also be used to remove obsolete parts of the system and replace it with current ones. This is used to increase the efficiency and capacity of the system.

4.6 USER GUIDE

The basic method of making the system its function is summarised in steps below

Assumptions is based on the fact that user can boot the system to windows

Click menu to run the main menu

Use the mouse to navigate the menu to choose option

When the appropriate option is highlighted, click the mouse

Give appropriate value for input prompt

At the end of each menu, give name to save calculated output.

To print report of output go to the print option and click the mouse

Give name of saved output and then send to printer.

CHAPTER FIVE

DOCUMENTATION, CONCLUSION AND RECOMMENDATION

5.1 SYSTEM DOCUMENTATION

System documentation is the description of how a system works. This is required to ensure a better understanding of the system by the users. The documentation of the system provides information on how the system can be started and its operation.

5.1.1 STARTING THE SYSTEM

The execution of the programs commences with the click on the start of the windows 95 or windows 98 environment. From the point, the user moves to the PROGRAM. This will take the system to Ms Dos prompt. The user will then activate the Qbasic compiler by typing. CD/QB and then press the ENTER key. Type QB again and press the ENTER key. The above process would activate the Qbasic compiler in the computer to accept to run the system. Press Alt F and then select OPEN. Then type in STEEL CAD and press the ENTER KEY. Press F5 key to Run.

5.1.2 DESCRIPTION OF SYSTEM MENU

The execution of the above steps allows the first level menu appeal on the screen from which the user would select an appropriate choice. The first level menu consists of three options.

Each of which will be itemized and discussed as follows:

- Diagrams
- Calculations
- Exit

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CODES

1.	B. S 5950;	Part 1 1990
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LECTURE NOTE

SYSTEMS ANALYSIS AND DESIGN	Prince Badmus (FUT Minna)

PROGRAM CODE

```
10 CLS

 COLOR 14, 1, 8: CLS

 LOCATE 2, 35: PRINT " WELCOME TO"
 LOCATE 4, 5: PRINT " ÛÛÛÛÛÛÛÛÛÛÛÛÛÛÛ        ÛÛÛÛÛÛÛÛÛÛÛÛÛÛ
ÛÛÛÛÛÛÛÛÛÛÛÛÛÛ "
 LOCATE 5, 5: PRINT " ÛÛÛ      ÛÛÛ      ÛÛÛ       ÛÛÛ     ÛÛÛ      "
 LOCATE 6, 5: PRINT " ÛÛÛ                ÛÛÛ        ÛÛÛ      ÛÛÛ     "
 LOCATE 7, 5: PRINT " ÛÛÛ                ÛÛÛ        ÛÛÛ      ÛÛÛ     "
 LOCATE 8, 5: PRINT " ÛÛÛ                ÛÛÛ        ÛÛÛ      ÛÛÛ     "
 LOCATE 9, 5: PRINT " ÛÛÛ                ÛÛÛ        ÛÛÛ      ÛÛÛ     "
LOCATE 10, 5: PRINT " ÛÛÛ                ÛÛÛÛÛÛÛÛÛÛÛÛÛÛÛÛÛÛ
ÛÛÛÛÛÛÛÛÛÛÛÛÛÛ "
LOCATE 11, 5: PRINT " ÛÛÛ                ÛÛÛ        ÛÛÛ              ÛÛÛ     "
LOCATE 12, 5: PRINT " ÛÛÛ                ÛÛÛ        ÛÛÛ              ÛÛÛ     "
LOCATE 13, 5: PRINT " ÛÛÛ                ÛÛÛ        ÛÛÛ              ÛÛÛ     "
LOCATE 14, 5: PRINT " ÛÛÛ                ÛÛÛ        ÛÛÛ              ÛÛÛ     "
LOCATE 15, 5: PRINT " ÛÛÛ                ÛÛÛ        ÛÛÛ              ÛÛÛ     "
LOCATE 16, 5: PRINT " ÛÛÛ      ÛÛÛ      ÛÛÛ       ÛÛÛ             ÛÛÛ
"
LOCATE 17, 5: PRINT " ÛÛÛÛÛÛÛÛÛÛÛÛÛÛÛÛ      ÛÛÛÛÛ         ÛÛÛÛÛ
ÛÛÛÛÛÛÛÛÛÛÛÛÛÛ "
LOCATE 18, 5: PRINT "  "
LOCATE 21, 5: COLOR 16: PRINT " C O M P U T E R   A I D E D  S T E E L  R
O O F "
LOCATE 22, 6: COLOR 16: PRINT "  S T R U C T R U C T U R A L   A N A L Y S
I S ": KEY OFF
GOSUB enter

20 COLOR 7, 0, 4: CLS
  LOCATE 6, 15: PRINT "        A PROJECT SUBMITTED TO"
  LOCATE 8, 15: PRINT "THE DEPARTMENT OF MATHEMATICS AND
COMPUTER SCIENCE"
  LOCATE 10, 15: PRINT "    FEDERAL UNIVERSITY OF
TECHNOLOGY,MINNA"
  LOCATE 13, 15: PRINT "              BY              "
  LOCATE 16, 15: PRINT "        FASOYIRO OLUKAYODE IBIKUNLE"
  LOCATE 18, 15: PRINT "          PGD/MCS/98/99/800       "
  GOSUB enter

30 SCREEN 0: COLOR 7, 0, 4: CLS
  COLOR 9
  COLOR 3, 0
  FOR Y = 4 TO 23
  LOCATE Y, 4
  PRINT STRING$(70, CHR$(176))
  NEXT Y
  COLOR 1
```

```
FOR K = 5 TO 20
LOCATE K, 20
PRINT STRING$(40, CHR$(219))
NEXT K
'LOCATE 4,4:COLOR 3:PRINT STRING$(70," ")
LOCATE 25, 4: COLOR 0, 3: PRINT "                PRESS [Esc] TO QUIT
"
MEN1$ = "   DIAGRAMS    "
MEN2$ = "  CALCULATIONS  "
MEN3$ = "    EXIT       "
LOCATE 2, 14: COLOR 4: PRINT "[COMPUTER AIDED STEEL ROOF
STRUCTURAL ANALYSIS]"
LOCATE 3, 30: COLOR 15: PRINT "(T H E   M E N U)"
LOCATE 23, 4: COLOR 0, 3: PRINT "                                        "
LOCATE 23, 15: COLOR 4: PRINT " USE  ": LOCATE 23, 20: PRINT " ":
LOCATE 23, 22: PRINT STRING$(1, 25) + STRING$(1, 24): LOCATE 23, 29:
PRINT "KEYS  TO  SELECT  AND  PRESS "; CHR$(17) + CHR$(196) +
CHR$(217)
COLOR 6, 1
LOCATE 8, 28: PRINT MEN1$
LOCATE 12, 28: PRINT MEN2$
LOCATE 16, 28: PRINT MEN3$
Y1 = 8
Y12 = Y1
COLOR 0, 3: LOCATE Y1, 28: PRINT MEN1$
MEN22$ = MEN1$
DO
a$ = INKEY$
SELECT CASE a$
CASE CHR$(0) + CHR$(80):
'COLOR 0,3:
Y1 = Y1 + 4
IF Y1 > 16 THEN Y1 = 8
IF Y1 = 8 THEN COLOR 6, 1: LOCATE Y12, 28: PRINT MEN22$: COLOR 0, 3:
LOCATE 8, 28: PRINT MEN1$
IF Y1 = 12 THEN COLOR 6, 1: LOCATE Y12, 28: PRINT MEN22$: COLOR 0,
3: LOCATE 12, 28: PRINT MEN2$
IF Y1 = 16 THEN COLOR 6, 1: LOCATE Y12, 28: PRINT MEN22$: COLOR 0,
3: LOCATE 16, 28: PRINT MEN3$
Y12 = Y1
IF Y1 = 8 THEN MEN22$ = MEN1$
IF Y1 = 12 THEN MEN22$ = MEN2$
IF Y1 = 16 THEN MEN22$ = MEN3$
CASE CHR$(0) + CHR$(72):
Y1 = Y1 - 4
IF Y1 < 8 THEN Y1 = 16
IF Y1 = 8 THEN COLOR 6, 1: LOCATE Y12, 28: PRINT MEN22$: COLOR 0, 3:
LOCATE 8, 28: PRINT MEN1$
IF Y1 = 12 THEN COLOR 6, 1: LOCATE Y12, 28: PRINT MEN22$: COLOR 0,
3: LOCATE 12, 28: PRINT MEN2$
```

```
  IF Y1 = 16 THEN COLOR 6, 1: LOCATE Y12, 28: PRINT MEN22$: COLOR 0,
3: LOCATE 16, 28: PRINT MEN3$
  Y12 = Y1
  IF Y1 = 8 THEN MEN22$ = MEN1$
  IF Y1 = 12 THEN MEN22$ = MEN2$
  IF Y1 = 16 THEN MEN22$ = MEN3$
  CASE CHR$(13):
    IF Y1 = 8 THEN GOSUB 40: GOTO 30
    IF Y1 = 12 THEN GOSUB 50: GOTO 30
    IF Y1 = 16 THEN GOSUB 90: END


  END SELECT
  COLOR 6, 1
  LOOP UNTIL a$ = CHR$(27)
  a$ = INKEY$: GOSUB 90
  ON KEY(a$ = CHR$(27)) GOSUB 90

40 CLS
  SCREEN 1
  CLS
  LOCATE 5, 1: INPUT "Input Span ,L= ", L
  LOCATE 8, 1: INPUT "Angle of Inclination of Rafter,@ =", T
  LOCATE 11, 1: INPUT "Input Purlin Spacing, PS = ", PS
  LOCATE 14, 1: INPUT "Input Truss Spacing, TS = ", TS
  LOCATE 17, 1: INPUT "Press ENTER key for Bow's Notation and Free Body
Diagram", a$
  CLS
  SCREEN 7
  'TRIANGLE
  LINE (30, 70)-(250, 70), 3    'BASE LINE
  LINE (30, 70)-(140, 20), 3    'LEFT SIDE
  LINE (140, 20)-(250, 70), 3   'RIGHT SIDE

  'BELOW THE TRIANGLE
  LINE (30, 70)-(30, 90), 3     'RIGTH POINTER
  LINE (250, 70)-(250, 90), 3   'LEFT POINTER
  LINE (250, 70)-(255, 74), 3   'RIGHT SIDE OF ARROW OF THE RIGHT
POINTER
  LINE (250, 70)-(247, 75), 3   'LEFT SIDE OF ARROW OF THE RIGHT
POINTER
  LINE (30, 70)-(23, 77), 3     'LEFT SIDE OF THE ARROW OF THE LEFT
POINTER
  LINE (30, 70)-(36, 76), 3     'RIGHT SIDE OF THE ARROW OF THE LEFT
POINTER

  'PARTITIONS OF THE TRIANGLE
  'LINE (140, 20)-(140, 70), 3   'CENTRAL PARTITION
  LINE (58, 57)-(58, 70), 3     'FIRST LEFT TO CENTRAL PARTITION
  LINE (87, 44)-(87, 70), 3     'SECOND LEFT TO CENTRAL PARTITION
```

```
LINE (114, 32)-(114, 70), 3    'THIRD LEFT TO CENTRAL PARTITION
LINE (166, 33)-(166, 70), 3    'FIRST RIGHT TO CENTRAL PARTITION
LINE (192, 44)-(192, 70), 3    'SECOND RIGHT TO CENTRAL PARTITION
LINE (218, 55)-(218, 70), 3    'THIRD RIGHT TO CENTRAL PARTITION

'DIVIDING THE PARTITIONS
LINE (58, 70)-(87, 44.8), 3    'FIRST LEFT DIVIDER TO CENTRAL
PARTITION
LINE (87, 70)-(114, 32), 3    'SECOND LEFT DIVIDER TO CENTRAL
PARTITION
LINE (114, 70)-(140, 20), 3    'THIRD LEFT DIVIDER TO CENTRAL
PARTITION
LINE (166, 70)-(140, 20), 3    'FIRST RIGHT DIVIDER TO THE CENTRAL
PARTITION
LINE (192, 70)-(166, 33), 3    'SECOND RIGHT DIVIDER TO THE CENTRAL
PARTITION
LINE (218, 70)-(192, 44), 3    'THIRD RIGHT DIVIDER TO THE CENTRAL
PARTITION

'TOP OF THE TRAINGLE
LINE (141, 18)-(141, 8), 3   'THE LINE OF THE ARROW
LINE (141, 18)-(134, 14), 3   'THE RIGHT SIDE OF THE ARROW
LINE (141, 18)-(148, 14), 3   'THE LEFT SIDE OF THE ARROW

'LABELS FOR THE DIAGRAM
LOCATE 10, 3: PRINT "A"
LOCATE 8, 5: PRINT "B"
LOCATE 9, 7: PRINT "1"
LOCATE 8, 9: PRINT "2"
LOCATE 9, 10: PRINT "3"
LOCATE 7, 12: PRINT "4"
LOCATE 8, 14: PRINT "5"
LOCATE 6, 16: PRINT "6"
LOCATE 8, 18: PRINT "7"
LOCATE 5, 20: PRINT "8"
LOCATE 8, 22: PRINT "9"
LOCATE 6, 22: PRINT "10"
LOCATE 9, 25: PRINT "11"
LOCATE 8, 27: PRINT "12"
LOCATE 9, 29: PRINT "13"

LOCATE 6, 9: PRINT "C"
LOCATE 4, 13: PRINT "D"
LOCATE 3, 16: PRINT "E"
LOCATE 3, 20: PRINT "F"
LOCATE 5, 24: PRINT "G"
LOCATE 6, 27: PRINT "H"
LOCATE 8, 31: PRINT "I"
LOCATE 10, 33: PRINT "J"
LINE (31, 84)-(249, 84), 3    'BASE LINE
```

```
 LOCATE 11, 18: PRINT "K"
 LOCATE 14, 10: PRINT "FREE BODY DIAGRAM"
 a$ = INPU$(1)
 LOCATE 18, 4: INPUT "PRESS ENTER KEY...", a$
 CLS

 INPUT "PRESS..", N$
 CLS
 PRINT "FORCE DIAGRAM"
'THE SECOND DIAGRAM
 LINE (270, 20)-(270, 160), 3   'LEFT VERTICAL LINE
 LINE (100, 84)-(270, 84), 3   'HORIZONTAL LINE
 LINE (120, 84)-(120, 140), 3   'VERTICAL BELOW THE HORIZONTAL
 LINE (80, 160)-(180, 40), 3   'FIRST CROSS LINE
 LINE (270, 40)-(120, 112), 3   'BELOW THE TOP TO THE LEFT VERTICAL
 LINE (120, 84)-(270, 20), 3   'TOP TO THE LEFT VERTICAL
 LOCATE 2, 35: PRINT "a"
 LOCATE 4, 35: PRINT "b"
 LOCATE 6, 35: PRINT "c"
 LOCATE 8, 35: PRINT "d"
 LOCATE 10, 35: PRINT "e"
 LOCATE 12, 35: PRINT "f"
 LOCATE 14, 35: PRINT "g"
 LOCATE 16, 35: PRINT "h"
 LOCATE 18, 35: PRINT "i"
 LOCATE 20, 35: PRINT "j"
 LOCATE 10, 15: PRINT "1"
 LOCATE 14, 15: PRINT "2"
 LOCATE 22, 10: INPUT "PRESS ENTER KEY", a$

 SCREEN 2
 RETURN

50 SCREEN 9
 CLS
 LOCATE 1, 15: PRINT "CALCULATIONS"
 LOCATE 2, 15: PRINT "************"
 INPUT "Truss Spacing = ", TS
 INPUT "Purlin Spacing = ", PS
 a = TS * PS
 S = 1: I = 1: P = 1: T = 1
 DL = (S + I + P + T) * a
 PRINT "Internal Panel ,DL, = ", DL
 DLE = 1 / 2 * (S + I + P + T) * a
 PRINT "End Panel  ,DL, =", DLE
 PRINT
 PRINT "IMPOSED LOAD = IL"
 PRINT "If roof is without access use 0.75KN/m^2, Use consult CP. 3"
 PRINT "Internal Panel ,IL = ", .75 * a
 IL = .75 * a
```

```
LOCATE 3, 24: PRINT "TYPES OF"
LOCATE 5, 24: PRINT "  FORCE"
LOCATE 3, 15: PRINT "UNIT"
LOCATE 5, 15: PRINT "VALUE"

LOCATE 3, 35: PRINT "FORCES IN KN "
LOCATE 3, 53: PRINT "FACTORED LOADS IN KN"
LOCATE 5, 34: PRINT "DEAD"
LOCATE 6, 35: PRINT "DL"
LOCATE 5, 40: PRINT "IMP."
LOCATE 6, 41: PRINT "IL"
LOCATE 5, 46: PRINT "WIND"
LOCATE 6, 47: PRINT "WL"
LOCATE 6, 52: PRINT "1.4DL+1.6IL"
LOCATE 6, 64: PRINT "1.0DL+1.4WL"
LOCATE 8, 3: PRINT "B1 I-13"
LOCATE 8, 16: PRINT "8.0"
LOCATE 10, 3: PRINT "1-2 12-13"
LOCATE 10, 16: PRINT "1.0"
LOCATE 12, 3: PRINT "K1 K-13"
LOCATE 12, 16: PRINT "7.5"
LOCATE 14, 3: PRINT "C2 H,I2"
LOCATE 14, 16: PRINT "8.0"
LOCATE 16, 3: PRINT "2-3 11-12"
LOCATE 16, 16: PRINT "1.5"
LOCATE 18, 3: PRINT "K3  K,11"
LOCATE 18, 16: PRINT "6.25"
LOCATE 20, 3: PRINT "3-4 10,11"
LOCATE 20, 16: PRINT "1.5"
LOCATE 22, 3: PRINT "D4 G,10"
LOCATE 22, 16: PRINT "7.5"
LOCATE 8, 27: PRINT "STRUT"
LOCATE 10, 27: PRINT "STRUT"
LOCATE 12, 27: PRINT "TIE"
LOCATE 14, 27: PRINT "TIE"
LOCATE 16, 27: PRINT "STRUT"
LOCATE 18, 27: PRINT "STRUT"
LOCATE 20, 27: PRINT "TIE"
LOCATE 22, 27: PRINT "TIE"
LOCATE 8, 33: PRINT USING "###"; DL * 8
LOCATE 8, 39: PRINT USING "###"; IL * 8
LOCATE 8, 45: PRINT USING "###"; WL * 8
LOCATE 8, 54: PRINT 1.4 * DL * 8 + 1.6 * IL * 8
LOCATE 8, 66: PRINT 1 * DL * 8 + 1.4 * WL * 8
LOCATE 10, 33: PRINT USING "###"; DL
LOCATE 10, 39: PRINT USING "###"; IL
LOCATE 10, 45: PRINT USING "###"; WL
LOCATE 10, 54: PRINT 1.4 * DL + 1.6 * IL
LOCATE 10, 66: PRINT 1 * DL + 1.4 * WL
LOCATE 12, 33: PRINT USING "###"; DL * 7.5
```

```
   LOCATE 12, 39: PRINT USING "###"; IL * 7.7
   LOCATE 12, 45: PRINT USING "###"; WL * 7.5
   LOCATE 12, 54: PRINT 1.4 * DL * 7.5 + 1.6 * IL * 7.5
   LOCATE 12, 66: PRINT 1 * DL * 7.5 + 1.4 * WL * 7.5
   LOCATE 14, 33: PRINT USING "###"; DL * 8
   LOCATE 14, 39: PRINT USING "###"; IL * 8
   LOCATE 14, 45: PRINT USING "###"; WL * 8
   LOCATE 14, 54: PRINT 1.4 * DL * 8 + 1.6 * IL * 8
   LOCATE 14, 66: PRINT 1 * DL * 8 + 1.4 * WL * 8
   LOCATE 16, 33: PRINT USING "###"; DL * 1.5
   LOCATE 16, 39: PRINT USING "###"; IL * 1.5
   LOCATE 16, 45: PRINT USING "###"; WL * 1.5
   LOCATE 16, 54: PRINT 1.4 * DL * 1.5 + 1.6 * IL * 1.5
   LOCATE 16, 66: PRINT 1 * DL * 1.5 + 1.4 * WL * 1.5
   LOCATE 18, 33: PRINT USING "###"; DL * 6.25
   LOCATE 18, 39: PRINT USING "###"; IL * 6.25
   LOCATE 18, 45: PRINT USING "###"; WL * 6.25
   LOCATE 18, 54: PRINT 1.4 * DL * 6.25 + 1.6 * IL * 6.25
   LOCATE 18, 66: PRINT 1 * DL * 6.25 + 1.4 * WL * 6.25
   LOCATE 20, 33: PRINT USING "###"; DL * 1.5
   LOCATE 20, 39: PRINT USING "###"; IL * 1.5
   LOCATE 20, 45: PRINT USING "###"; WL * 1.5
   LOCATE 20, 54: PRINT 1.4 * DL * 1.5 + 1.6 * IL * 1.5
   LOCATE 20, 66: PRINT 1 * DL * 1.5 + 1.4 * WL * 1.5
   LOCATE 22, 33: PRINT USING "###"; DL * 7
   LOCATE 22, 39: PRINT USING "###"; IL * 7
   LOCATE 22, 45: PRINT USING "###"; WL * 7
   LOCATE 22, 54: PRINT 1.4 * DL * 7 + 1.6 * IL * 7
   LOCATE 22, 66: PRINT 1 * DL * 7 + 1.4 * WL * 7
   LOCATE 24, 12: INPUT "PRESS ENTER KEY", N$
   SCREEN 2

  RETURN
90 CLS : COLOR 15, 1, 2
   LOCATE 6, 10: PRINT "ÞÞÞÞÞÞÞÞÞÞÞ ÞÞÞÞÞÞÞÞÞ ÞÞÞÞÞÞÞÞÞ
ÞÞÞÞÞÞÞÞÞÞÞ "
   LOCATE 7, 10: PRINT "ÞÞÞ    ÞÞÞ ÞÞÞ    ÞÞÞ ÞÞÞ    ÞÞÞ    ÞÞÞ    ÞÞÞ "
   LOCATE 8, 10: PRINT "ÞÞÞ         ÞÞÞ    ÞÞÞ ÞÞÞ    ÞÞÞ    ÞÞÞ    ÞÞÞ "
   LOCATE 9, 10: PRINT "ÞÞÞ         ÞÞÞ    ÞÞÞ ÞÞÞ    ÞÞÞ    ÞÞÞ    ÞÞÞ "
   LOCATE 10, 10: PRINT "ÞÞÞ   ÞÞÞÞÞ ÞÞÞ    ÞÞÞ ÞÞÞ    ÞÞÞ    ÞÞÞ    ÞÞÞ "
   LOCATE 11, 10: PRINT "ÞÞÞ    ÞÞÞ ÞÞÞ    ÞÞÞ ÞÞÞ    ÞÞÞ    ÞÞÞ    ÞÞÞ "
   LOCATE 12, 10: PRINT "ÞÞÞÞÞÞÞÞÞÞÞ ÞÞÞÞÞÞÞÞÞ ÞÞÞÞÞÞÞÞÞ
ÞÞÞÞÞÞÞÞÞÞÞ "

   LOCATE 14, 18: PRINT "ÞÞÞÞÞÞÞÞÞÞÞ ÞÞÞ   ÞÞÞ ÞÞÞÞÞÞÞÞÞ            "
   LOCATE 15, 18: PRINT "ÞÞÞ    ÞÞÞ   ÞÞ   ÞÞ   ÞÞÞ    ÞÞÞ            "
   LOCATE 16, 18: PRINT "ÞÞÞ    ÞÞÞ    ÞÞÞÞÞ    ÞÞÞ            "
   LOCATE 17, 18: PRINT "ÞÞÞÞÞÞÞÞ       ÞÞÞ    ÞÞÞÞÞÞÞ            "
   LOCATE 18, 18: PRINT "ÞÞÞ    ÞÞÞ     ÞÞÞ     ÞÞÞ            "
   LOCATE 19, 18: PRINT "ÞÞÞ    ÞÞÞ     ÞÞÞ     ÞÞÞ   ÞÞÞ            "
```

```
   LOCATE 20, 18: PRINT "ÞÞÞÞÞÞÞÞÞÞÞ    ÞÞÞ    ÞÞÞÞÞÞÞÞÞÞ           "
   GOSUB enter
   IF a$ = CHR$(27) THEN END ELSE GOTO 100
100  RETURN

enter:
    LOCATE 23, 60: PRINT "Press" + CHR$(17) + CHR$(196) + CHR$(217):
INPUT " ", N$
    CLS
    RETURN
```

WELCOME TO

CAS

C O M P U T E R   A I D E D   S T E E L R O O F
S T R U C T R U C T U R A L   A N A L Y S I S

Press◄┘

WELCOME TO

CAS

C O M P U T E R   A I D E D   S T E E L R O O F
S T R U C T R U C T U R A L   A N A L Y S I S

Press◄┘

WELCOME TO

CAS

O M P U T E R A I D E D S T E E L R O O F
S T R U C T R U C T U R A L A N A L Y S I S

Press◂┘

A PROJECT SUBMITTED TO

THE DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

BY

FASOYIRO OLUKAYODE IBIKUNLE

PGD/MCS/98/99/800

Press◂┘

A PROJECT SUBMITTED TO

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FASOYIRO OLUKAYODE IBIKUNLE

PGD/MCS/98/99/800

ut Span ,L= 8

of Inclination of Rafter,@ =5

Purlin Spacing, PS = 1

Truss Spacing, TS = 3

ENTER key for Bow's Notation and F
ody Diagram

Span ,L= 8

of Inclination of Rafter,@ =5

Purlin Spacing, PS = 1

Truss Spacing, TS = 3

ENTER key for Bow's Notation and F
ody Diagram

Span ,L= 8

of Inclination of Rafter,@ =5

ing, PS = 1

```
         E   F
      D
             8   G
  C      6     10    H
     4
  2    5   7   9    12  I
1  3               11  13
                           J
──────────K────────────────
```

FREE BODY DIAGRAM

SS ENTER KEY...


```
         E   F
      D
             8   G
  C      6     10    H
     4
  2    5   7   9    12  I
1  3               11  13
                           J
──────────K────────────────
```

FREE BODY DIAGRAM

SS ENTER KEY...

CALCULATIONS
****

ss Spacing = 6
in Spacing = 1
rnal Panel ,DL, = 24
Panel ,DL, = 12

ED LOAD = IL
of is without access use 0.75KN/m^2, Use consult CP. 3
al Panel ,IL = 4.5
anel ,IL = 2.25

LOAD,WL
wind speed appropriate to the district
the structure is to be erected, V = 80
.= 1 (Or check appendix D)
rom Table 3)= 0.08
1 (Or check Fig 2) Or Appendix C
n Wind Speed,VS = 6.4 m/s
3N/m^2
c Pressure of Wind ,q= 25.10848 N/m^2
ENTER KEY

CALCULATIONS
****

Spacing = 6
n Spacing = 1
nal Panel ,DL, = 24
anel ,DL, = 12

ED LOAD = IL
of is without access use 0.75KN/m^2, Use consult CP. 3
nal Panel ,IL = 4.5
Panel ,IL = 2.25

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Wind Speed,VS = 6.4 m/s
3N/m^2
c Pressure of Wind ,q= 25.10848 N/m^2
ENTER KEY

MEMBER	UNIT VALUE	TYPES OF FORCE	FORCES IN KN			FACTORED LOADS IN KN	
			DEAD DL	IMP. IL	WIND WL	1.4DL+1.6IL	1.0DL+1.4WL
I-13	8.0	STRUT	192	36	%6026	326.4	8628.447
12-13	1.0	STRUT	24	5	753	40.8	1078.556
K-13	7.5	TIE	180	35	%5649	306	8089.17
H,I2	8.0	TIE	192	36	%6026	326.4	8628.447
11-12	1.5	STRUT	36	7	%1130	61.2	1617.834
K,11	6.25	STRUT	150	28	%4708	255	6740.975
10,11	1.5	TIE	36	7	%1130	61.2	1617.834
G,10	7.5	TIE	168	32	%5273	285.6	7549.892

PRESS ENTER KEY

EMBER	UNIT VALUE	TYPES OF FORCE	FORCES IN KN			FACTORED LOADS IN KN	
			DEAD DL	IMP. IL	WIND WL	1.4DL+1.6IL	1.0DL+1.4WL
I-13	8.0	STRUT	192	36	%6026	326.4	8628.447
12-13	1.0	STRUT	24	5	753	40.8	1078.556
K-13	7.5	TIE	180	35	%5649	306	8089.17
H,I2	8.0	TIE	192	36	%6026	326.4	8628.447
11-12	1.5	STRUT	36	7	%1130	61.2	1617.834
K,11	6.25	STRUT	150	28	%4708	255	6740.975
10,11	1.5	TIE	36	7	%1130	61.2	1617.834
G,10	7.5	TIE	168	32	%5273	285.6	7549.892

PRESS ENTER KEY

MEMBER	UNIT VALUE	TYPES OF FORCE	FORCES IN KN DEAD DL	IMP. IL	WIND WL	FACTORED LOADS IN KN 1.4DL+1.6IL	1.0DL+1.4WL
B1 I-13	8.0	STRUT	192	36	%6026	326.4	8628.447
1-2 12-13	1.0	STRUT	24	5	753	40.8	1078.556
K1 K-13	7.5	TIE	180	35	%5649	306	8089.17
C2 H,I2	8.0	TIE	192	36	%6026	326.4	8628.447
2-3 11-12	1.5	STRUT	36	7	%1130	61.2	1617.834
K3 K,11	6.25	STRUT	150	28	%4708	255	6740.975
3-4 10,11	1.5	TIE	36	7	%1130	61.2	1617.834
D4 G,10	7.5	TIE	168	32	%5273	285.6	7549.892

PRESS ENTER KEY

MEMBER	UNIT VALUE	TYPES OF FORCE	FORCES IN KN DEAD DL	IMP. IL	WIND WL	FACTORED LOADS IN KN 1.4DL+1.6IL	1.0DL+1.4WL
B1 I-13	8.0	STRUT	192	36	%6026	326.4	8628.447
1-2 12-13	1.0	STRUT	24	5	753	40.8	1078.556
K1 K-13	7.5	TIE	180	35	%5649	306	8089.17
C2 H,I2	8.0	TIE	192	36	%6026	326.4	8628.447
2-3 11-12	1.5	STRUT	36	7	%1130	61.2	1617.834
K3 K,11	6.25	STRUT	150	28	%4708	255	6740.975
3-4 10,11	1.5	TIE	36	7	%1130	61.2	1617.834
D4 G,10	7.5	TIE	168	32	%5273	285.6	7549.892

PRESS ENTER KEY

```
              CALCULATIONS
              ************
 Truss Spacing = 6
 Purlin Spacing = 1
 Internal Panel ,DL, =          24
 End Panel  ,DL, =              12

 IMPOSED LOAD = IL
 If roof is without access use 0.75KN/m^2, Use consult CP. 3
 Internal Panel ,IL =           4.5
  End Panel ,IL =               2.25

 WIND LOAD,WL
 Basic wind speed appropriate to the district
 where the structure is to be erected, V = 80
 S1.....= 1 (Or check appendix D)
 S2 (From Table 3)= 0.08
  S3 = 1 (Or check Fig 2) Or Appendix C
 Design Wind Speed,VS =         6.4          m/s
 K=0.613N/m^2
 Dynamic Pressure of Wind ,q=                 25.10848     N/m^2
 PRESS ENTER KEY
```


```
              CALCULATIONS
              ************
 Truss Spacing = 6
 Purlin Spacing = 1
 Internal Panel ,DL, =          24
 End Panel  ,DL, =              12

 IMPOSED LOAD = IL
 If roof is without access use 0.75KN/m^2, Use consult CP. 3
 Internal Panel ,IL =           4.5
  End Panel ,IL =               2.25

 WIND LOAD,WL
 Basic wind speed appropriate to the district
 where the structure is to be erected, V = 80
 S1.....= 1 (Or check appendix D)
 S2 (From Table 3)= 0.08
  S3 = 1 (Or check Fig 2) Or Appendix C
 Design Wind Speed,VS =         6.4          m/s
 K=0.613N/m^2
 Dynamic Pressure of Wind ,q=                 25.10848     N/m^2
 PRESS ENTER KEY
```

```
                E    F
             D
                        8    G
         C          6      10    H
               4
     B     2     5    7    9     12   I
        1   3                  11   13
  A                                      J
     ——————————————K——————————————
```

FREE BODY DIAGRAM

PRESS ENTER KEY...


```
                E    F
             D
                        8    G
         C          6      10    H
               4
     B     2     5    7    9     12   I
        1   3                  11   13
  A                                      J
     ——————————————K——————————————
```

FREE BODY DIAGRAM

PRESS ENTER KEY...

```
Input Span ,L= 8

Angle of Inclination of Rafter,@ =5

Input Purlin Spacing, PS = 1

Input Truss Spacing, TS = 3

Press ENTER key for Bow's Notation and F
ree Body Diagram
```


```
Input Span ,L= 8

Angle of Inclination of Rafter,@ =5

Input Purlin Spacing, PS = 1

Input Truss Spacing, TS = 3

Press ENTER key for Bow's Notation and F
ree Body Diagram
```

```
Input Span ,L= 8

Angle of Inclination of Rafter,@ =5
```


```
PS = 1
```