Pipe Rack Design and Automation Using Openstaad and Excel Vba

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ABSTRACT: In past few years civil engineering industry is on boom due to fact that, India is being the developing country many new projects start day by day which needs to be completed in given time scenario. The major factor for completion of projects is designing and implementation which helps the structure to be stand still for 100 of years. In this paper, we have presented our new VBA approach (Visual Basic for Applications) for Automation of design process using OpenSTAAD, and Microsoft Excel for designing pipe rack structure. In petrochemical, chemical, and power plants, structural steel pipe racks often support pipes, power cables, and instrument cable trays. On rare occasions, pipe racks may also be used to support mechanical devices, tanks, and platforms for accessing valves. Our proposed VBA approach result shows the technique is very much efficient, time and cost saving. Normally designing process is very lengthy which take couple of hours to finalize the structure design but with the help of proposed technique efficient results could be achieved in just few minutes.

Keywords:- Excel VBA(Visual Basic For Applications), OpenSTAAD, Pipe Rack Design And Automation, Macros, MS-Excel.

I. INTRODUCTION

In petrochemical, chemical, and power plants, structural steel pipe racks often support pipes, power cables, and instrument cable trays. On rare occasions, pipe racks may also be used to support mechanical devices, tanks, and platforms for accessing valves. Typically, main pipe racks move materials from machines to storage or utility locations. Even though they hold lengths of pipe, storage racks found in warehouses are not pipe racks. The pipe stand is the main artery of the technical unit. Pipe racks support process and engineering lines and can contain tool racks, cables, and equipment connected to each. **Visual Basic for Applications** is a programming language developed and owned by Microsoft. With VBA, you can create macros to automate repetitive text and data processing functions, and create custom forms, charts, and reports. This is not a standalone product with VBA functionality for MS Office applications. Users cannot directly cannot the core Excel software through VBA, but can learn the art of creating macros to optimizeTime in Excel. There are two ways to create an Excel macro.

II. OBJECTIVES

The main aim of the project isto Automate the entire project by using Excel VBA and OpenSTAAD.

1) Analysis and design of pipe rack and formulation programming using visual basics in excel to make design process quicker.

III.   METHODOLOGY
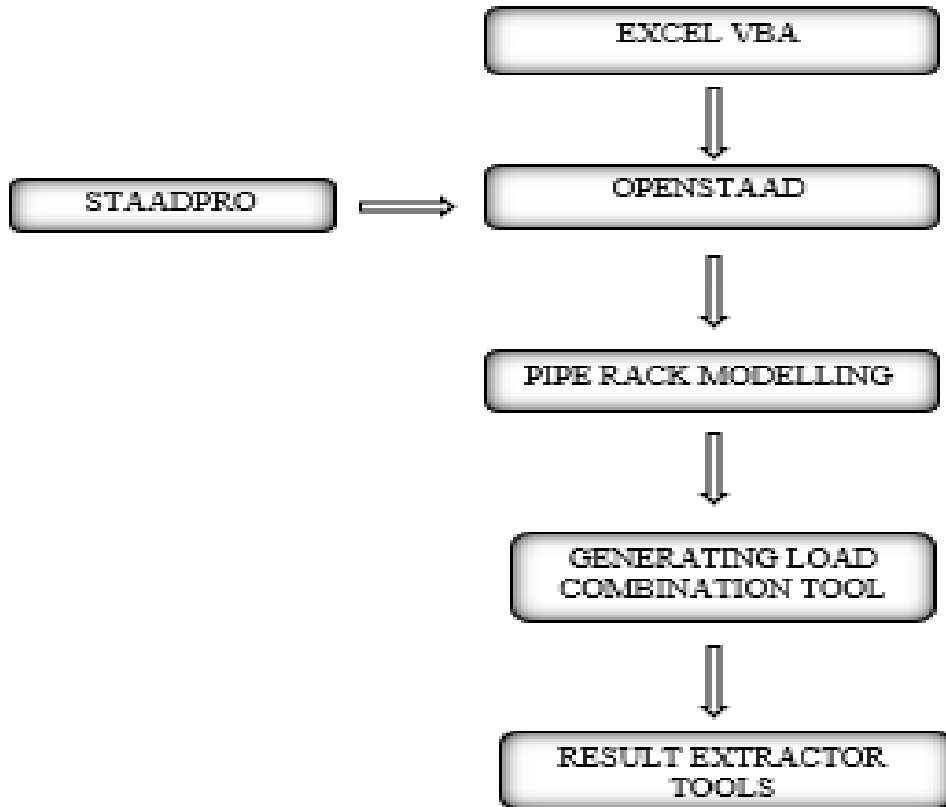
IV.   MODELLING
PIPE RACK GEOMETRY GENERATOR

pipe rack name	prname	PIPE
no. of transverse grids	ntg	6
no. of longitudinal grids	nlg	2
no.of tiers	nt	2
under side of base plate	usb	100
long direction	dr	X

spacings for	Column1	tier
Transverse grids	Longitudinal grids	EL
0	0	103
5	5	107

5	110
5	
5	
5	

EXCEL VBA CODE FOR MODEL CREATION

```vba
Private Sub CommandButton1_Click()
Dim prname As String
Dim ntg As Integer
Dim nlg As Integer
Dim nt As Integer
Dim usb As Double
Dim dr As String
'''''''''''''''''''''''''''''''''
prname = Cells(2, 4) & ".std"
ntg = Cells(3, 4)
nlg = Cells(4, 4)
nt = Cells(5, 4)
usb = Cells(6, 4)
dr = Cells(7, 4)
'''''''''''''''''''''''''''''''''
Dim objOpenSTAAD As Object
Dim strFileName As String
Dim intInputUnitForLength As Integer
Dim intInputUnitForForce As Integer
'Get the application object
Set objOpenSTAAD = GetObject(, "StaadPro.OpenSTAAD")
'Create New File
objOpenSTAAD.NewSTAADFile prname, 4, 4
'Nodes
n = ntg * nlg * (nt + 1)
Dim nodes() As Long
ReDim nodes(1 To n)
For i = 1 To n
    nodes(i) = i
    Cells(10 + i, 7) = nodes(i)
Next i
'coordinates
Dim coord() As Double
ReDim coord(1 To n, 1 To 3)
Dim tgs() As Double
ReDim tgs(1 To ntg)
Dim lgs() As Double
ReDim lgs(1 To nlg)
Dim te() As Double
ReDim te(1 To nt + 1)
For i = 1 To ntg
  tgs(i) = Cells(10 + i, 2)
```

```vb
Next i
For i = 1 To nlg
    lgs(i) = Cells(10 + i, 3)
Next i
For i = 2 To nt + 1
    te(i) = Cells(10 + i - 1, 4)
Next i
te(1) = usb
For i = 1 To nt + 1
    For j = 1 To nlg
        For k = 1 To ntg
            p = p + 1
            coord(p, 1) = tgs(k)
            coord(p, 3) = lgs(j)
            coord(p, 2) = te(i)
        Next k
    Next j
Next i
For i = 1 To n
    For j = 1 To 3
        Cells(10 + i, 7 + j) = coord(i, j)
    Next j
    objOpenSTAAD.Geometry.CreateNode nodes(i), coord(i, 1), coord(i, 2), coord(i, 3)
Next i
'column incidences
nc = ntg * nlg * nt
Dim colinci() As Long
ReDim colinci(1 To nc, 1 To 3)
For i = 1 To nc
    colinci(i, 1) = i
    colinci(i, 2) = i
    colinci(i, 3) = i + ntg * nlg
Next i
For i = 1 To nc
    For j = 1 To 3
        Cells(10 + i, 10 + j) = colinci(i, j)
    Next j
    objOpenSTAAD.Geometry.CreateBeam colinci(i, 1), colinci(i, 2), colinci(i, 3)
Next i
'longitudinal beam incidences
nlb = (ntg - 1) * nlg * nt
Dim lbeaminci() As Long
ReDim lbeaminci(1 To nlb, 1 To 3)
```

```
Dim lbeaminci() As Long
ReDim lbeaminci(1 To nlb, 1 To 3)
For i = 1 To nt
    For j = 1 To nlg
        For k = 1 To (ntg - 1)
            q = q + 1
            lbeaminci(q, 1) = nc + q
            lbeaminci(q, 2) = ntg * nlg * i + ntg * (j - 1) + k
            lbeaminci(q, 3) = lbeaminci(q, 2) + 1
        Next k
    Next j
Next i
For i = 1 To nlb
    For j = 1 To 3
        Cells(10 + i, 13 + j) = lbeaminci(i, j)
    Next j
    objOpenSTAAD.Geometry.CreateBeam lbeaminci(i, 1), lbeaminci(i, 2), lbeaminci(i, 3)
Next i
'transverse beam incidences
ntb = ntg * (nlg - 1) * nt
Dim tbeaminci() As Long
ReDim tbeaminci(1 To ntb, 1 To 3)
For i = 1 To nt
    For j = 1 To ntg
        For k = 1 To nlg - 1
            r = r + 1
            tbeaminci(r, 1) = nc + nlb + r
            tbeaminci(r, 2) = ntg * nlg * i + j + ntg * (k - 1)
            tbeaminci(r, 3) = tbeaminci(r, 2) + ntg
        Next k
    Next j
Next i
For i = 1 To ntb
    For j = 1 To 3
        Cells(10 + i, 16 + j) = tbeaminci(i, j)
    Next j
    objOpenSTAAD.Geometry.CreateBeam tbeaminci(i, 1), tbeaminci(i, 2), tbeaminci(i, 3)
Next i

End Sub
```
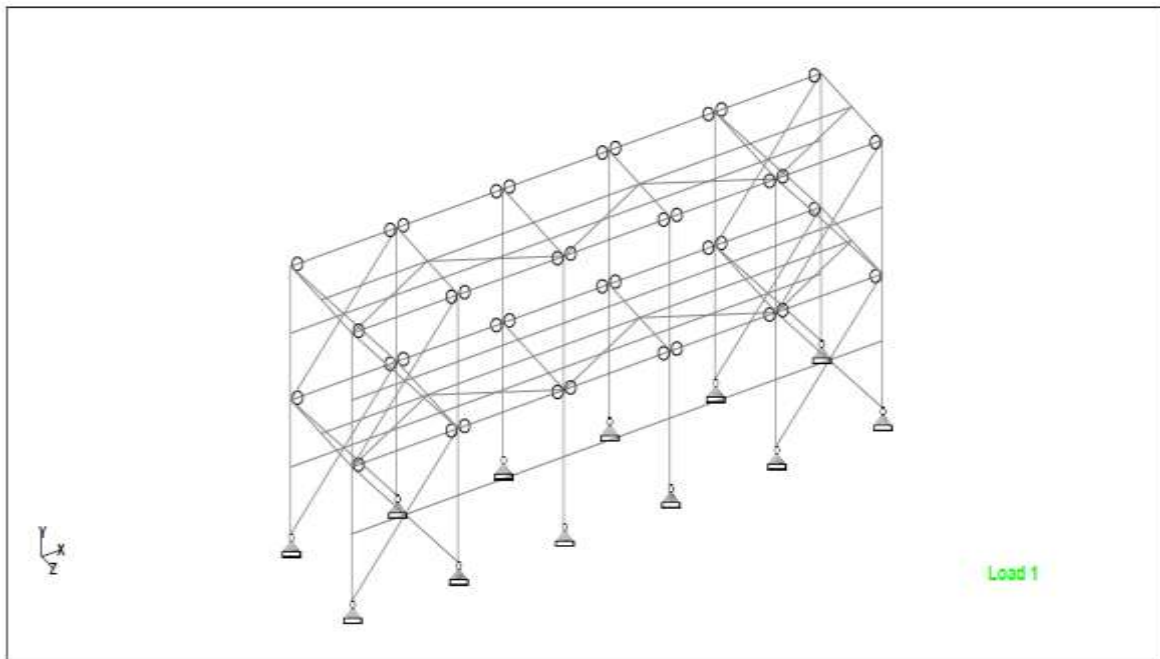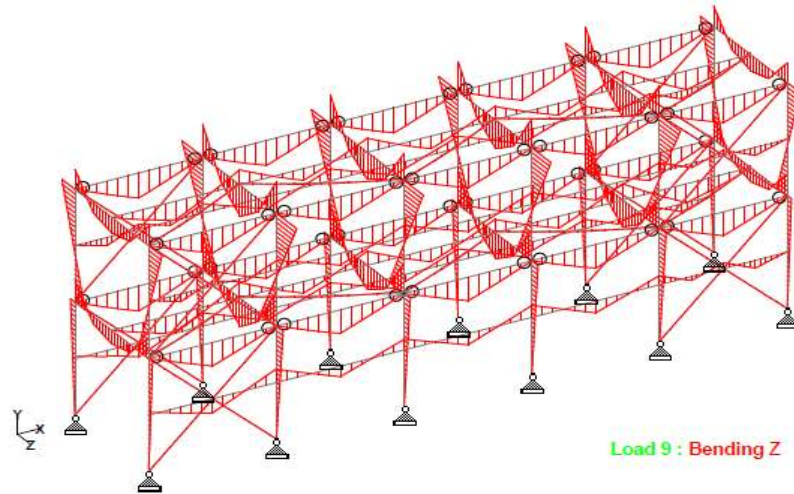

Fig.1 Model Of Pipe Rack
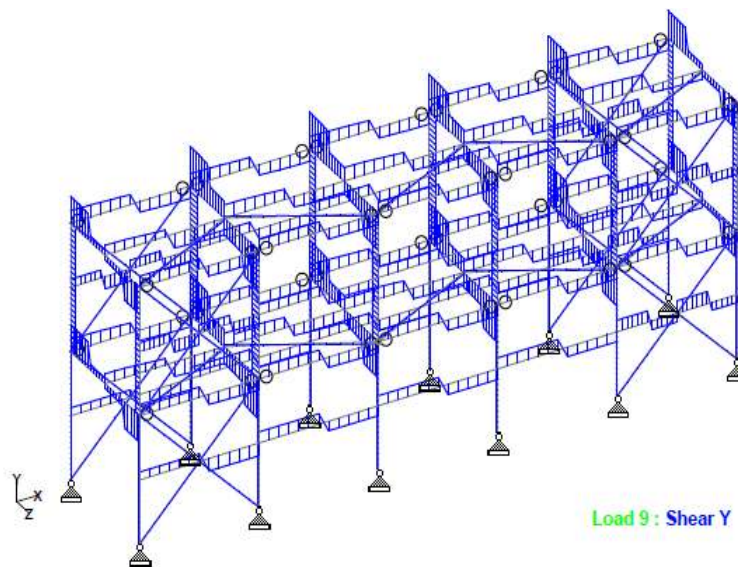
Fig.2 BMD Diagram of pipe rack

Fig.3 SFD Diagram of pipe rack

V.   CONCLUSION

A. A pipe rack is not only a non-bearing structure similar to a structural steel building, but also has additional loads and design features.

B. Macros automate the standard repetitive keystrokes that Excel uses to create and edit spreadsheets. Macros speed up your work by reducing the number of keystrokes required to execute common commands and reduce the amount of time you spend daily browsing spreadsheets.

C. From one commandbutton we can run entire project by creating VBA code and also extract results.

D. By using macros we can hide or protect our worksheets which are confidential.

E. Once if we create VBA, that codes can used for repetitive projects.

F. Visual basic applications not only applicable for OpenSTAAD software. VBA macros can also used for various softwares.

G. Macros simplify our work lives by automating most of the routine works that we do. Macros in Excel are powered by Visual Basic for Applications. The speed of the execution of the program is the major advantage of using a macro. It saves a lot of time that is spent by the compiler for

invoking / calling the functions. It reduces the length of the program.

H. The move toward greater automation of office tasks has been ongoing for the better part of the past three decades, but Microsoft's use of macros is one of the biggest moves toward eliminating needless keystrokes and boosting the productivity levels of administrative workers, accountants, and others who regularly deal with vast spreadsheets, large amounts of data, and chart-driven presentations.

I. For business professionals who are just being introduced to the idea of a macro, there is much to learn and a great deal of information to understand about the benefits, drawbacks, and other considerations associated with this feature.

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