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AUTOMATION IN CIVIL ENGINEERING DRAWING BY USING AutoLISP

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Abstract – ***AutoLISP is generally used to customize the AutoCAD. It is very useful to draw the figures, for repeated commands like (line, offset, trim). Using AutoLISP drawing can be made more quicker and precise. In this paper we developed LISP program for building plan, detailing of beam reinforcement, footing reinforcement and slab reinforcement.***

Key Words: *AutoLISP, Automation in CAD drawing, AutoCAD*

1. INTRODUCTION

After the invention of AutoCAD, drafting of engineering drawing becomes easier. In case of Civil Engineering drawing, drafting of building element with small detailing at any scale is made possible. Also main advantage of AutoCAD is to increase efficiency and reduce in time. But to achieve this benefits user must have thorough knowledge of AutoCAD. Though one may have good command on CAD, he becomes bore in detailing in drawing elements and errors may be happens. To eliminate this problem, we can customize the AutoCAD. AutoLISP is the old but very powerful tool to Automation of drawing. In AutoLISP programmer sets arithmetic equations to get specific point of the drawing in terms of inputs given by user. After given inputs LISP draws the figure automatically.

1.1 VARIOUS SYSTEMS OF CAD AUTOMATION

1.1.1 Visual Basic for Applications

Visual Basic for Applications enables building user-defined functions It helps to automate the processes and accessing Windows API and other low-level functionality. It can be used to control many aspects of the host application, including manipulating user interface features, such as menus and toolbars, and working with custom user forms or dialog boxes. VBA code normally can only run within a host application, rather than as a standalone program

1.1.2 AutoLISP

AutoLISP is the programming language for use with AutoCAD. It is the subset of high level of LISP language especially adapted from within the AutoCAD working environment. AutoLISP code can interact with the user through AutoCAD's graphical editor by use of primitive functions that allow the user to pick points, choose objects on screen, input numbers and other data. AutoLISP also has a built-in GUI mini-language, the Dialog Control Language, for creating modal dialog boxes with automated layout, within AutoCAD

1.1.2.1 *Benefits of AutoLISP*

Almost all activities user do manually can be performed automatically using AutoLISP. AutoLISP have rich set of functions that you user use to perform any activity in AutoCAD automatically. It has general programming functions for variable manipulation, decision control, loops, arithmetic operations, error handling and function handling. And special functions such as geometric functions, display control functions, query and command functions, user input functions and object handling functions. Once program is made user get drawing as a output within fraction of minutes.

2. PROGRAMMING IN AutoLISP

2.1 Math functions that accepted as a multiple argument-Before programming in AutoLISP user must have basic structure of AutoLISP. If we want to do basic arithmetic function using LISP following basics should be understand

(+ number number ...) …..add
(- number number ...) …….subtract
(* number number ...) …….multiply
(/ number number ...) ……..divide

2.2 Numerical solution in AutoLISP

Now Consider Value Of A= 10 And Value Of B= 20 Then Operation Will Be Like Below

Table 1 Numerical functions

Operator	Description	Example
+	Adds two operands	(+ A B) gives 30
-	Subtracts second operand from the first	(- A B) gives-10
*	Multiplies both operands	(* A B) gives 200
/	Divides numerator by de-numerator	(/ B A) gives 2

2.3 IMPORTANT FUNCTUONS USED IN LISP PROGRAMMING

Table 2 Functions of LISP

getpoint	Needs you to pick a point on the screen.
getint	Needs an Integer e.g.: 1.
getreal	Needs a real number e.g.: 10.00.
getstring	Needs a string of text.

2.4 COMMANDS USING IN AutoLISP

Three types of command are used.

2.4.1 CAR, CADR, CADDR

It directs the point into X, Y, Z directions respectively. For example if user want to direct the point pt1 in X direction then will write it as: (car pt1)

2.4.2 List

The LIST function simply used to link the coordinates together into one point. For example if user wants to define Q1 in X and Y direction will write as:
(list (car pt1) (cadr pt2))

3. CO-ORDINATING OF FIGURE

The main work of creating the program is to define some specific points of the drawing. The points are defined as X-Y coordinate with respect to fixed point of drawing. These points are defined by simple mathematical relations with each other. Once these points are defined, it automatically draws in the CAD drawing as per the inputs are given by the user. The inputs include the dimensions of drawing such as width, depth of the section. For detailing of drawing like reinforcement the respective values should be taken as per requirement.

3.1- Co-ordinates of column footing

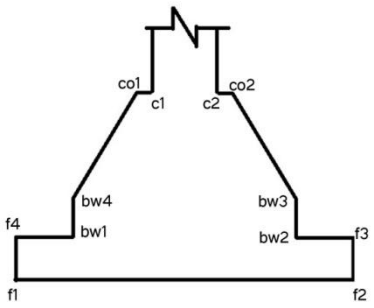


Fig 1- Section of column footing

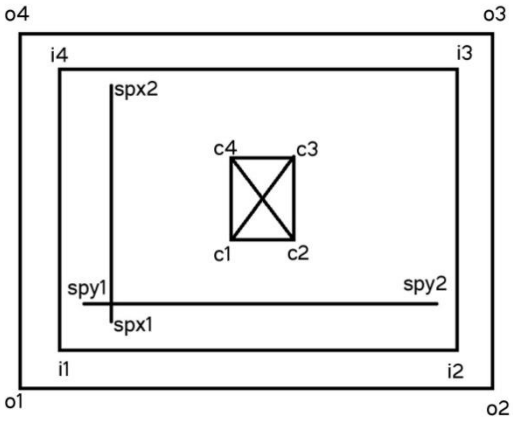


Fig 2- Plan of column footing

Table 3 Inputs required in program

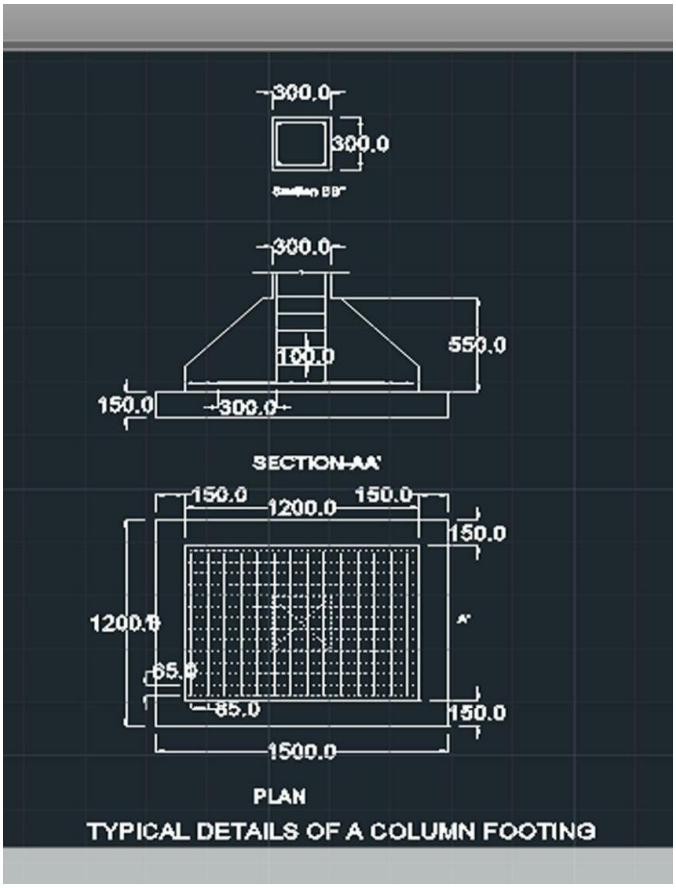
Sr.no	Notations	Descriptions
1	breadth	breadth of footing in meter
2	width	width of footing in meter
3	Lo	Left offset of Footing in meter
4	Ro	Right offset of Footing in meter
5	Bo	bottom offset of footing in meter
6	To	top offset of Footing in meter
7	spb	c/c Spacing of bar in breadth in meter
8	spw	c/c Spacing of bar in width in meter
9	Cb	breadth of column in meter
10	Cw	width of column in meter

Table 3 Inputs required in program

Point	X Direction		Y Direction	
	FIXED	VARIABLE	FIXED	VARIABLE
01	0		0	
02	O1	breadth	O1	0
03	O1	breadth	O1	width

04	O1	0	O1	width
I1	O1	$+L_o$	O_1	$+b_o$
I2	O2	$-r_0$	O_2	$+b_0$
I3	O3	$-r_0$	O_3	$-T_0$
I4	O4	$+L_0$	O_4	$-T_0$
C1	Pt_0	-Cw/2	Pt_0	-Cb/2
C2	Pt_0	+Cw/2	Pt_0	-Cb/2
C3	Pt_0	+Cw/2	Pt_0	+Cb/2
C4	Pt_0	-Cw/2	Pt_0	-Cb/2
Spx_1	I_1	+Sc	I1	+Sc
Spx_2	I_4	-Sc	I_4	-Sc
Spy_1	I_1	-Sc	I_1	+Sc
Spy_2	I_2	-Sc	I_2	+Sc
F_1	Pt_o	-W/2	Pt_o	+W
F_2	F_1	+W	0	0
F_3	F_1	+W	0	0
F_4	F_2	+d	0	0
bw_1	F_1	$+L_o$	F_1	+ht
bw_2	F_2	$-r_o$	F_2	+ht
bw_3	F_2	$-r_0$	bw_2	+ht
bw_4	F_1	$+L_o$	bw_1	+ht
C_{o1}	C_1	$-C_o$	bw_4	+depth
C_{o2}	C_2	$+C_o$	bw_3	+depth

4. RESULT



5 CONCLUSION

AutoLISP is great powerful tool to automate the drawing. It has variety of ways to edit and manipulate the CAD. Specific task that takes several minutes can be complete within few seconds. It has flexibility to redraw the same drawing using different dimensions. LISP increases efficiency of work and reduces the time of work and make CAD efficient.

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