iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IX **Month of publication:** September 2019

DOI: http://doi.org/10.22214/ijraset.2019.9035

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue IX, Sep 2019- Available at www.ijraset.com

Designing Typical Cross-section for Highway Corridor using Autodesk Subassembly Composer

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Abstract: This article explains the technique which will help us to design the Typical Cross-section of a highway using the most advance software developed by the Autodesk "Subassembly Composer". Highway design involves various Design stages like creation of surface, Alignment creation, Profile creation, corridor creation etc. One of the important parts in Highway designing is the Typical cross-section of Highway which is known as the assembly in Civil 3D. This assembly is created by joining subassemblies. Our upcoming future is geared to use of new technologies, as this new and advanced technologies saves our efforts and saves our time as well. The main aim of this presentation is to demonstrate how these new technologies helps us to perform our work with high precision and least time.
Keywords: Highway Design; Assembly, Typical Cross-section, Subassembly Civil3D.

I. INTRODUCTION

Typical cross-section of highway contains the details of various elements of the highway within the travel way width or we can say with in the right of way of the highway. It explains the detailed dimensions of the various elements with the thickness of the pavement layers.

The various elements that a typical cross-section determines are given below: -

A. Lane Details

It provides the detail of the lane present in the carriageway, which includes the width of the lane and the number of lane present in our highway.

B. Shoulder Details

The typical cross-section provides the detail of the shoulder as if it is an earthen shoulder or a paved shoulder and the detail of width provided to the shoulder.

C. Median Details

To avoid conflicts with the opposing traffic a median is provided on divided highway. Cross-section of the highway contains the details of the median width and the type of kerb stone used.

D. Side Slopes

The graded area which is adjacent to the shoulder of the carriageway is called its slope. The details of the crossfall is also given in the cross-section.

E. Pave Details

The typical cross-section consists of the details of the type and thickness of the pavement.

II. AUTODESK SUBASSEMBLY COMPOSER

Subassembly composer is the software developed to compose subassembly for the Civil 3D. it provides an interface to modify and compose complex subassemblies, without any need for the programmer's coding. We can create custom subassemblies to meet our specific needs and that can be used again as per our requirement once we have imported them in Civil 3D.

Subassembly composer consists of five Panels:

A. Toolbox Panel

The toolbox panel displays the elements which the software provides for designing the subassembly. The toolbox window provides all the elements which are used to create a flow chart.

B. Flowchart Panel

The flowchart panel displays a flowchart that can be a simple straight line or tree of branching of logic or decisions which always begins at start element.

C. Properties Panel

The property panel provides the input location for the parameters that are used to define the geometry of the subassembly.

D. Preview Panel

The preview panel is used to view the sketch of the subassembly. It has two modes: -

1) Layout mode
2) Roadway mode

E. Settings and Parameters Panel

It consists of five tabs

1) Packet settings
2) Input/output parameters
3) Superelevation
4) Target parameters
5) Event viewer

III. DESIGN METHODOLOGY

For design methodology of a subassembly consists mainly of follow procedure: -

1) First, we need to create a new project
2) We need to add the subassembly elements
3) We need to specify the subassembly parameters
4) We need to modify the geometric elements of subassembly
5) After above steps we can preview the geometry of subassembly
6) At last we need to save the project and import the file in Civil 3D.

The flow chart of the above steps is shown in the Figure 1.

Flow chart

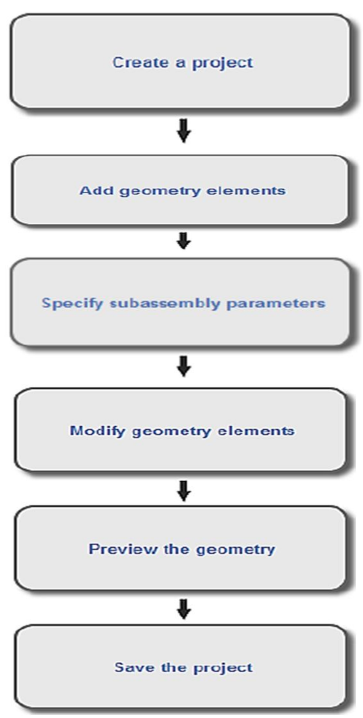

Figure 1.

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A. Design Steps

1) Open Autodesk subassembly composer and grab the point from toolbox panel and drop it flow chart panel under the start element. As shown in Fig. 2.

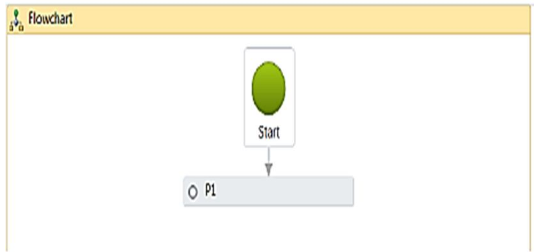

Figure 2.

A point number “P1” is automatically assigned to the point and the point is set to origin all these details are given in properties panel

2) Now drag another point P2 from the toolbox panel under the point P1. Now in flowchart panel we can see the point P2 is automatically assigned a link L1 as shown in Fig. 3.

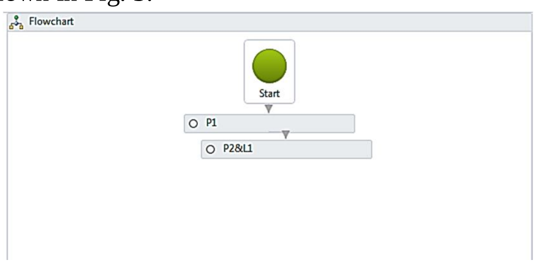

Figure 3.

3) Now use the property panel and change the point geometry type to slope and delta X, now to assign the slop and length, where Slope of -2.5% and Delta X is 3.5. as shown in Fig 4.

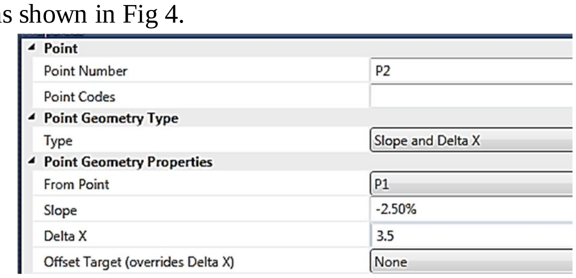

Figure 4.

Now in preview panel click on the fit to screen to see the link created as shown in Fig. 5

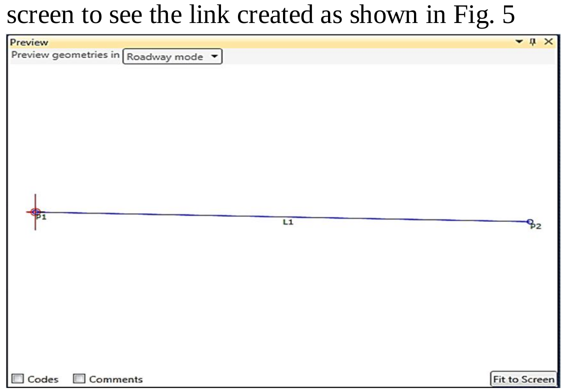

Figure 5.

4) Now grab another point P3 from the toolbox and drag it under P2&L1. Change the point geometry properties, where from point is P2, put the Delta X value to 0 and Delta Y value to -0.100. Now this show the thickness of our Pavement.
5) Now grab another point P4 from the tool box and drag it under P3&L2. Change the point geometry properties, where from point is P1, put the Delta X value to 0 and Delta Y value to -0.100. Now this show the thickness of our Pavement.
6) Now grab a link L4 from the toolbox and drag it under P4&L3.in properties panel change the position Start Point to P3 and End point to P4. In the preview panel we can se a rectangular shape as shown in the Fig.6 below which is the desired pave layer of thickness 100mm with a provided slope of -2.5%.

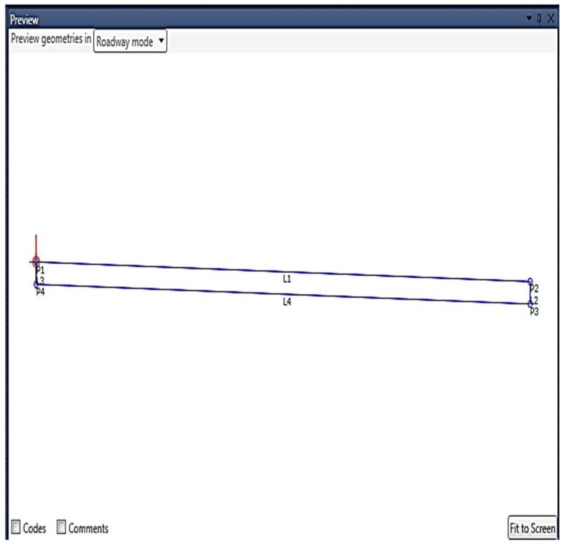

Figure 6.

7) In the next step we will assign a shape to our geometry to do so grab the Shape S1 from the toolbox and drop it under the Link L4. Now in component add all the links created L1, L2, L3, L4. Now we need to assign a code to the shape so that our software can identify the layer type name the shape code to "Pave1".
8) We must assign a code to every point and link of our pave layer as "Crown" to P1, "EOP"," ETW" to P2, "TOP" to L1, Datum to L4. Coding is an important part as Civil 3D cannot identify the points and links without codes. Coding is shown in Fig. 7.

Figure 7.

The coding of the shape will help to identify civil 3d to render the material for the top layer and also helps us to calculate the quantity take off criteria for each layer.

9) Now drag and drop sequence from the toolbox. Double click and now we will repeat all the above steps for further layers of our pavement inside the sequence workflow. As shown in Fig 8.

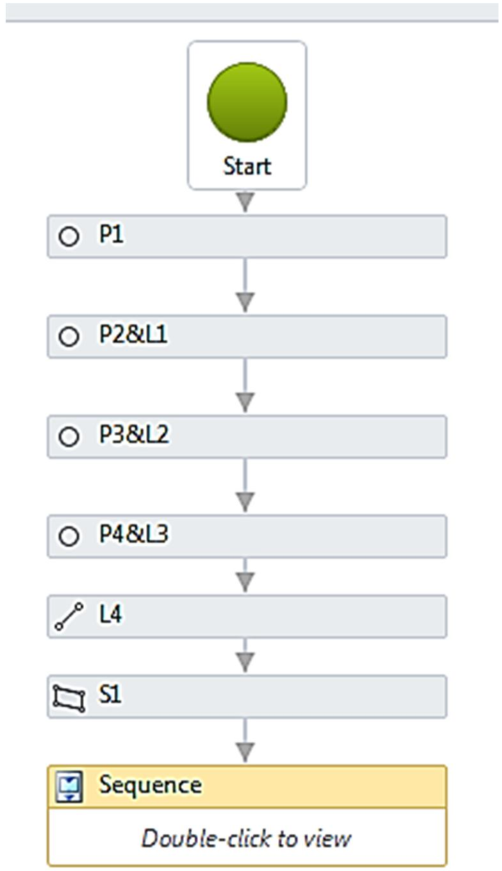

Figure 8.

10) After completion of above steps now in input/output parameters click on default value and assign a side (say "left") to the designed subassembly.

IV. DESIGN OUTPUT

A. Pave layers

The layers of a flexible pavement designed using subassembly composer are shown in Fig. 9 below

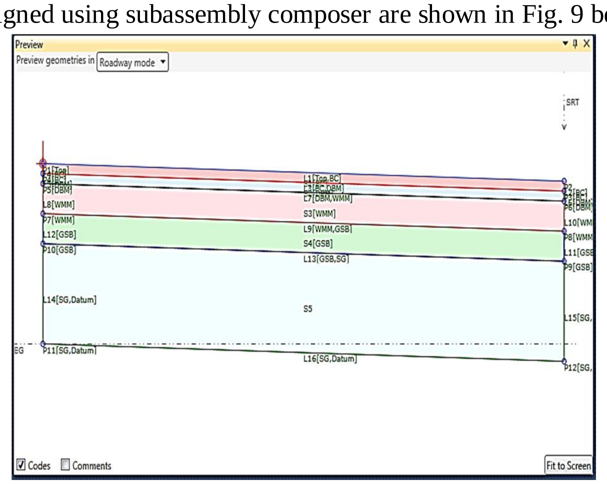

Figure 9.

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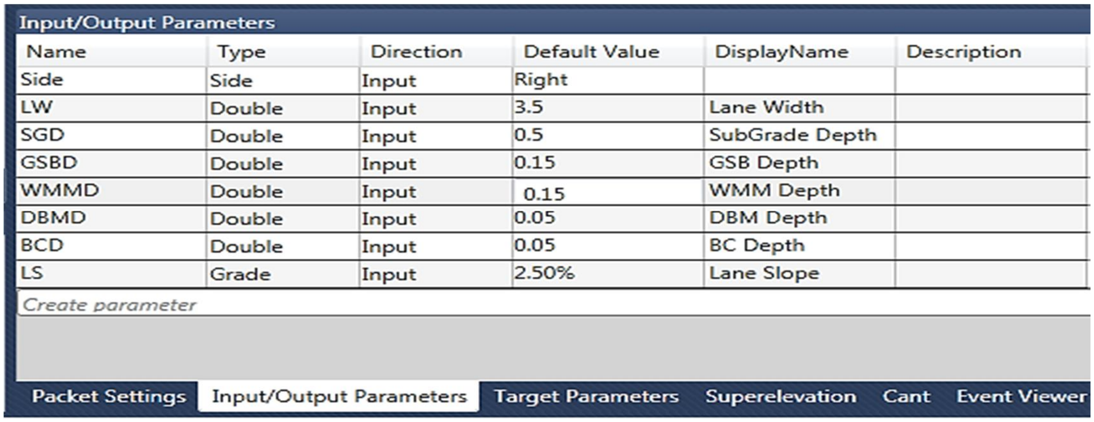
B. Input/ Output Parameters

Details of parameters applied in designing are given in Fig.10 below



Input/Output Parameters

Name	Type	Direction	Default Value	DisplayName	Description
Side	Side	Input	Right		
LW	Double	Input	3.5	Lane Width	
SGD	Double	Input	0.5	SubGrade Depth	
GSBD	Double	Input	0.15	GSB Depth	
WMMD	Double	Input	0.15	WMM Depth	
DBMD	Double	Input	0.05	DBM Depth	
BCD	Double	Input	0.05	BC Depth	
LS	Grade	Input	2.50%	Lane Slope	

Create parameter

Packet Settings | Input/Output Parameters | Target Parameters | Superelevation | Cant | Event Viewer

Figure 10.

C. Flow Chart Prepared

Flow chart of designed typical cross-section is given in Fig. 11.

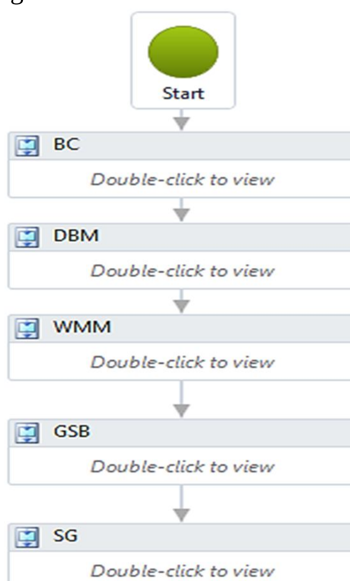


Figure 11.

D. Exporting Subassembly to civil 3D

Figure 12. show the Assembly formed after assigning subassemblies.

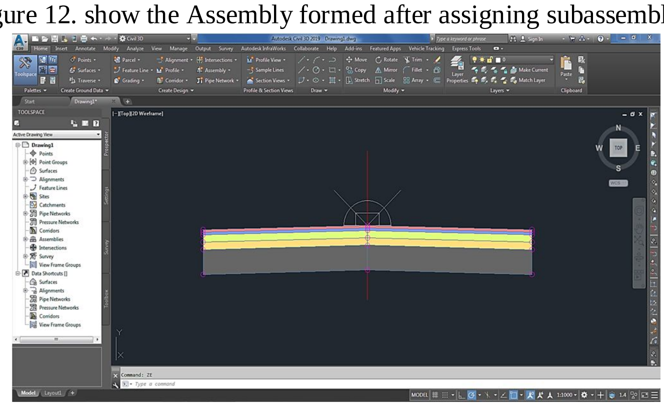


Figure 12.

V. CONCLUSION

After performing the complete design of the highway, we can conclude by saying that these designing tools helped a lot in designing and the efficiency of work has been increased drastically, which makes the completion of work much faster reducing errors and increasing accuracy. This method of designing a Typical cross-section is found to be much accurate as compared to other methods.

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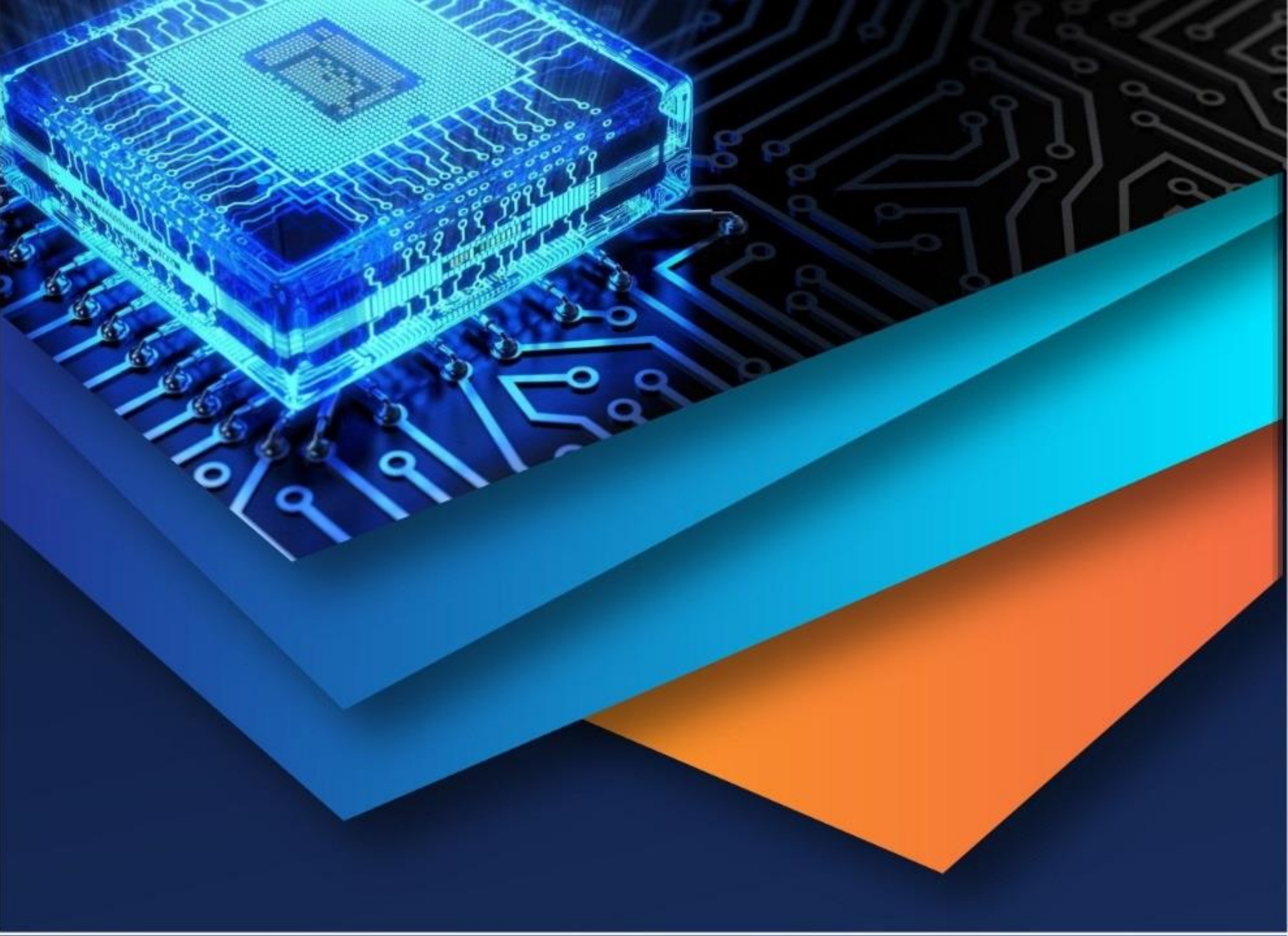

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