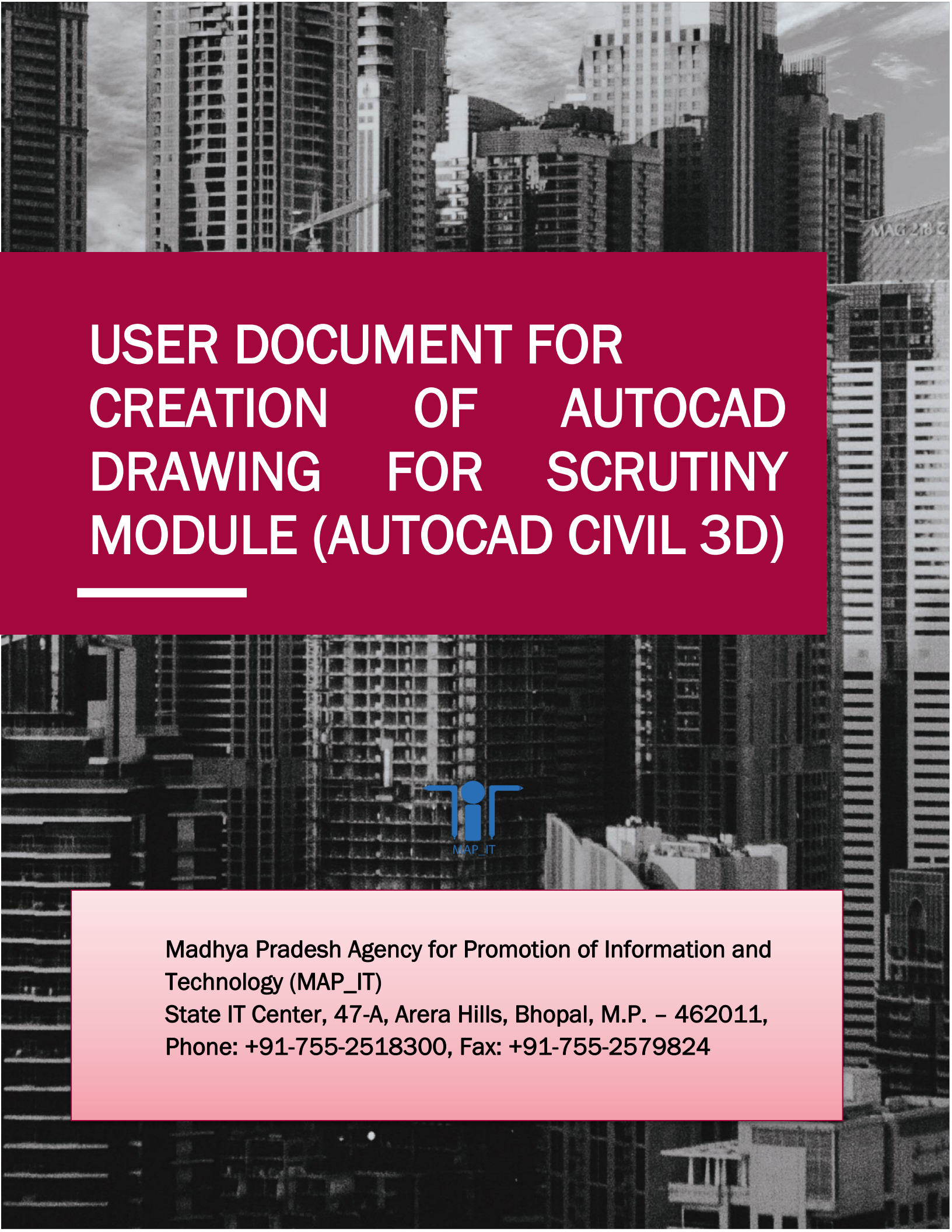

USER DOCUMENT FOR CREATION OF AUTOCAD DRAWING FOR SCRUTINY MODULE (AUTOCAD CIVIL 3D)

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1. INTRODUCTION

T&CP is converting its drawing scrutiny process from Non-GIS to GIS. In new process input file for scrutiny module will be shapefile (.shp). User will continue to create drawing files in AutoCAD but now projection information is mandatory. To make compatible with the GIS system now table schema of drawing file has changed. In GIS system projection and table schema is the most important aspect, without proper projection and table schema the system will unable to handle drawing files.

In this new system, there will be two methods to create drawing files;

- Civil 3D AutoCad based
- QGIS and AutoCad based

This document will describe drawing file creation using Civil 3D AutoCad software. Procedure to create drawing file using QGIS and AutoCad will be described in separate document.

2. PROJECTION INFORMATION

Projections are the backbone of any GIS system. Projections (Coordinate System) are a mathematical transformation that takes spherical coordinates (latitude and longitude) and transforms them into an XY (planar) coordinate system. This enables to create a map that accurately shows distances, areas, or directions. With this information, we can accurately work with the data to calculate areas and distances and measure directions. To create drawings, user first select UTM projection and later on during export drawing file should be converted into Geographic projection.

Users need to select UTM Northing-Easting coordinate system from AutoCAD coordinate system library. For AutoCAD system details of UTM Northing-Easting coordinate system are as follows;

2.1. UTM Projection Detail:

- Code Type – EPSG
- Category – UTM, WGS84 Datum
- Code – UTM84-44N
- Categories – UTM, WGS84 Datum

- EPSG Code – 32644
- Unit – Meter
- Description – UTM-WGS 1984 datum, Zone 44 North, Meter cent. Meridian 81d E

Zone will be different as per cities; user should select zone as per below mentioned list;

- ✓ Bhopal - Zone 43 North
- ✓ Indore - Zone 43 North
- ✓ Shivpuri - Zone 43 North
- ✓ Ujjain - Zone 43 North
- ✓ Betul - Zone 43 North
- ✓ Morena - Zone 43 North
- ✓ Narmadapuram - Zone 43 North
- ✓ Omkareshwar - Zone 43 North
- ✓ Burhanpur - Zone 43 North
- ✓ Gwalior - Zone 44 North
- ✓ Jabalpur - Zone 44 North
- ✓ Sagar - Zone 44 North
- ✓ Rewa - Zone 44 North
- ✓ Datia- Zone 44 North
- ✓ Bhind- Zone 44 North
- ✓ Dabra - Zone 44 North
- ✓ Chhatarpur - Zone 44 North
- ✓ Gohad - Zone 44 North

2.2. GCS Projection Detail:

- Code Type – EPSG
- Category – World / Continental
- Code – LL84
- Description – WGS84 datum, Latitude-Longitude
- Categories – Lat Longs; World/Continental
- EPSG Code – 4326

- Unit – Degree

3. LAYER TYPES

Based on scrutiny rules parameters, Features need to captured in shape file will be divided into two types. Polygon feature and line feature. Users will need to create drawing features in a polygon or line format.

User should ensure to use same spelling in layer. User must ensure to draw drawing units as per above-mentioned table. Detailed methodology will be described in methodology section.

Category wise details of polygon and line features are as follows;

Table 1 - Polygon and Line features

S.No.	Polygon Feature	Remarks	Line Features
1	INTERNAL ROAD		ELECTRIC LINES
2	OUTER ROAD		FRONTAGE
3	RAILWAY		DIM_MOSF
4	OUTER BOUNDARY		DIM_MOSR
5	ROAD WIDENING		Dim_MOS_SIDE_1
6	PLOT AREA		Dim_MOS_SIDE_2
7	GROUND COVERAGE		DIM_INTERNAL ROAD
8	OPEN SPACE		DIM_OUTER ROAD
9	SERVICE AREA		DIM_OUTER DIMENSION
10	PATHWAY		INTERNAL ROAD CENTERLINE
11	AREA UNDER MASTERPLAN ROAD		OUTER ROAD CENTERLINE
12	NOT INCLUDED IN PLANNING AREA		
13	CONVENIENCE SHOP		
14	SHOP CUM RESIDENTIAL		
15	MUNICIPALITY EWS		
16	MUNICIPALITY LIG		
17	PANCHAYAT EWS		
18	PANCHAYAT LIG		
19	OPENSPACE PARKING		
20	BASEMENT PARKING		
21	OVERGROUND PARKING		
22	PODIUM PARKING		
23	CLUB_RESORT		
24	GYM		
25	YOGA CENTER		
26	SWIMMING POOL		

27	RESTAURANT		
28	RESIDENTIAL UNDER INDUSTRY		
29	1 FLOOR PARKING		
30	2 FLOOR PARKING		
31	MILK BOOTH		
32	CRECHE		
33	SCHOOL		
34	WATERBODIES		
35	RIVER		
36	LAKE		
37	NALA		
38	MAJOR CANAL		
39	MINOR CANAL		
40	WATERBODY BUFFER		

4. LAYERS TABLE SCHEMA

In the GIS system, attributes are managed in tables based on a series of simple, yet essential, relational data concepts:

Tables contain rows.

- All rows in a table have the same columns.
- Each column has a data type, such as integer, decimal number, character, and date.

Tables and relationships play a key role in GIS, just as they do in traditional database applications. Rows in tables can be used to store all the properties of geographic objects. This includes holding and managing feature geometry in a Shape column.

As per final layout template, users need to create/upload four types of shapefile (.shp). details are as follows;

1. PolyData
2. LineData
3. Location plan

PolyData file – This shape file contains all feature in polygon format. Features captured in this file is shown in table-1. While creation user must ensure to capture all feature plot wise and fill attributes as per below table structure.

Table 2 - PolyData columns

plot_no	area	road_abt	height	width	length	road_nm	far	pltd_pr_nm	othr_pr_nm	unt_cnt	type	layer	Landuse	sublanduse

User should ensure to fill plot wise details. All fields must be in same format as described above (small letters); Details of each column are as follows

- plot_no – In this column user will fill individual plot numbers. Write 0 where it is not applicable.

  Fill Plot_no as IR1, IR2, IR3 etc. in Internal Road Centerline and DIM_Internal Road.

  Fill the Plot_no as "RA" in Dim_Outer Road, of the outer road for which the user wants the road abutting.
- area – In this column user will fill an area of each polygon.
- road_abt – In this column user will fill road abutting values, if applicable.
- height – In this column, the user will fill in the height details wherever applicable.
- width - In this column, the user will fill in the width details wherever applicable.
- length - In this column, the user will fill in the length details wherever applicable.
- road_nm - In this column, the user will fill in the road names wherever applicable. If not applicable then user should write N.A.
- far - In this column, the user will fill in the plot wise FAR values wherever applicable.
- pltd_pr_nm - In this column, the user will fill plotted premises name (category) wherever applicable. If not applicable then user should write N.A.
- other_pr_nm - In this column, the user will fill other category premises name wherever applicable. If not applicable then user should write N.A.
- unt_cnt - In this column, the user will fill dwelling unit count against each plot wherever applicable. In case of cinema, user will write seat count.
- type - In this column, the user will fill Major / Minor wherever applicable.
- layer - In this column, the user will layer/feature name, such as MOSF, Ground Coverage, Road, EWS-LIG, etc.
- landuse - In this column, the user will enter landuse category.
- sublanduse - In this column, the user will enter sublanduse category.
- If user creates a separate polygon for EWS/LIG then Polygon should be named as OB2. Distance between Main promises and EWS/LIG polygon cannot be greater than 2 KM.

Table 3 - PolyData attribute type

Attribute	Type
plot_no	Character
area	Real
road_abt	Real
height	Real
width	Real
length	Real
road_nm	Character
far	Real

Attribute	Type
pltd_pr_nm	Character
othr_pr_nm	Character
unt_cnt	Integer
type	Character
layer	Character
landuse	Character
sublanduse	Character

Type Field: User should ensure to fill ***"Inside Planning Area"*** or ***"Outside Planning Area"*** under type field.

LineData file – This shapefile contains all features in line format. Features captured in this file are shown in table-1. While creation user must ensure to capture all feature plot wise and fill attributes as per below table structure.

Table 4 - LineData columns

elec_volt	plot_n	front_lngt	layer
0	38	10	Frontage
32	0	0	Electric

Table 5 - LineData attribute tyoe

Attribute	Type
elec_volts	Real
plot_no	Character
front_lngt	Real
feature	Character

Users should ensure to fill plot wise details. All fields must be in same format as described above (small letters); Details of each column are as follows;

Elec_volts - In this column, the user will fill attributes (volts) against electric line. Units will be in volts.

Plot_no - In this column user will fill individual plot numbers. Write 0 where it is not applicable.

Front_lngt - In this column user will fill plot wise frontage length. Write 0 where it is not applicable.

layer – In this column user will write feature name for example; Frontage / High Voltage Electric line / Medium Voltage Electric Line etc.

Annotation file – This shapefile contains all Annotations as Point. User may enter Annotations, if required, as Point and fill attributes as per below table structure.

Table 6B - Annotation attribute tyoe

Attribute	Type
name	Character

Location plan- This file shows location details of site. This file will contain nearby colony boundaries, approach roads, etc. While creation user must ensure to capture all feature and fill attributes as per below table structure.

Table 7 - Location plan attributes

layer
Adjacent Khasra
Proposed Site
SH_20m
NH_25M

Layer_nm - In this column user will fill name of individual polygons. User will capture features like proposed site, Road name & adjacent khasra, etc.

Khasra plan - This file shows Khasra plans of the site. This file will all adjoining khasra boundaries with their numbers. While creation user must ensure to fill attributes as per below table structure.

Table 8 - Khasra plan attributes

khasranum	layer
290	Khasra
315	Khasra
316	Khasra

Khasranum - In this column user will fill the khasra number.

Layer_nm – In this column user will fill the name of polygon; like khasra.

Points to remember –

1. **In case of Others Category for Premises like self-residence etc.** Following fields must have filled under outer boundary;

- Open space area
- FAR
- Frontage (Line Feature)
- In case of common “open space/park area” “plot_no” field should be blank.

2. **In case of “outer boundary”, user should “plot_no” as OB1, OB2……n.**

3. **In case of open space for individual plot, “plot_no” field should be filled.**

4. **In case of others category; For DIM_Outer Road, user should write “RA” in plot_no column as per Line feature, which is made in front of the "frontage" .**

5. **For ABD area (Indore), Plot width should be mentioned under width column of outer boundary.**

6. **In case of plotted category, “pltd_pr_nm” & “othr_pr_nm” should be filled with respective categories.**

7. **In case of area falls on AB road 60m Buffer (Indore City Case). User shall create drawing with two outer boundaries. One outer boundary contains details as per commercial premises (Area within 60 buffer) and another outer boundary contains premises details as per actual Land Use (outside 60m buffer).**

5. SOFTWARE REQUIRED

- AutoCAD Civil 3D

6. METHODOLOGY

Before starting creation of drawing in AutoCAD, user should take coordinates from fields using DGPS/Total Station /GPS. Minimum of four coordinates of the plot will be required. The more coordinate points are, the greater the accuracy. Users should ensure to take sufficient numbers of coordinates. Number of coordinates will depend upon shape of the site, if site is irregular then user should try to take coordinates on each corner of the site. Users should take coordinates in UTM, Northing-Easting format (UTM, WGS84 Datum, coordinate system). For example;

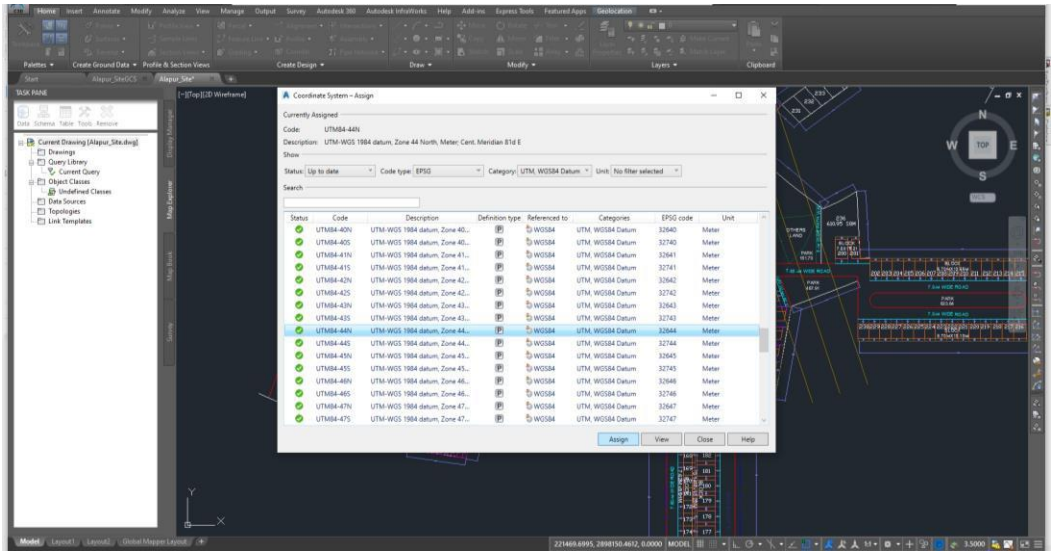
Table 9 - Coordinates sample

S.No	Easting	Northing
1	213791.9245	2899570.855
2	213760.0462	2899588.024
3	213810.6914	2899604.012
4	213779.1875	2899621.843

6.1. Assign Coordinate System

Now user will need to assign a coordinate system. To assign coordinate system user shall use “MAPCSLIBRARY” command.

Figure 1 - Coordinate system



- First user shall select created boundary.
- Then type “MAPCSLIBRARY” command in command box, a new window (Coordinate System Library) will open.
- Users will need to select Code type to EPSG and Category to UTM, WGS84 Datum.
- A list of coordinate system will open.
- User should select as Code - UTM84-44N, Description - UTM-WGS 1984 datum, Zone 44 North, Meter cent. Meridian 81d E, Categories – UTM, WGS84 Datum, EPSG code – 32644, Unit-Meter

6.2. CogoPoint Creation

- Users will open a new workspace with metrics.

Figure 2 - New drawing file

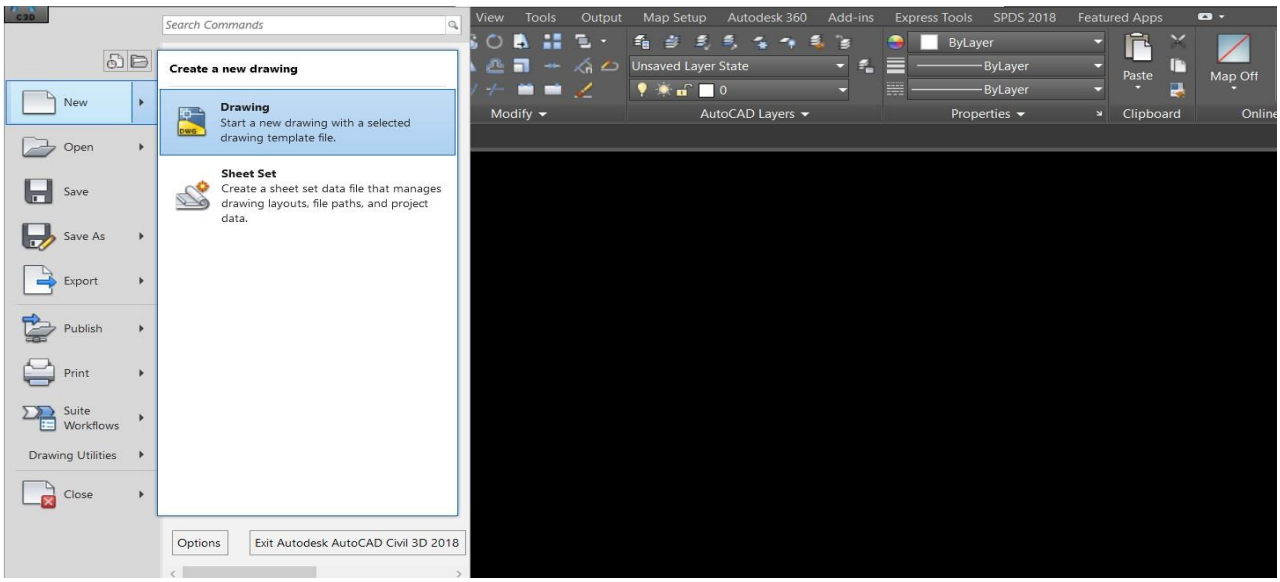
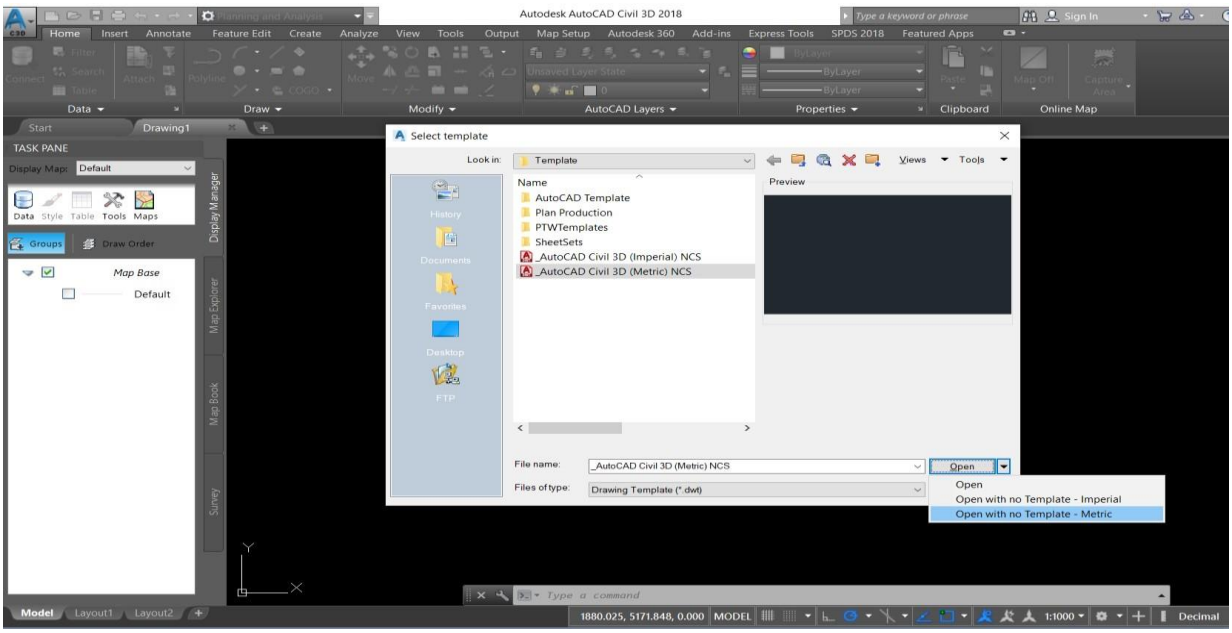
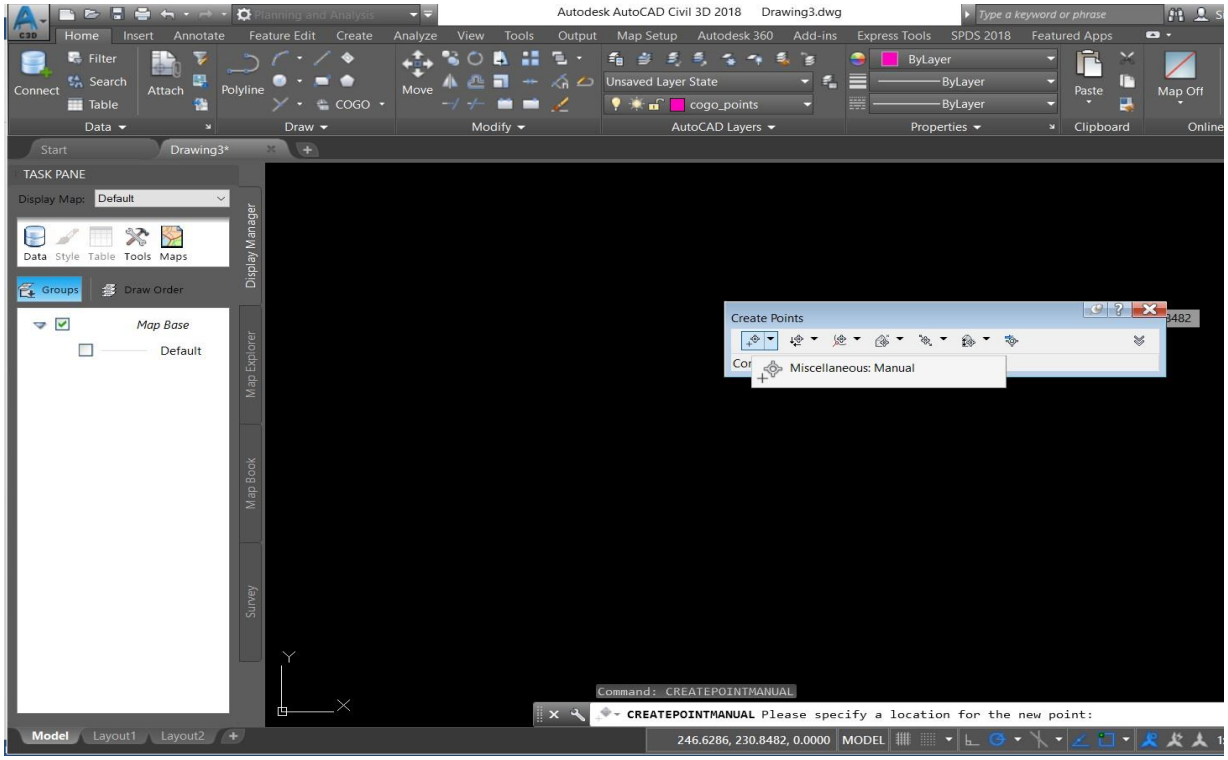


Figure 3 - Template with matrix



- To mark the coordinate points, user shall select the layer (cogo_point). Place points using “CREATEPOINTMANUAL” command.

Figure 4 - Create points



- Select miscellaneous: manual.

I. Specify location for new point.
II. Enter a point description e.g. 1
III. Double enter.

Figure 5 - Enter points

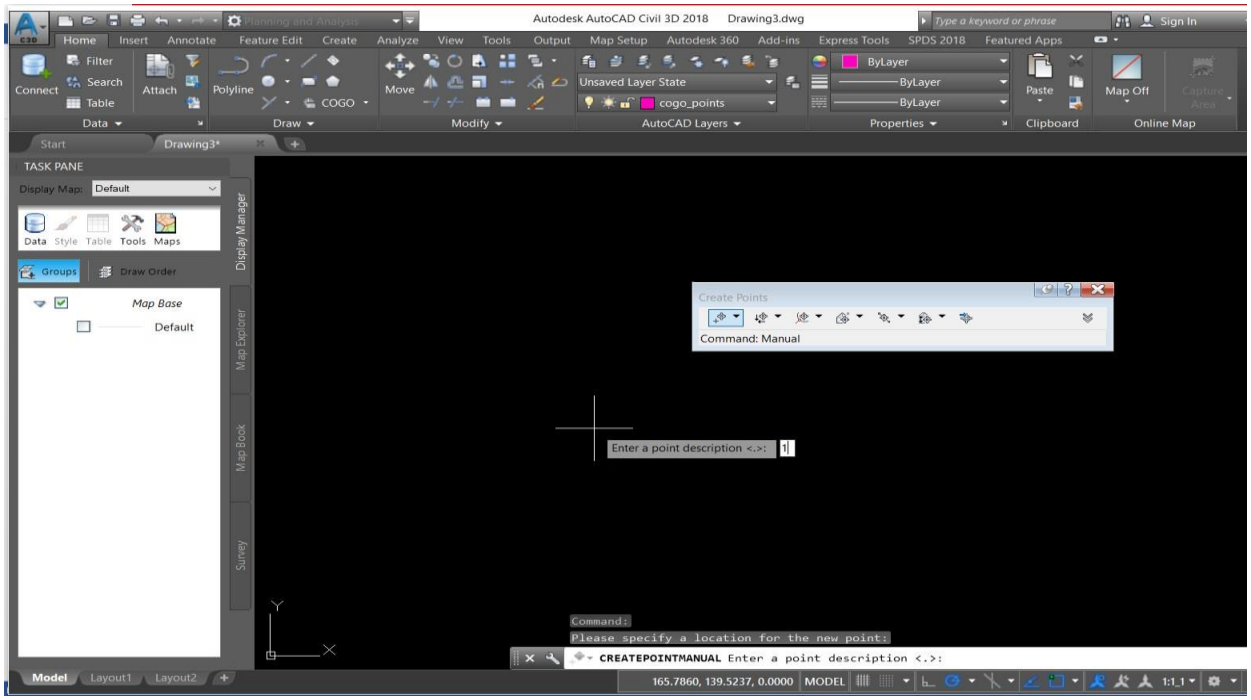
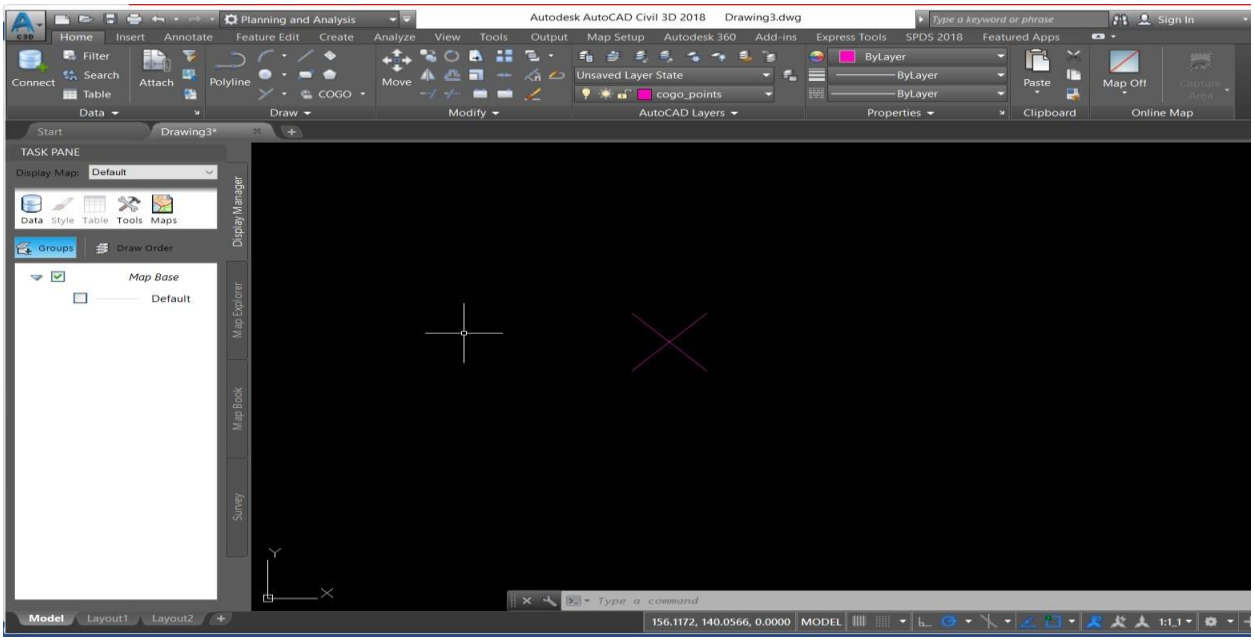


Figure 6 - Point placed



- To enter the values of coordinates, use properties window.

  √ Click on Cogo point.

  √ Click on properties and enter the coordinates in Geometry section.

Figure 7 - Cogo points properties

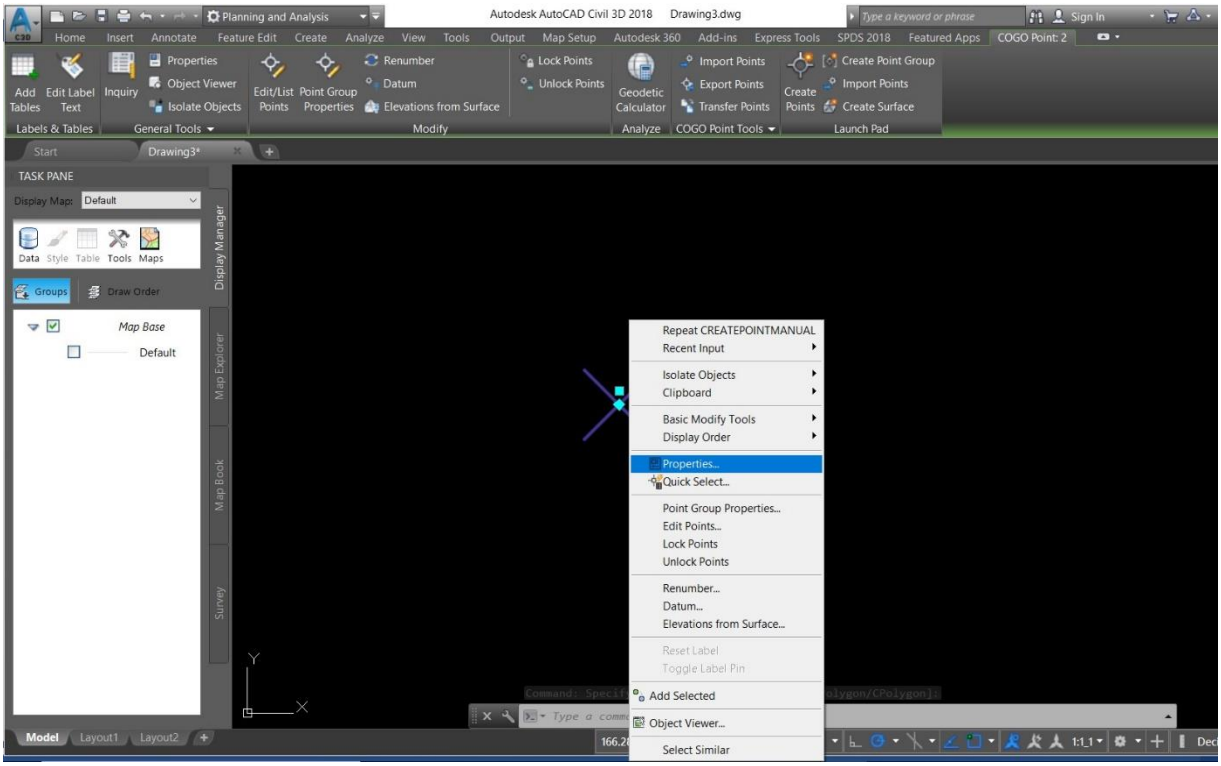
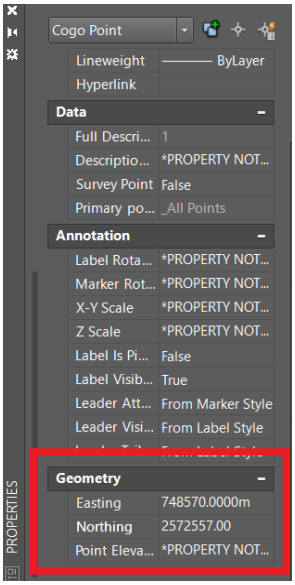
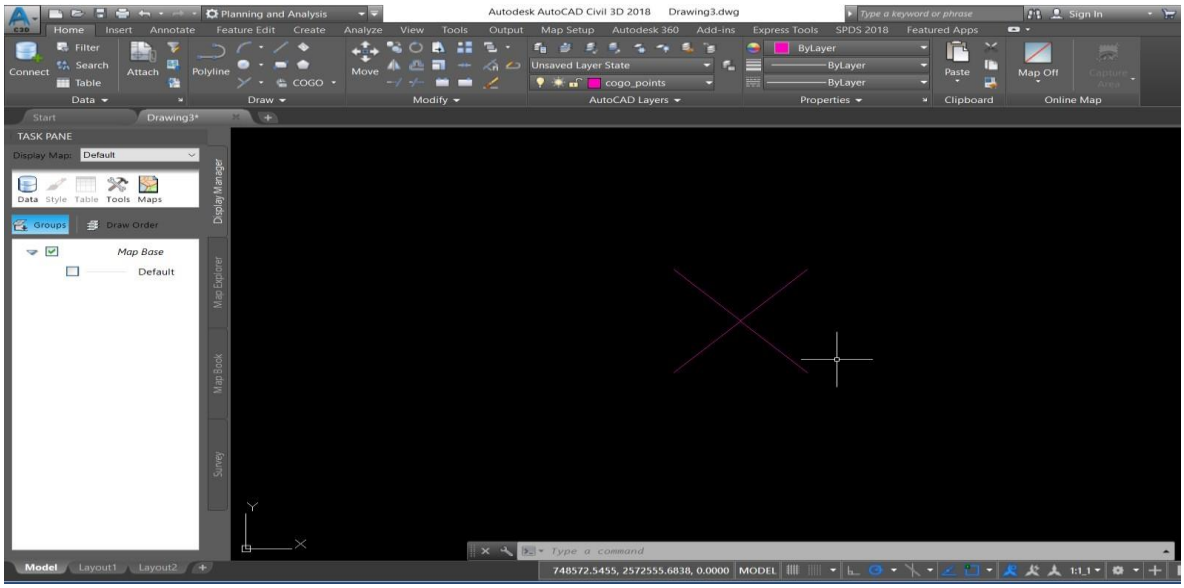


Figure 8 - Cogo point properties panel



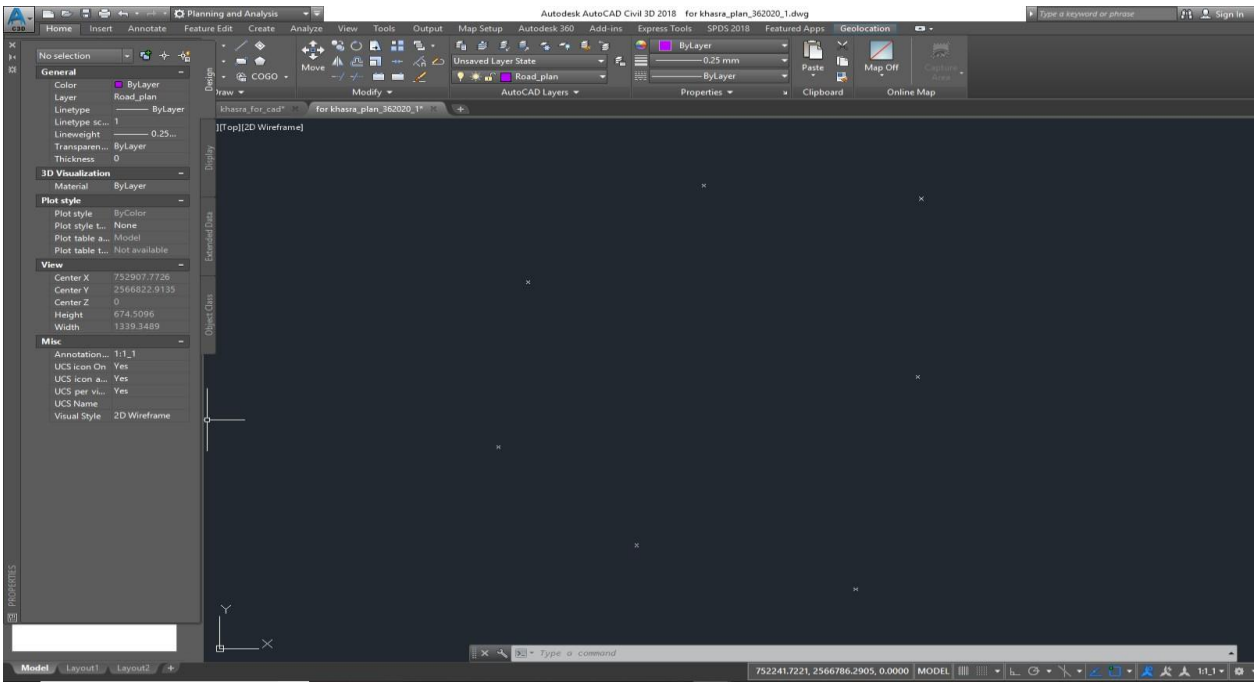
- After entering value of latitude and longitude, Cogo point will shift to its geographical location.
- To view this point, use zoom extend command. Press Z enter E enter.

Figure 9 - Cogo point zoom extent



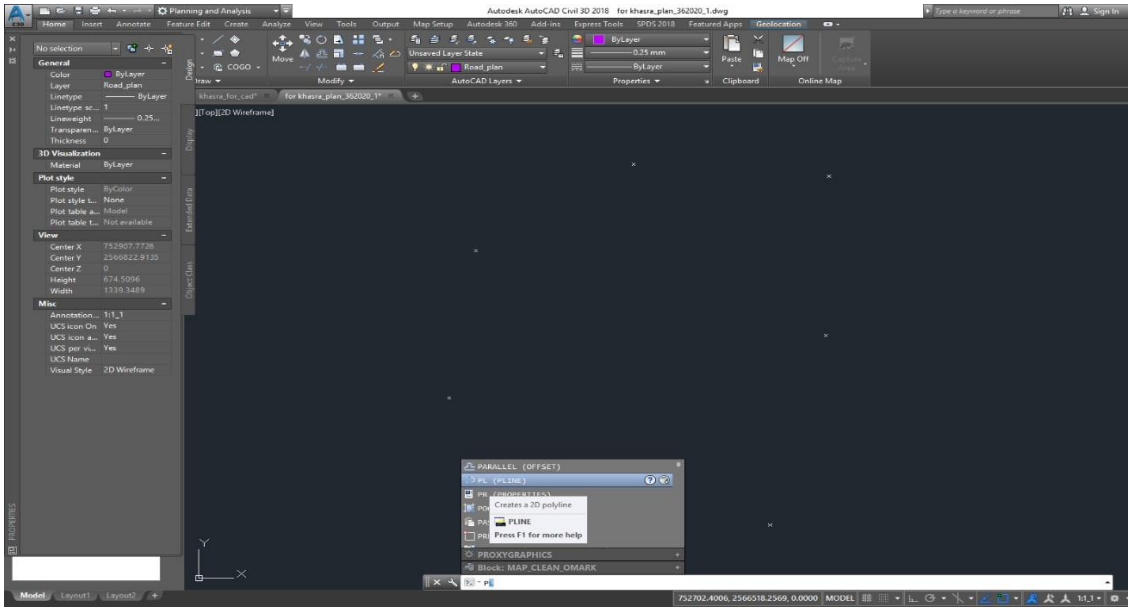
- For next points, just copy and paste this point to other locations.

Figure 10 - All cogo points



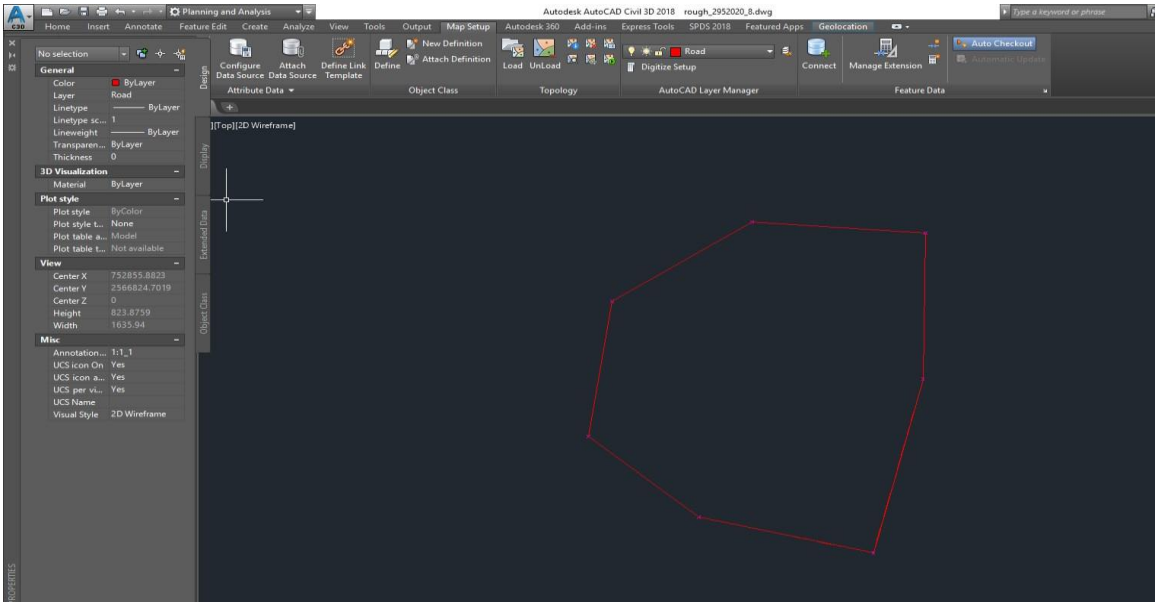
- To enter the coordinates in each point, fill values in these points individually using their properties.
- To start outer boundary creation, user should use “POLYLINE” command.

Figure 11 - Polyline Command



- User will join all the coordinates points, using Polyline commands and create outer boundary, at the end user will double click to end the digitization process.

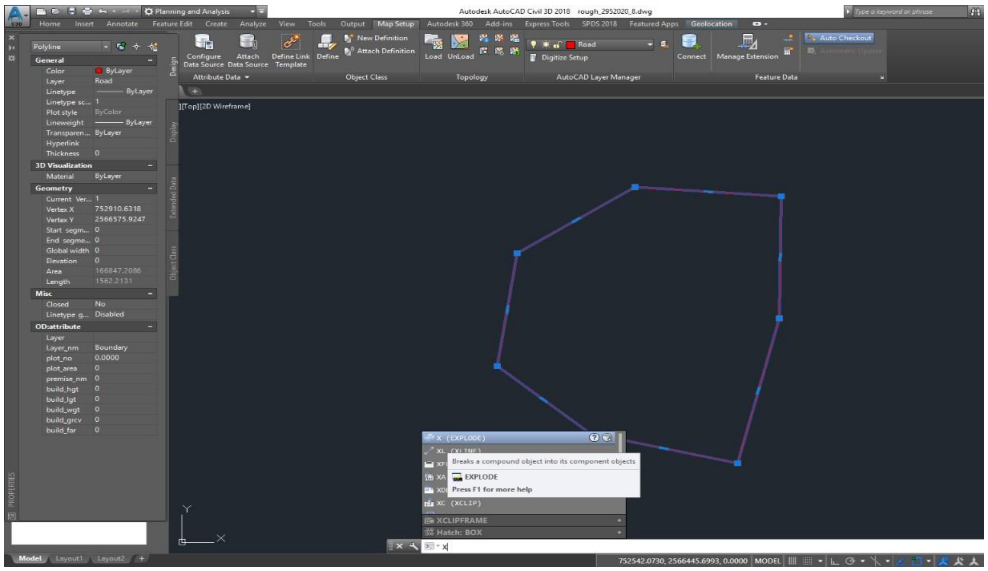
Figure 12 - Outer Boundary



- Created drawing is in block form. to convert it into polyline, explode drawing using "EXPLODE" command.

1. Select drawing.
2. Type explode command.

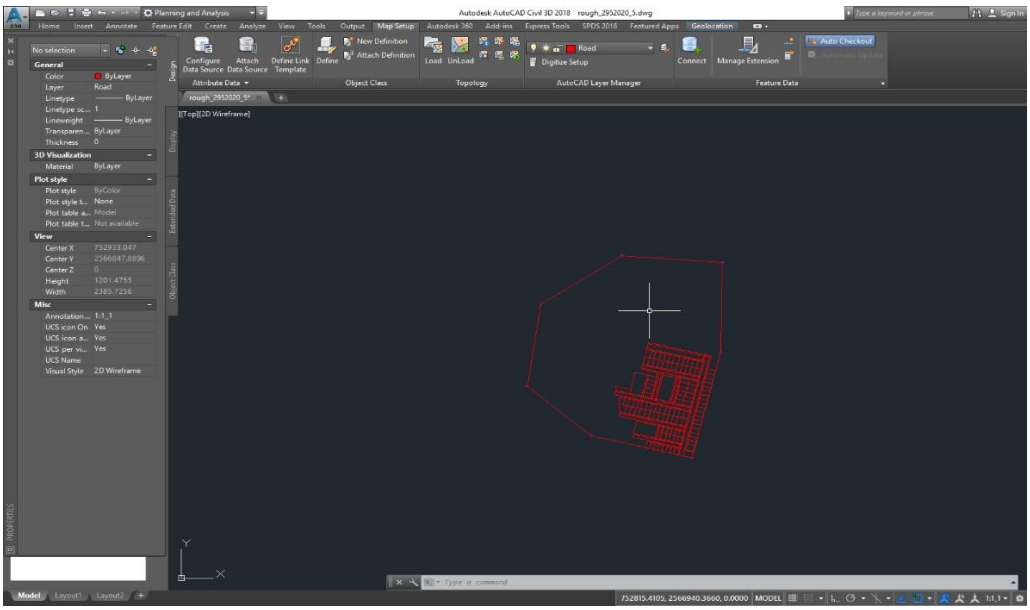
Figure 13 - Explode command



6.3. Drawing creation in Polylines

- Now user will start to create drawings as per their layout in polylines.

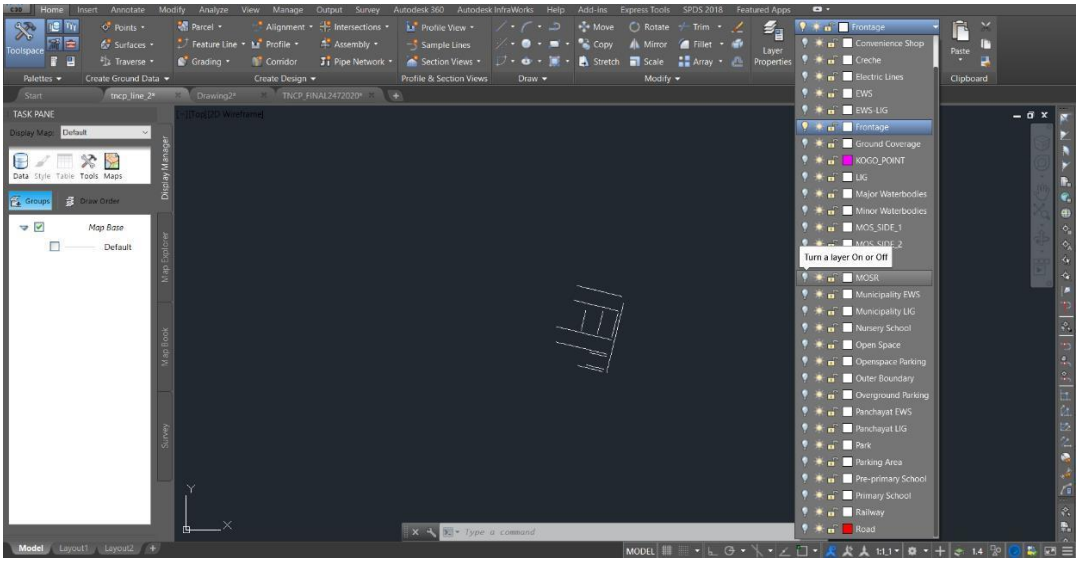
Figure 14 - Drawing in polylines



6.4. Drawing Cleaning Process

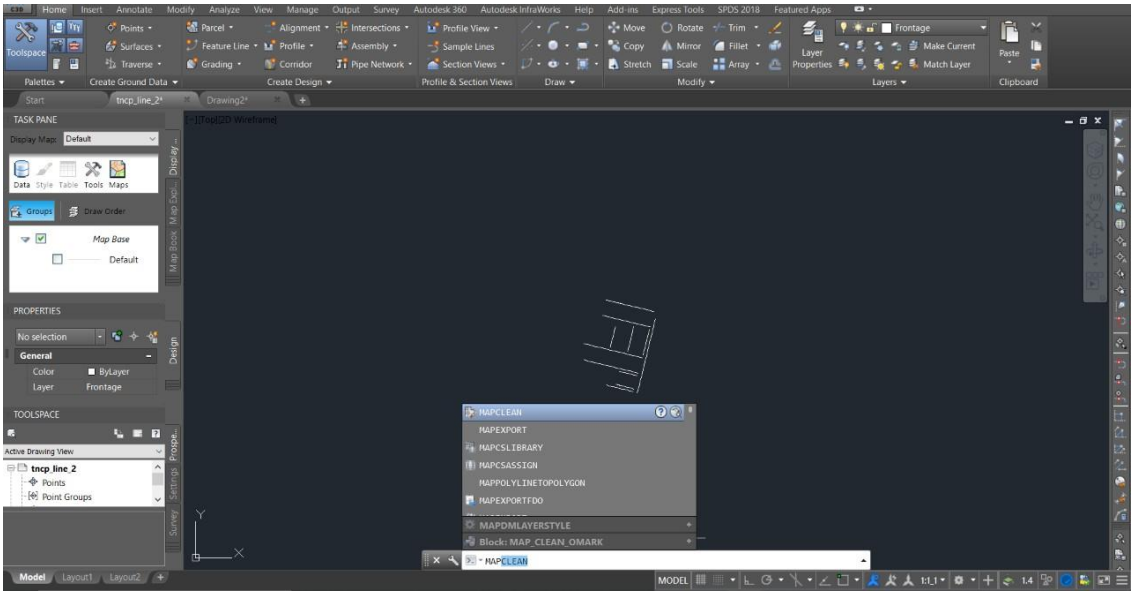
- Drawing Cleanup actions can be used to detect map errors (for example, duplicate objects, undershoots, or zero length objects), simplify complex 2D maps, and to weed and supplement 3D polylines. Because Drawing Cleanup can alter your data, make a backup of your data before cleaning up a map.
- Before start MAPCLEAN PROCESS, all layers should off, only one layer in which cleaning need to perform will be on for map clean process.
- Drawing Cleanup affects objects on layers that are OFF. It does not affect objects on layers that are FROZEN. It is recommended that user should use drawing cleanup on a layer-by-layer basis, or on selective sets of layers. Avoid using automatic cleanup for all objects on all layers

Figure 15 - All layer off



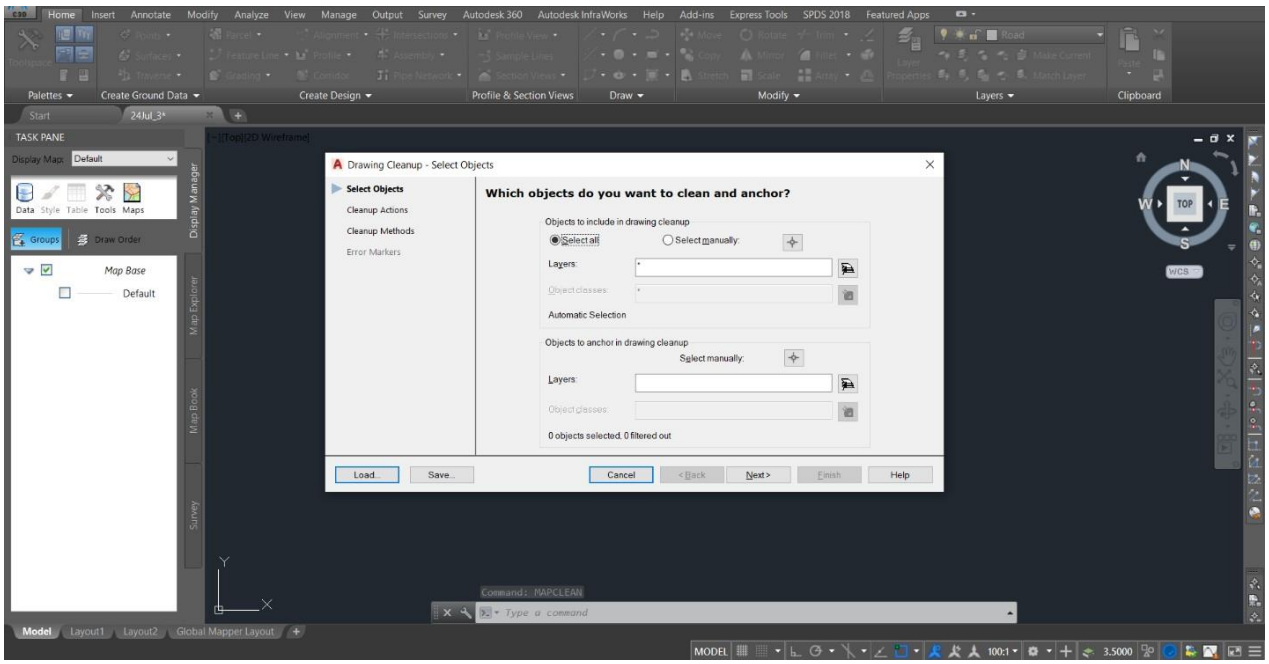
- User shall type Command-: MAPCLEAN and press ENTER

Figure 16 - Map clean command



- Click on Select all and press Next.

Figure 17 - Objects selection



- Now user need to select cleanup actions.
- In AutoCAD, there is following options for drawing cleanup;
  - **Delete Duplicates -** Delete Duplicates locates objects that share the same start and end points as well as all other points within the tolerance distance. User can delete one of the objects.
  - **Erase Short Objects -** Using the Erase Short Objects cleanup action, user can locate any objects shorter than the specified tolerance and erase them. This removes short isolated linear objects and short linear objects that are part of a polyline.
  - **Break Crossing Objects -** Use Break Crossing Objects to locate objects that cross each other and have no node at the crossing, break the crossing objects, and create a node at the crossing. This action takes a complex system of lines, arcs, circles, and polylines and breaks them at intersections into individual, unambiguous objects.
  - **Extend Undershoots -** Undershoots are often caused by inaccurate digitizing or when converting scanned data. Using the Extend Undershoots cleanup action, user can locate objects that come within the specified tolerance radius of each other, but do not meet. If one object can be extended to cross the other, it will be extended (while maintaining the same direction) and snapped to a point on the object. If no node exists, one will be created at the intersection.

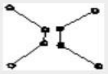
- **Apparent Intersection -** With Apparent Intersection, user can locate two objects that do not intersect but that could be extended (within a specified tolerance radius) along their natural paths to intersect at a projected point.
- **Snap Clustered Nodes -** Use Snap Clustered Nodes to correct multiple nodes near the same point. With Snap Clustered Nodes, user can locate nodes within a specified tolerance radius distance of each other and snap them to a single location. Nodes at the ends of lines and polylines are automatically included in this cleanup action. User can also include stand-alone nodes (points and blocks).
- **Dissolve Pseudo-Nodes -** A pseudo-node is an unnecessary node in a geometric link that is shared by only two objects. For example, a long link might be divided unnecessarily into many, smaller links by pseudo-nodes. Using the Dissolve Pseudo-Nodes cleanup action, user can locate any pseudo-nodes, dissolve the node, and join the two objects. This option removes nodes that are at the intersection of two linear objects, but leaves the vertex in place.

- **Erase Dangling Objects –** User can user Erase Dangling Objects to locate an object with at least one end point that is not shared by another object, and erase the object. The Erase Dangling Objects action searches for and deletes all line, arc, and polyline dangling edges, and nodes. Dangling objects do not include closed polylines.
- **Simplify Objects -** When maps are digitized, edges may be defined with more detail than necessary. User can use Simplify Objects to reduce unnecessary complexity in contour lines, rivers, and coastlines. Simplifying objects, also known as generalizing or weeding, reduces the number of points on a complex line. Simplify Objects works in two dimensions, ignoring Z-values. For information about how to add and remove vertices from 3D polylines, see Weed Polylines.
- **Zero-Length Objects –** User can use Zero-Length Objects to locate lines, arcs, and polylines that have a start point and an end point but have zero-length, or are missing an end point, and erase them. The Zero-Length Objects cleanup action does not evaluate closed polylines. Zero-length objects can be introduced inadvertently when importing data from other applications or when digitizing map data.

- **Weed Polylines (Not useful) –** User can use Weed Polylines to add and remove vertices on 3D polylines. This is helpful to control the drawing file size and contour appearance, or to remove redundant information. Enter Weeding Factors and Supplementing Factors to determine if a vertex should be added or removed from the 3D polyline.

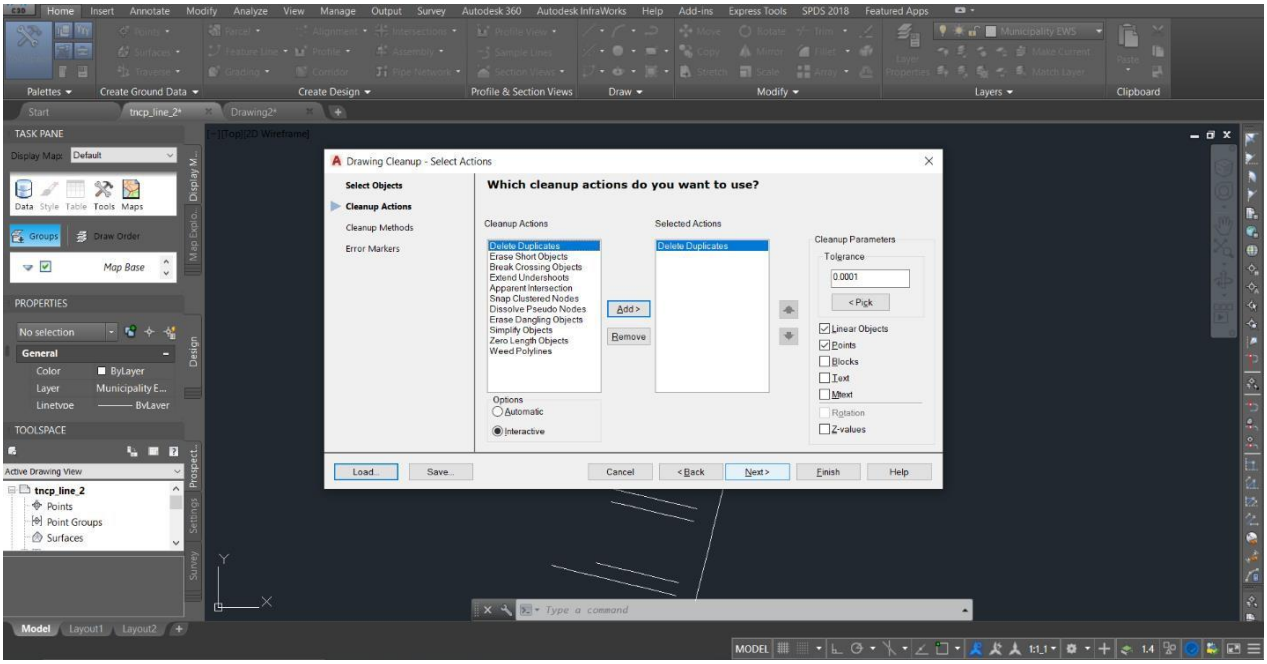
The following table shows examples of problems that Drawing Cleanup can correct.

Figure 18 - Drawing Cleanup Option

Before Drawing Cleanup	After Drawing Cleanup	Description of Problem	Cleanup Action
		Duplicate objects	Delete Duplicates
		Short objects	Erase Short Objects
		Crossing objects	Break Crossing Objects
		Undershoots	Extend Undershoots
		Objects could be extended along their natural paths to intersect at a projected point	Apparent Intersection
		Node cluster	Snap Clustered Nodes
		Pseudo-nodes	Dissolve Pseudo-Nodes
		Dangles or overshoots	Erase Dangling Objects
		2D linear object simplification	Simplify Objects
		Zero-length objects	Zero-Length Objects.
		Too many or too few vertices in a 3D polyline	Weed Polylines

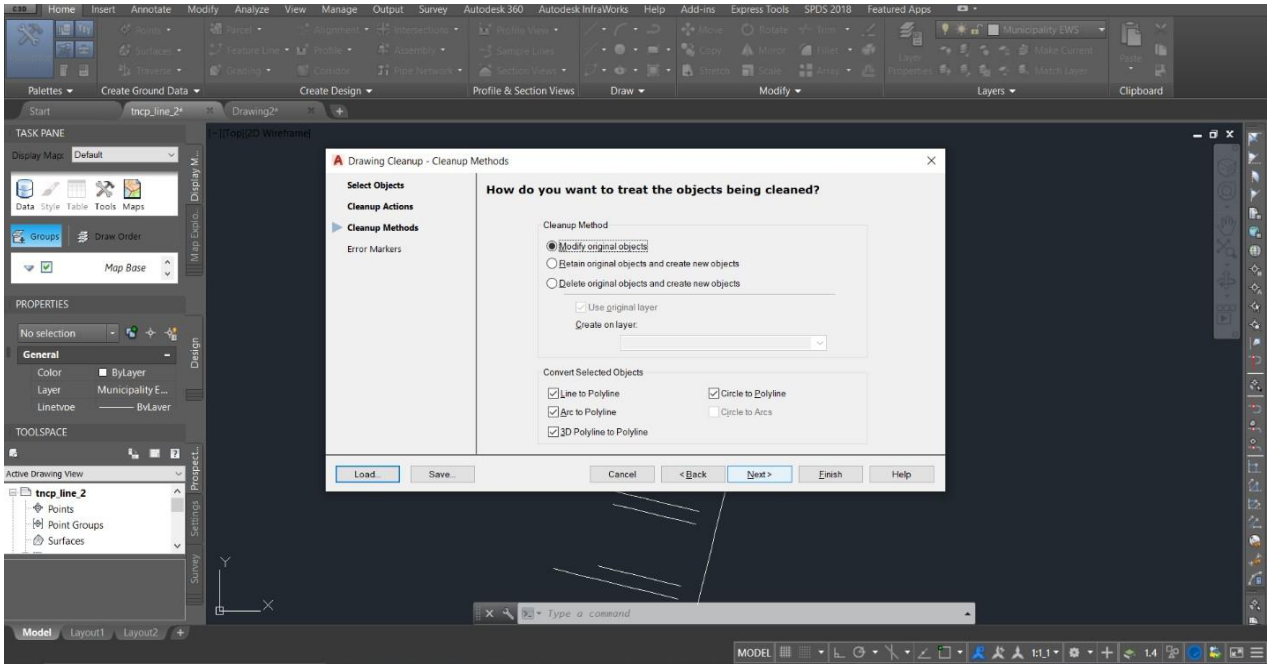
- User will select required cleanup actions and press add button.
- User should click on Linear objectsa and Points options at the left hand side.
- Press next.

Figure 19 - cleanup action selection



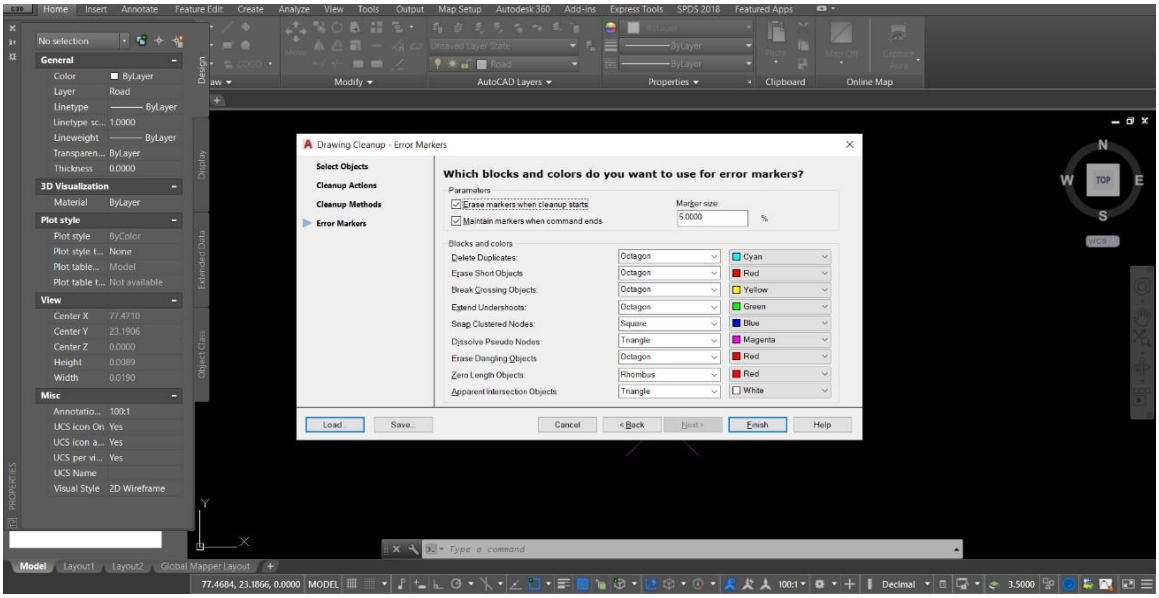
- In next screen, user need to select cleanup method, in this user will select “Modify original objects”.
- Select desired options in “Convert selected Objects” and press next for further step.

Figure 20 - cleanup method selection



- User will select required shape, size and color for error markers and click on Finish button.

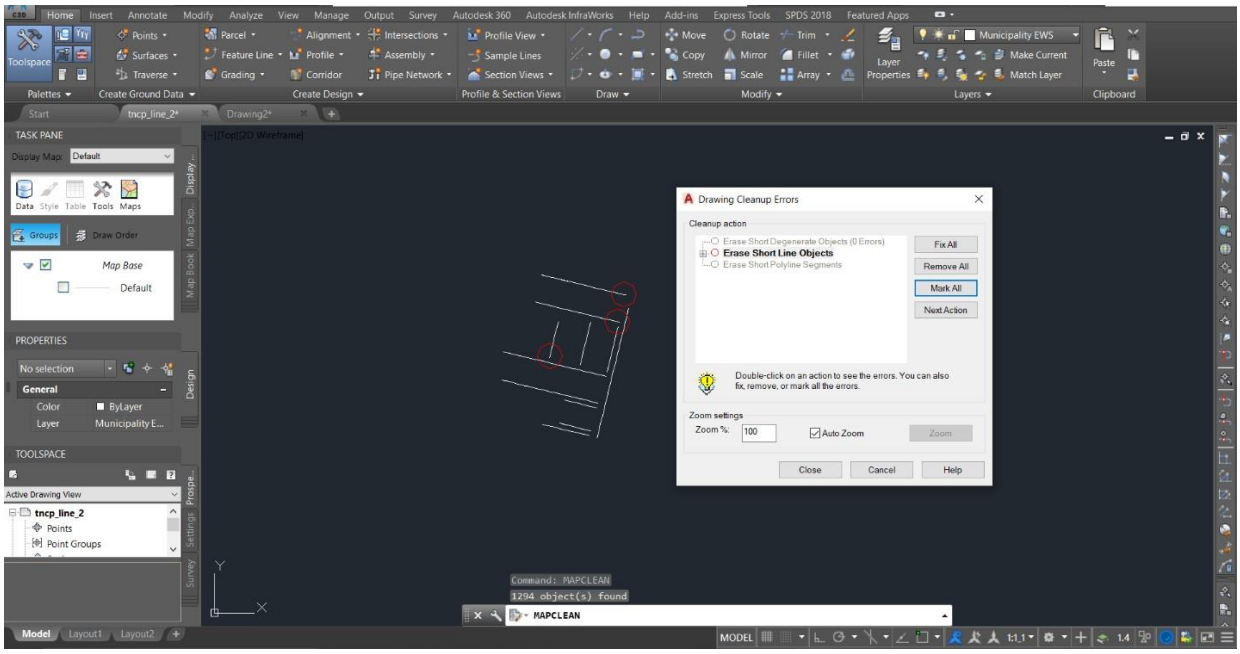
Figure 21 - Error color selection



- On Clicking Finish button, process will start. A new window will open “Drawing Cleanup Errors”

- User shall click on “Mark all”

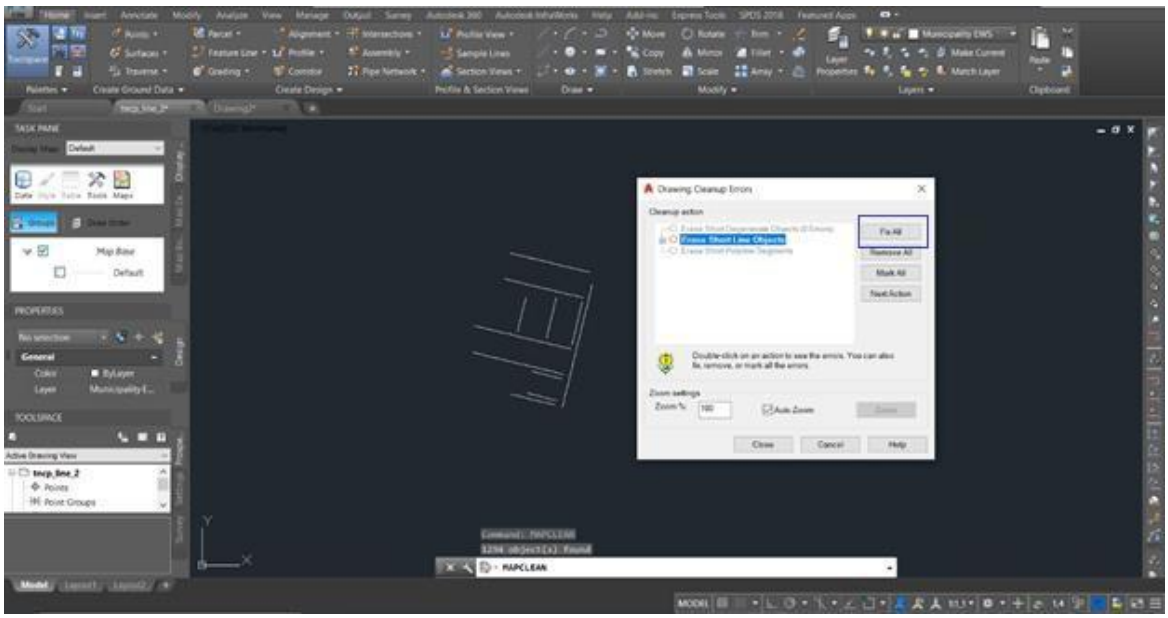
Figure 22 - Mark all option



- All error will gets highlighted.

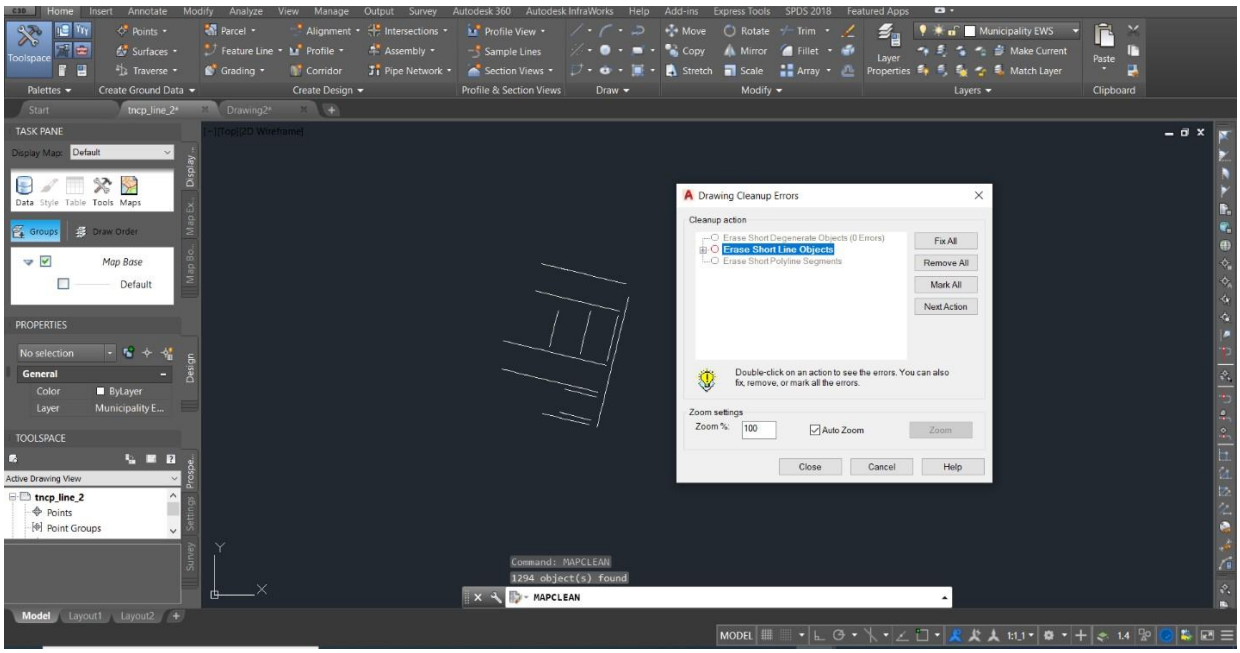
- Now, user will click on “Fix all” button to fix error automatically.

Figure 23 - Fix all option



- Drawing cleaup error-Mark all after fix all Keep repeating this method till error become zero.

Figure 24 - Error color selection

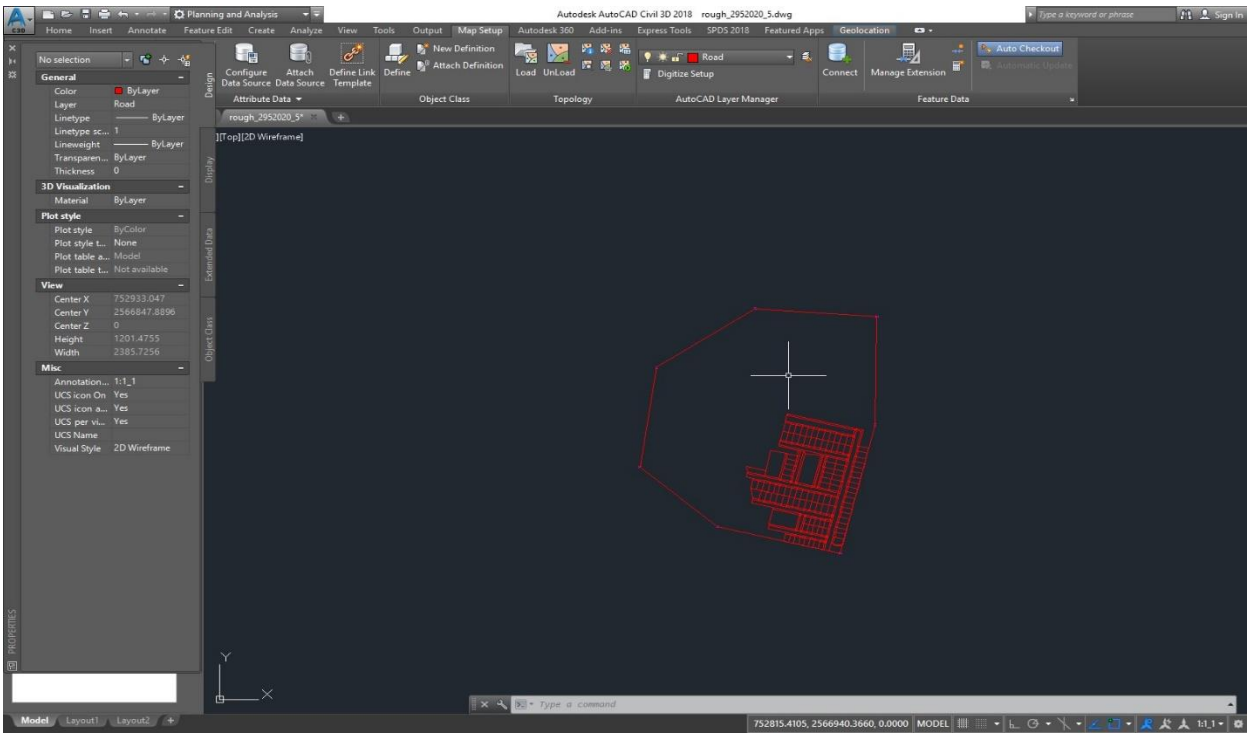


6.5. Convert Polylines to Polygons

- After creation of all features, users need to convert it into polygons.
- To convert polylines to polygons. Select all features.
- Set the PROXYGRAPHICS system variable to 0.

- On the command line, enter MAPPOLYLINETOPOLYGON command and press Enter.
- The selected closed polylines are converted.
- Each closed polyline in the selection set is converted. If the polyline belongs to a group, only the first (outermost) polyline is converted. Other polylines in the group are copied into the polygon as additional boundaries and the polygon is rebalanced.

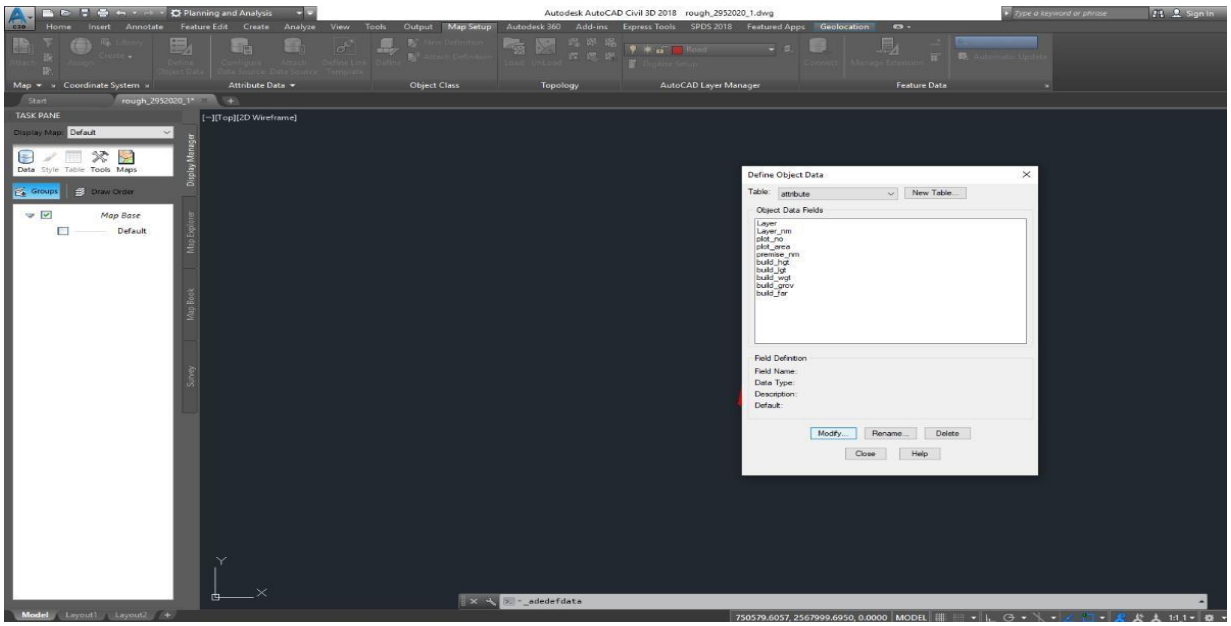
Figure 25 - Completed drawing file



6.6. Adding attribute in polygon file

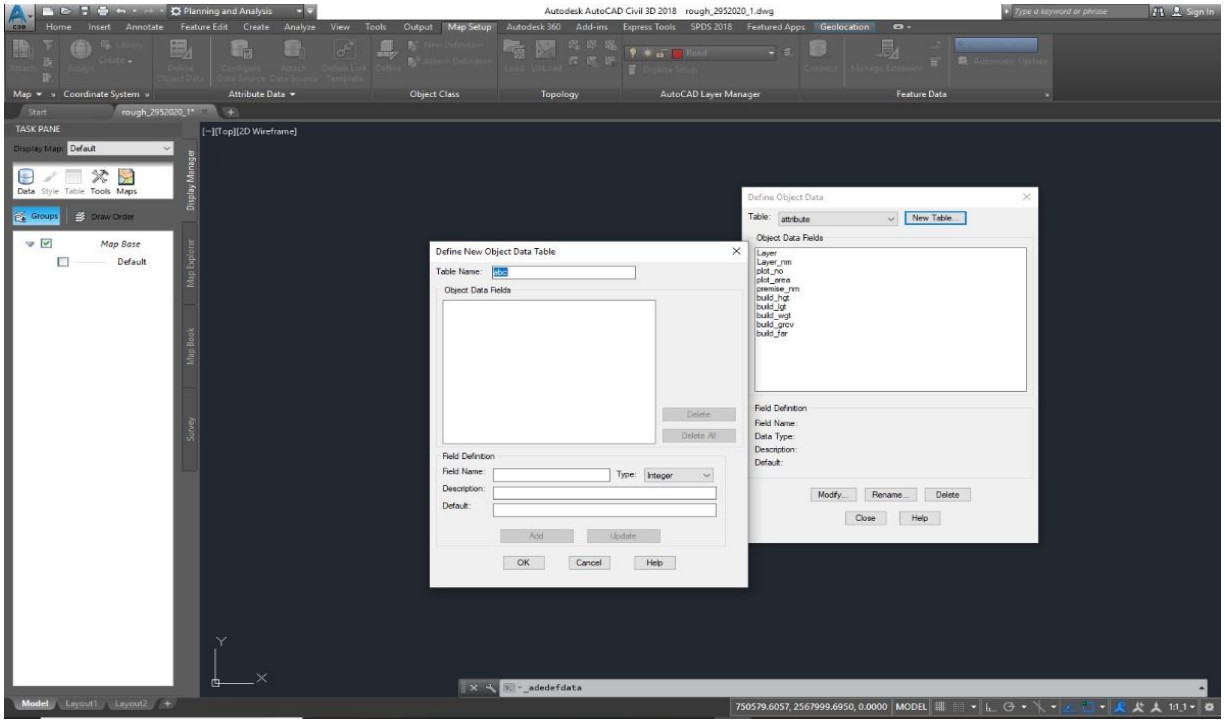
- To create attributes as per defined schema.
- Users will change workspace from civil 3D to planning and analysis and go to map set up then define object data.

Figure 26 - Define object data



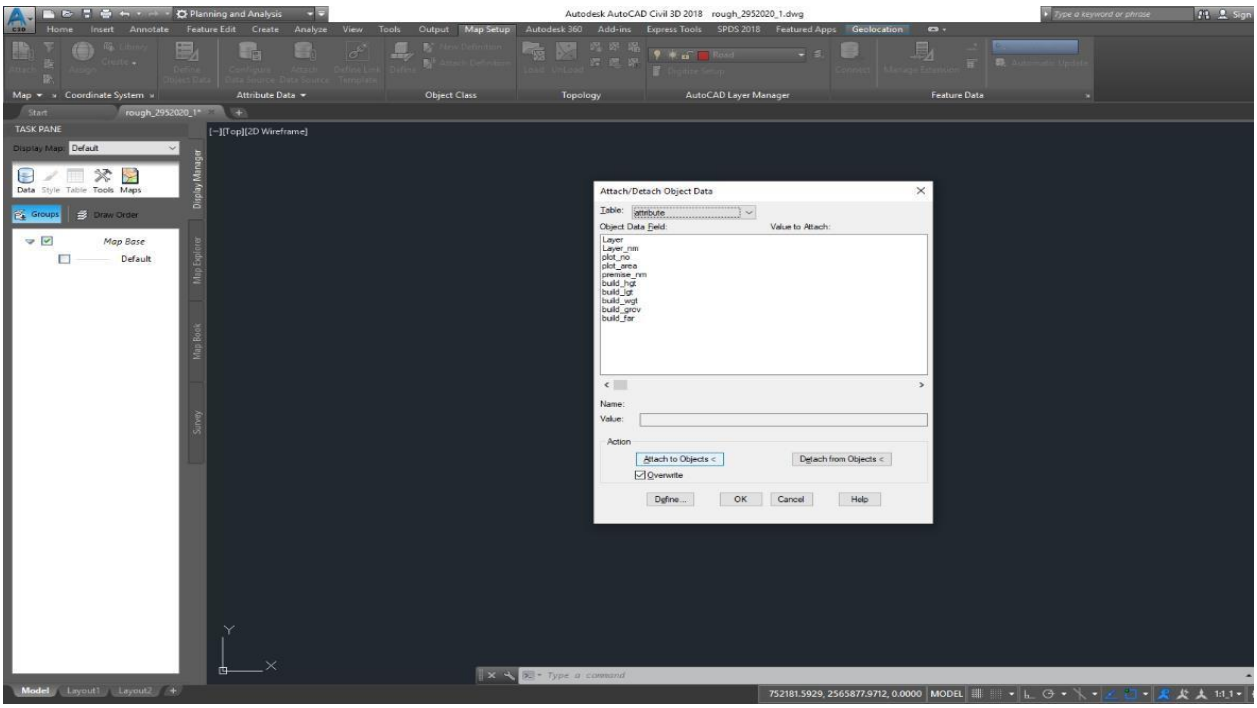
- Go to new table – define table name – add field in field name – define type of field and enter ok.

Figure 27 - New object data



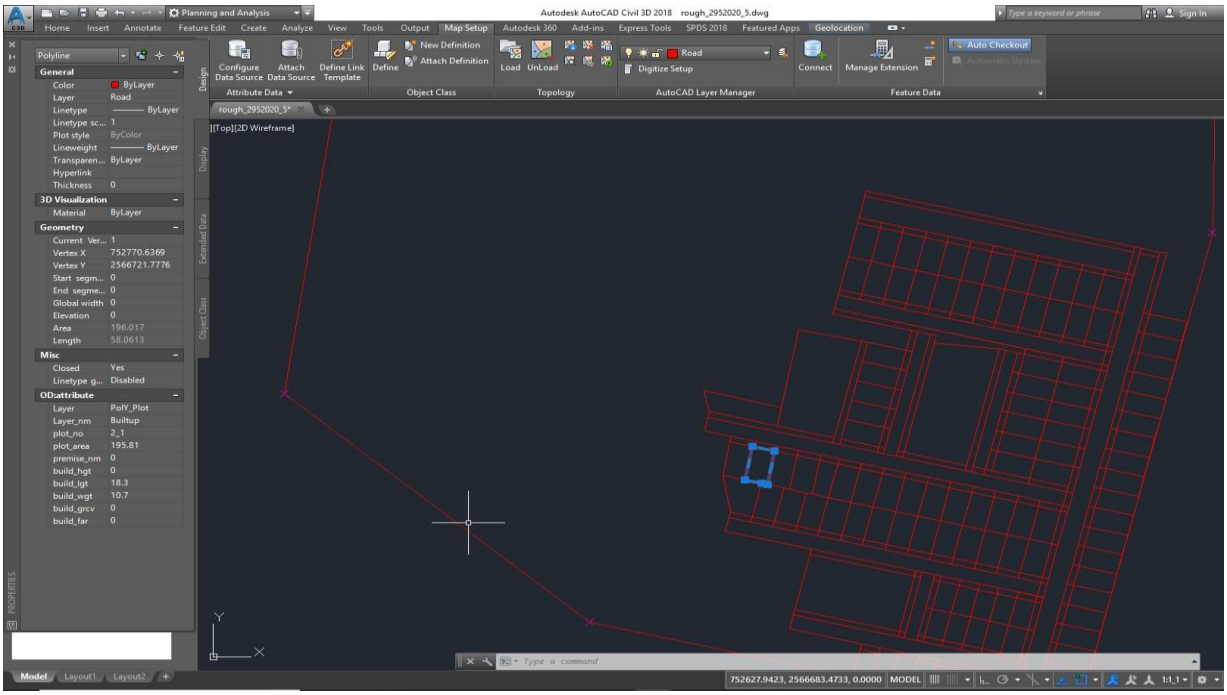
- To enter the attribute in every feature, user will use “ADEATTACHDATA” command.

Figure 28 - Attributes selection



- To enter the attributes, user will open the properties of object data.

Figure 29 - Attribute selection

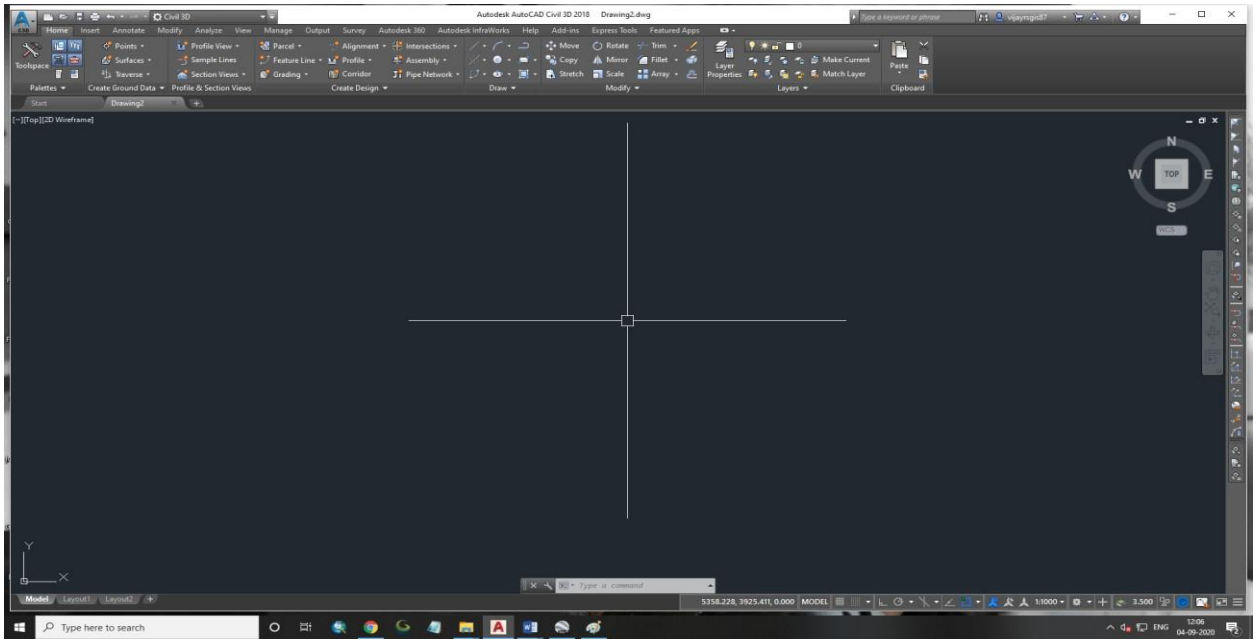


- Now user will select single or multiple features and add their values in their respective fields in left panel.
- Now all the process is completed and export is remaining, before using export options, user should ensure that every polygon feature have correct attributes.

6.7. Projection conversion (UTM to Geographic)

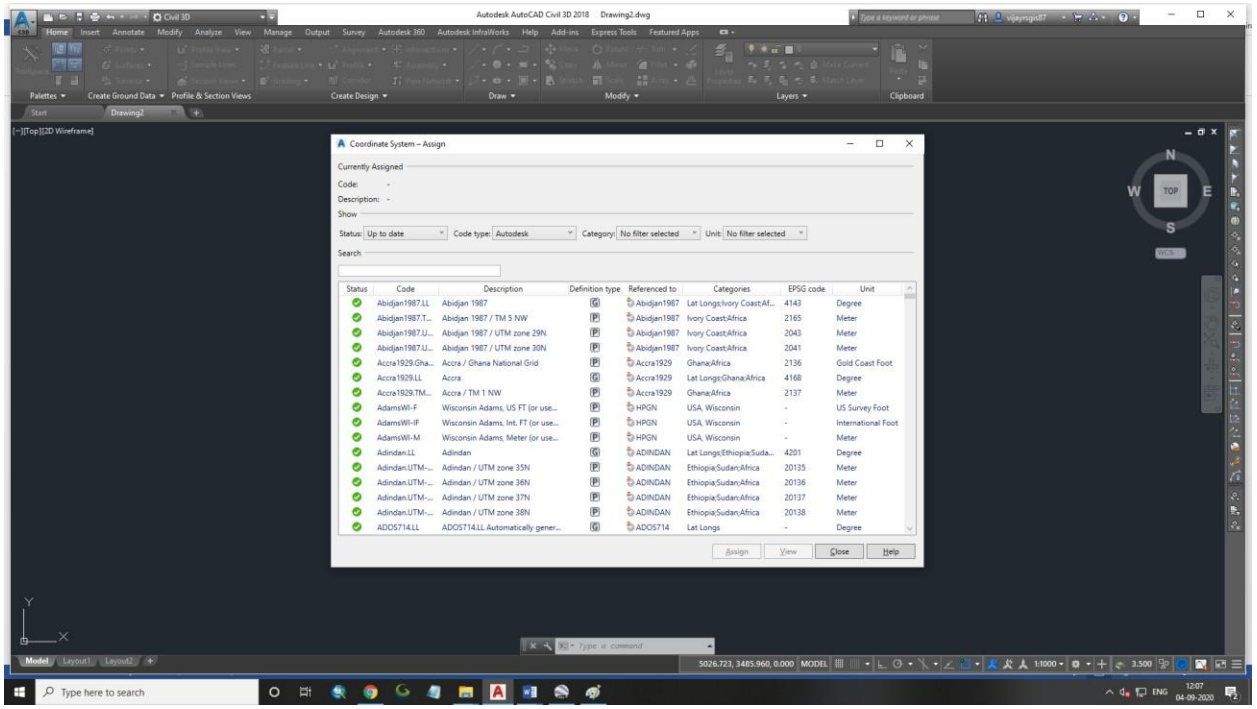
- Now Users need to change coordinate system (UTM Northing-Easting to GCS).
- User should open a new empty template drawing.

Figure 30 - Blank Template



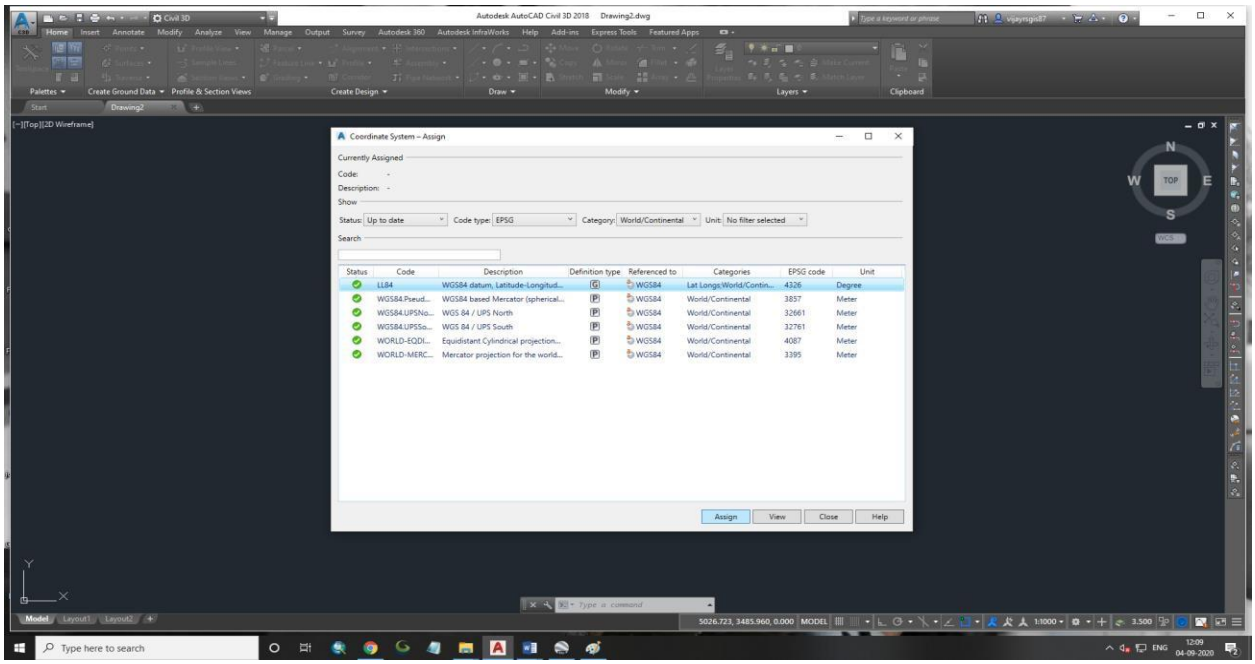
- Assign the target coordinate system (command - Mapcsassign).

Figure 31 - Assign coordinate system



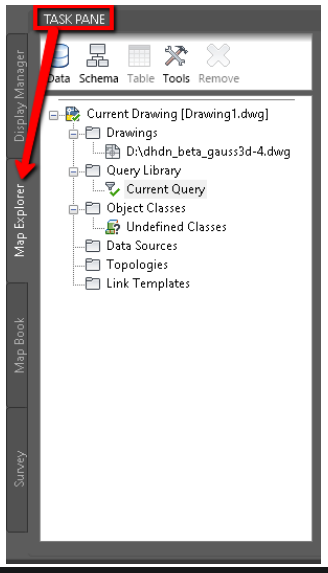
- Change Coordinate System as:
    - Code Type – EPSG
    - Category – World / Continental
    - Code – LL84
    - Description – WGS84 datum, Latitude-Longitude
    - Categories – Lat Longs; World/Continental
    - EPSG Code – 4326
    - Unit – Degree

Figure 32 - Coordinate system selection



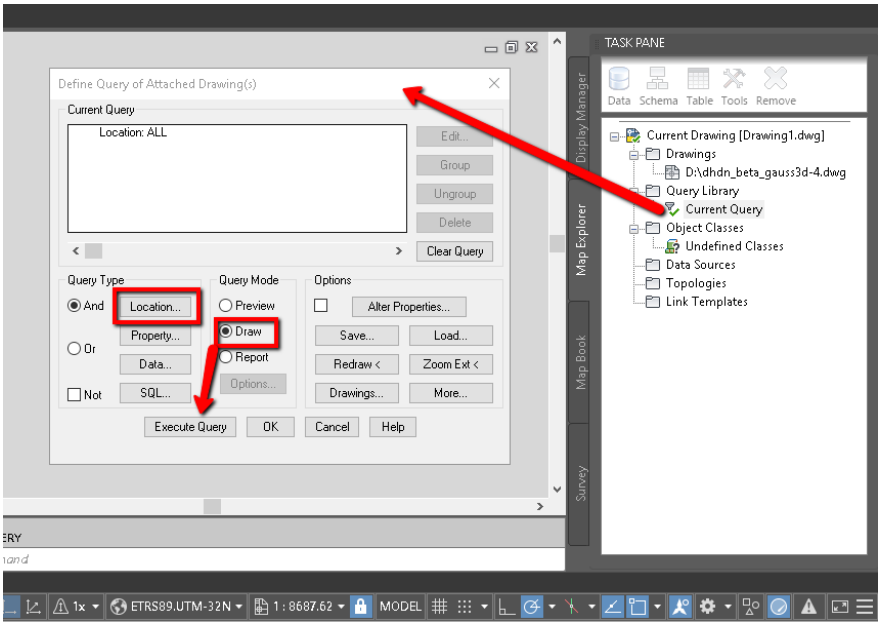
- Open Task Pane via command _MAPWSPACE on Tab Map Explorer.

Figure 33 - Task Pane



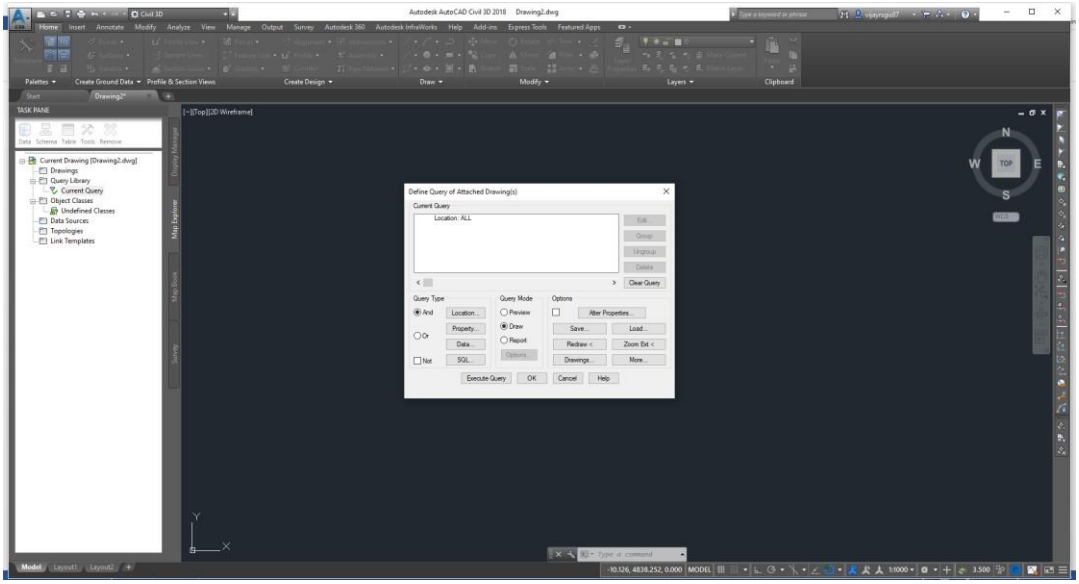
- Attach the drawing above with the output coordinate system using drag & drop from Windows Explorer to Task Pane
- Create a Query with settings to draw mode

Figure 34 - Define query



- Execute Query
- As a result, all objects will be requested as a copy to the new drawing (Geographic) and all data are transformed to the coordinate system of the current drawing. Remove the output drawing (UTM file) in Task Pane and save the new drawing.

Figure 35 - Define query

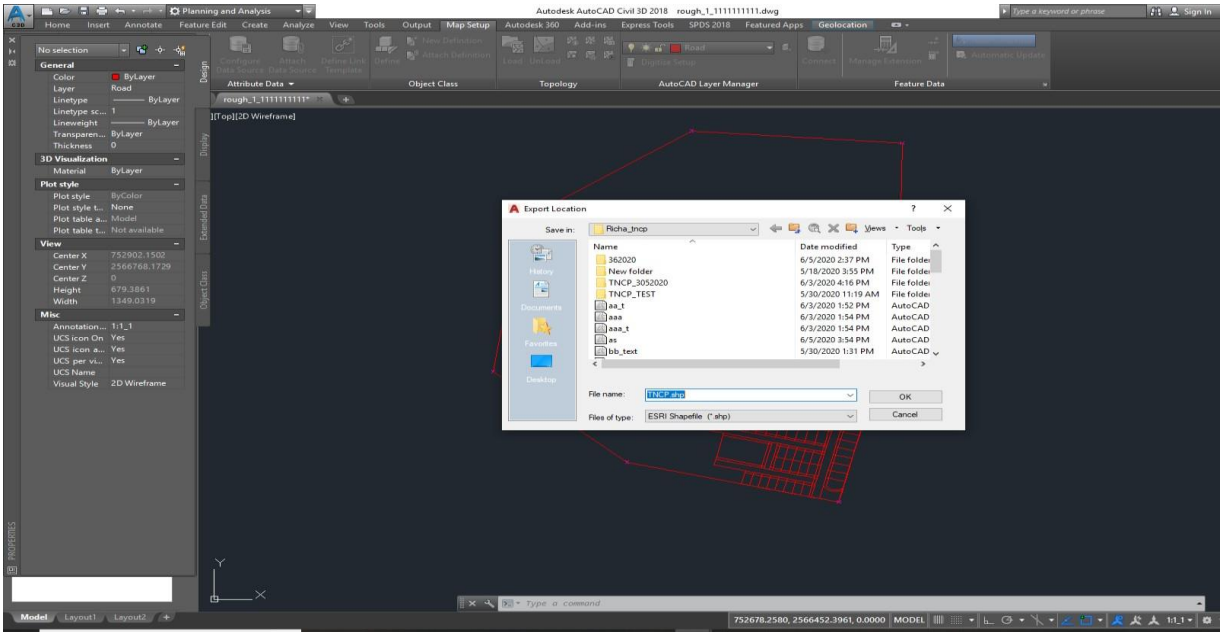


- Drawing file will show latitude and longitude at the bottom.

6.8. Map Export

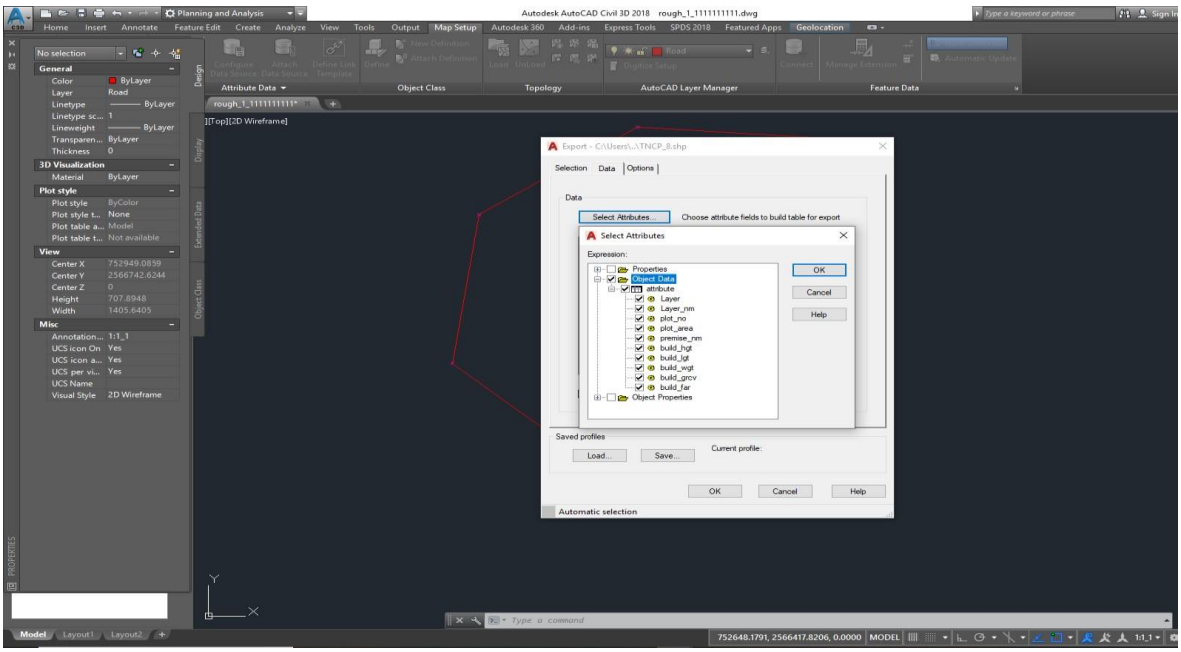
- To export drawing as shape file with same projection user will use “MAPEXPORT” command.
- System will prompt for export location; user will specify export location and defined name as PolyData.shp.

Figure 36 - Export Shape file



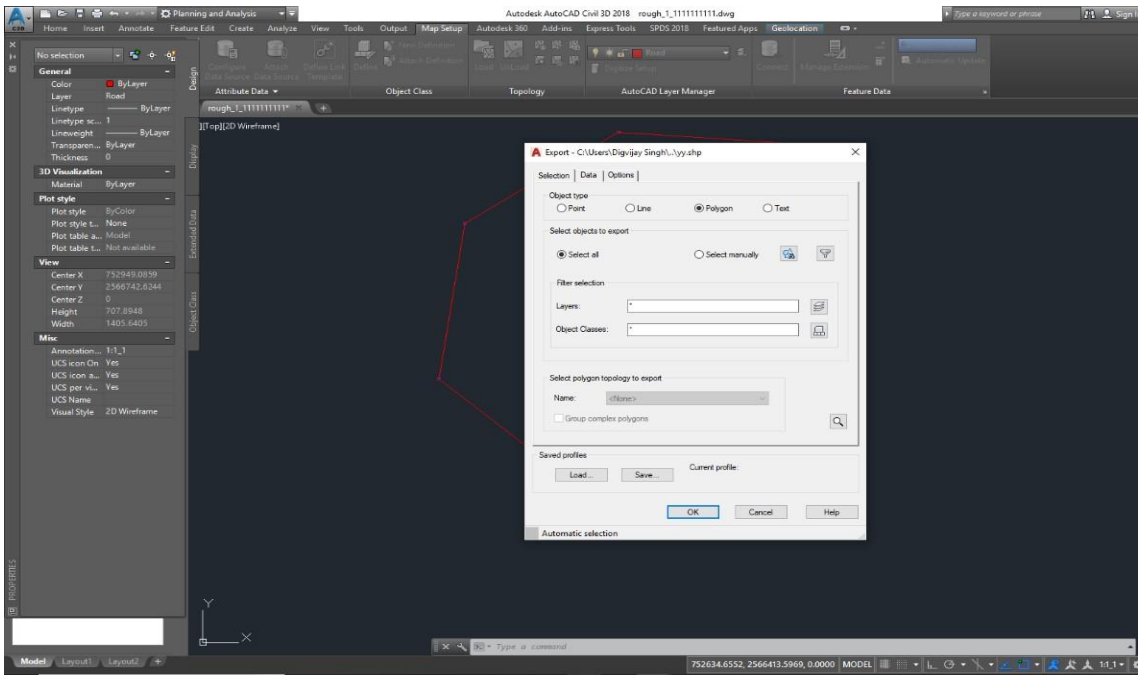
- After path section, select data tab and select attribute – object data

Figure 37 - Attribute Selection



- Select polygon in selection tab and press ok.
- Shape file will be saved on defined path.

Figure 38 - Polygon selection



- In the same way, user should draw other files (LineData, Location Plan, and Khasra Plan) as per defined schema and export to shapefile.

7. DELIVERABLES

User shall create zip files of the exported shapefiles. Details of zip files are as follows; User should ensure to kept same nomenclature as specified in this document and export the zip file.

Zip Folder 1 – This folder contains PolyData and LineData. Name of this folder will be *LayoutPlan.*

Zip Folder 2 – This folder contains Location data shapefile. Name of this folder will be *LocationPlan.*

Zip Folder 3 – This folder contains Khasra Plan shapefile. Name of this folder will be *KhasraPlan.*

**********End of Document**********