Learn Guide

OPENROADS DESIGNER LEARNING GUIDE

Bentley

LET'S START TO LEARN OPENROADS

Prepared For:

Beginner Level

Prepared By:

SUCCESS SERVICE TEAM – CIVIL CONSULTANTS INDIA

Key Use

Highway/Road Design
Geometrical Design
Project Cost Estimates
3D Engineered Model
Terrain Modelling (DTM)
Automated Plan Profile

Who Can Refer?

Highway Design Engineers
CAD Engineers, Students
Transportation Professionals
Pavement Design Engineers
MX Road/Civil 3D Users
Quantity & Billing Engineers

About

3D BIM (BETTER INFORMATION MANAGEMENT) ROAD DESIGN

Today's transportation market is evolving from linear project delivery methods to an integrated approach. With a need for all stakeholders to collaborate and offer expertise in the early stages of a project, roadway designers and engineers require software that seamlessly collaborates across disciplines, innovatively supports growing industry demands, and efficiently performs to meet increasing contract requirements.

OpenRoads Designer (ORD) introduces a new comprehensive modelling environment to provide construction-driven engineering to help accelerate project delivery of road networks, unifying design, and construction processes from concept to completion. The application provides complete detailed design capabilities for surveying, drainage, subsurface utilities, and roadway design. OpenRoads Designer redefines best practices for the generating design and construction deliverables and ensures the exchange of data throughout the project delivery and asset lifecycle.
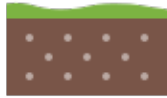
OpenRoads
CONNECT Edition

OpenRoads FEATURES
CONNECT Edition

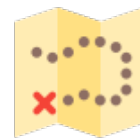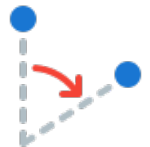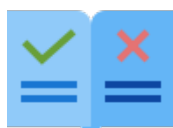|				
Terrain Modeling	Cut / Fill Volumes	3D Road Design	3D TCS Templates	Hill Road Design
Intersection Design	Rotary Design	Utility Modeling	Drainage Modeling	Quantity Estimates
Pre-configurations	Properties Change	Tabular Structured Data	1-Click Operations	File Autosave
Background Maps	Hybrid Maps	Bing Maps Integration	Geocoordinate Library	XYZ ACS Design
Multiple Reference	Multiple Alignments	Pavement Markings	Vertical Profile Design	Truck/Bus Laybys
Superelevation Editor	Kmz/Kml Import	Report Exports	Dynamic Measurements	A0/A1/A2/A3 Export
Design Speed Schema	Design Standards	DWG Compatibility	Organized Folders	Road Safety Designs
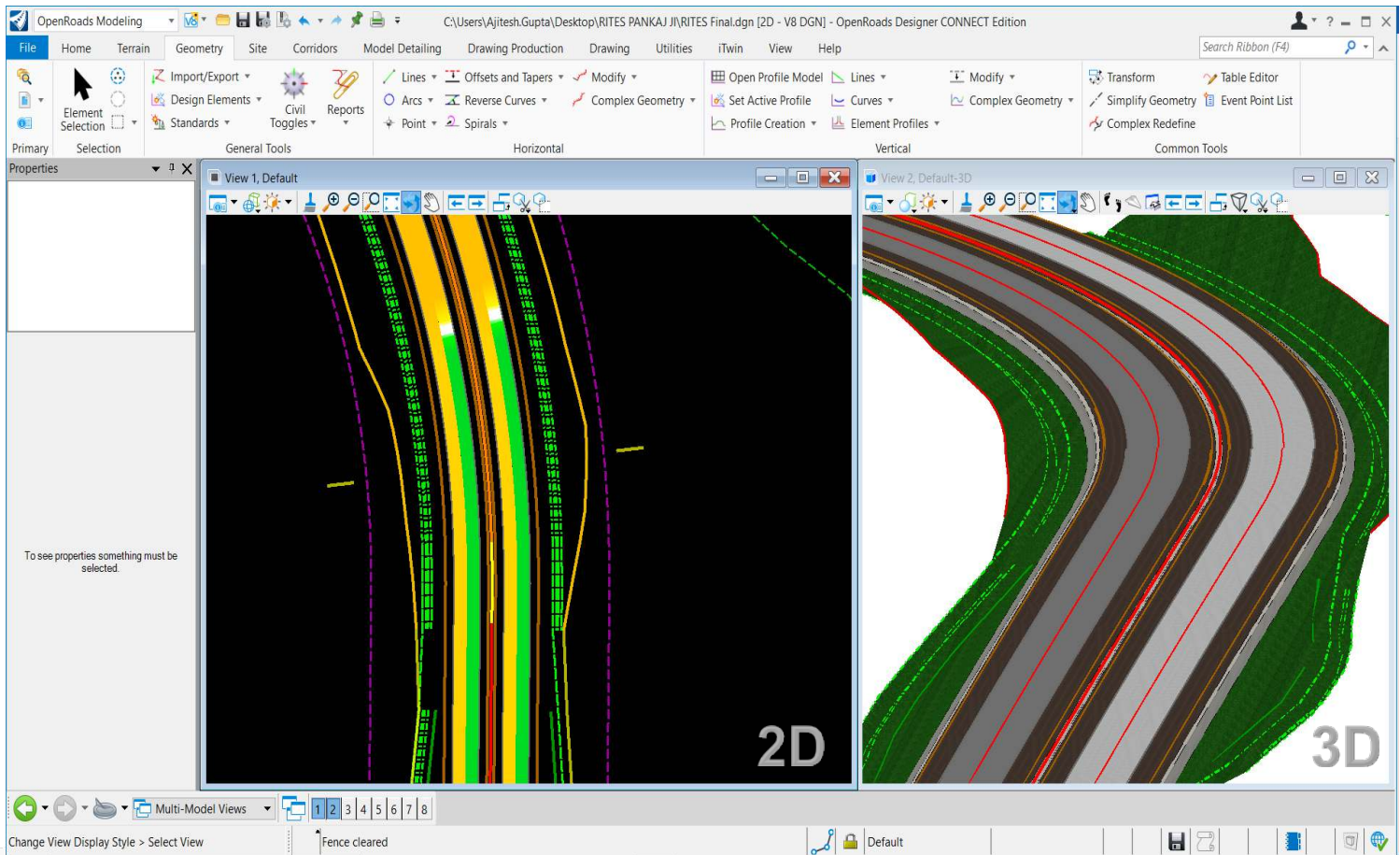
ADAPTIVE SIMPLIFIED LEARNING

FUTURE WITH OPENROADS

Many government and non-government organizations are working on projects with project specific requirement of 3D or 5D BIM compliance. Even the early-stage contract documents also mention to carry out the project in accordance with 3D/5D BIM. It is expected that in future the conventional practice of project accomplishment will be replaced with these compliances. One of the recent examples of 5D BIM compliant project was Nagpur Metro (NMRCL). So, it is worthy to go for such advanced high-end technological software which can cater the present and futuristic project requirements.

"Design is not about how its looks like, it's also about how it works"

Let's Do It

ROAD DESIGN CHALLANGES

Different and multiple file formats of design files. No autocorrelation b/w elements of road design. No design change after annotation update, re-work required. Only 2D interface, No simultaneous engineered 3D Output. Multiple files were shared with other teams, so project was not synchronized which led to work repetition.

SOLUTIONS BY OPENROADS

ORD Provides you completely parametric modelling with advanced GUI with single file format (*.dgn). In ORD all the elements are autocorrelated with dynamic and robust editing on the go. It remembers the relationship and is much simplified and easy to adapt. It has been power packed with many automation processes like instant drawing production for deliverables.
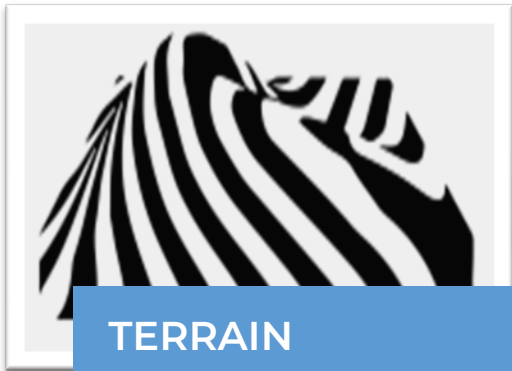
He has achieved success who has worked well, laughed often, and loved much.

ELBERT HUBBARD

# Design Components

ESSENTIAL ROAD DESIGN COMPONENTS

TERRAIN

A Digital Terrain Model (DTM) is a digital file consisting of a grid of regularly spaced points of known height which, when used with other digital data such as maps or orthophotographs, can provide a 3D image of the land surface.


ALIGNMENT

A Highway Alignment is 2D geometry line made from several individual elements such as straight lines & curves having specific length, direction, radius, and slope. Together they are united to form complex alignment.
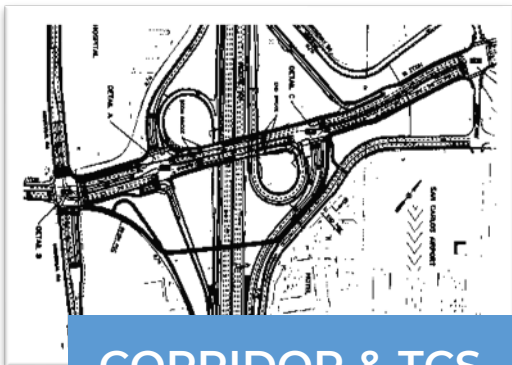
CORRIDOR & TCS

A Corridor is a collection of several templates with different start and end chainages. A template is a typical cross section of road having pavement layer widths, depths, cross slope, cut & fill slopes, median, retaining walls etc.
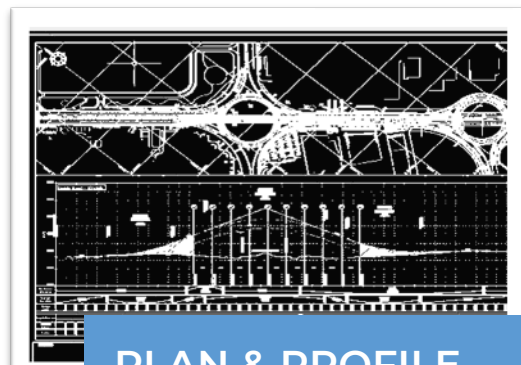
PLAN & PROFILE

A Plan & Profile drawing is used mainly for carrying out construction activities at actual site. A plan drawing contains straight & curve data and profile contains ground levels, road surface levels, horizontal & vertical schema.

C DESIGN COMPONENTS

why choose ORD?

WE ARE CREATIVE

Parametric Modelling

Single File Platform (*.DGN)

Elements are Autocorrelated

Dynamic and Robust Editing

Both 2D and 3D Output

Precise Engineering

LEARNING

1. **SURVEYED TERRAIN MODELING**
2. **ROAD GEOMETRY DESIGN**
3. **TEMPLATE & CORRIDOR DESIGN**
4. **SUPERELEVATION APPLICATION**
5. **DRAWING PRODUCTION**
6. **BEST PRACTICES OF USING ORD**
7. **FREQUENTLY ASKED QUESTIONS**
   NOTE: PRACTICE DATASET

Testimonials

MARTIN SMITH // STRUCTIRAL ENGINEER

Extremely powerful Engineering product which offers the ability to create accurate and professional models based on alignment style. The drainage designing and the ability on Road's design production and the coordination environment offered by OpenRoads Designer is good.

TEJSINGH RANA // PROJECT MANAGER

We are using it for all the infrastructure (road) projects we work on. We use it for design, analysis, and plan production of the infrastructure projects from start to end of the design period. It is very suitable for any widening, reconstruction, or new road projects where we need to look at the different alternative or alignments in 3D and then produce 2D plans using the 3D model

LINA MONICA ALI // BIM MANAGER

Though it took a fair bit of trying to understand the workings methods and environment of OpenRoads (especially for those transitioning from older versions), once familiar was quite helpful in speeding up the design & modelling works.
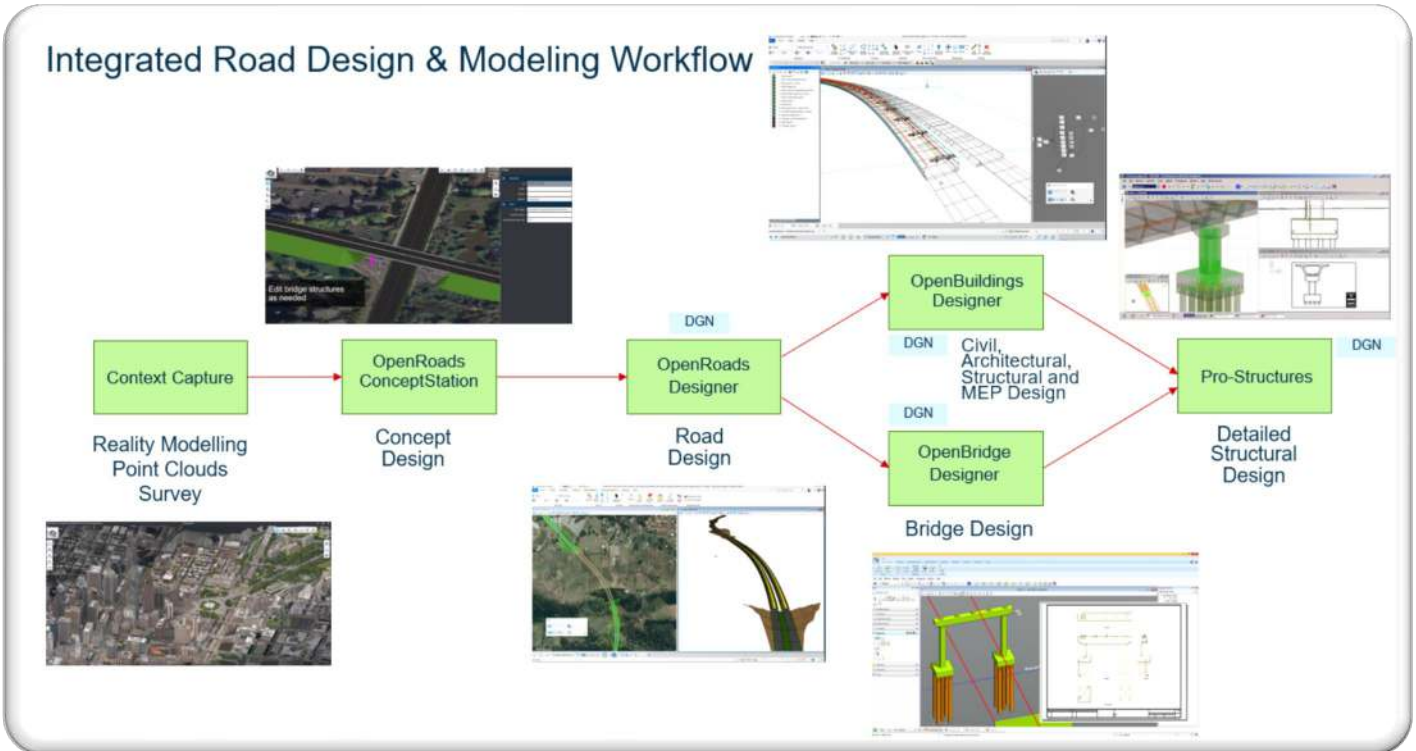
WARREN MCLACHLAN // ENGINEER

ORD is really focused on modeling of roads infrastructure projects but includes a few design workflows that are in other disciplines such as stormwater and drainage design and site modelling tools for developments. This is handy because you don't need a third-party application that you have to transfer your design files over to carry on with the project. Including LumenRT for free with ORD is by far the most helpful feature because of the visualisation capabilities which most software does not include.
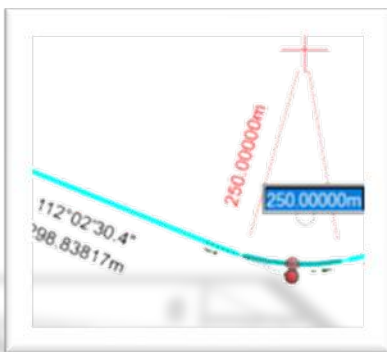
E TESTIMONIALS

" Multi-Disciplinary

Integrated Road Design & Modeling Workflow

OpenBridge Designer — CONNECT Edition

OpenRoads ConceptStation — CONNECT Edition

OpenBuildings™ — CONNECT Edition

ContextCapture — CONNECT Edition

OpenSite — CONNECT Edition

MicroStation — CONNECT Edition

SYNCHRO™

ProjectWise — CONNECT Edition

Power Capabilities

FOR COMPLETE ENGINEERED ROAD MODEL DESIGN

PARAMETRIC MODELLING

Easy alignment drag & drop with 1-click increase & decrease radius, line length, direction. View terrain contours change typical cross-sections using properties and quick heads-up display.
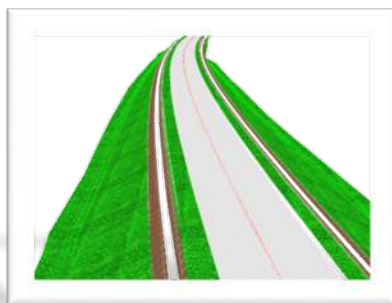

SIMULTANEOUS 3D MODEL

With the terrain, 2D road plan & profile geometry, templates, corridor. ORD itself creates an engineered 3D model. Dynamic Cross- Section view at desired chainages & intervals with cut/fill details.
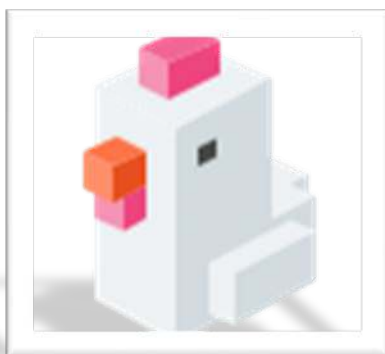
DRAINAGE & UTILITIES MODELING

3D Network modelling of Water, Effluent, Sewer, Electrical, Re-use, Fire, Stormwater can be done for Smart City Projects. Utility Clash checks can also be performed using OpenRoads Designer.
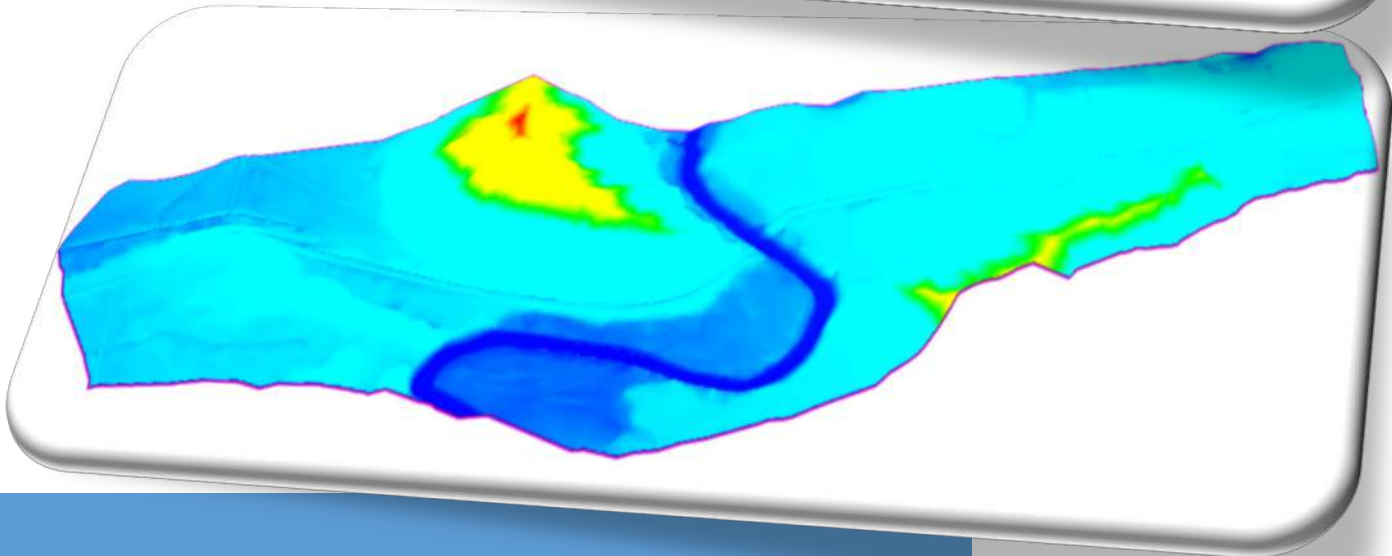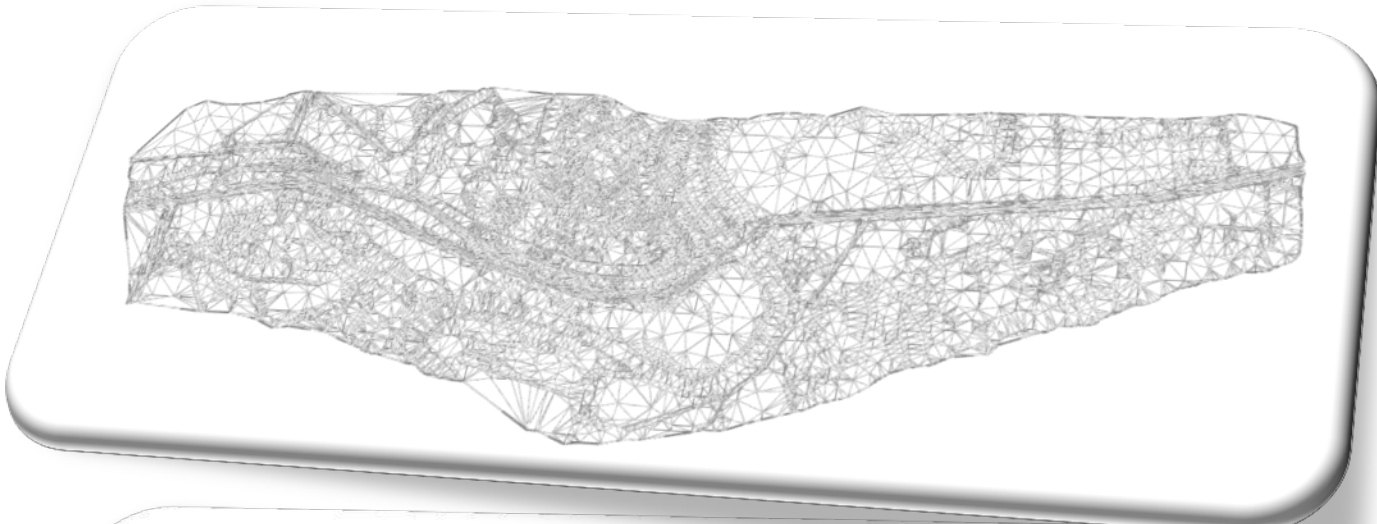
Terrain Modelling

From Survey Data

Introduction to Ribbon Interface Feature Definitions & Element Templates

Learn Series recording link (Session 1)

1. Select Workspace – Training & examples – Country specific Standards / Country kits / FoldersWorkset – Training matric – team specific
2. Seed file for a new file – 3D only for terrain / 2D for alignment, c/s, superelevation etc.
3. Dropdown – Top left corner – "Workflow" – mainly ORD Modeling
4. Templates => TCS; Corridor => Collection of templates (Project)
5. Civil cells – Intersections/Truck lay byes/Bus bays
6. Keep checking the file names for 2D and 3D
7. File > Save settings – Top view in new window opens fresh
8. Tools > Compress file > heavy file – delete unnecessary files (40 mb to 8/10 mb)
9. Undo > Set mark > Stepwise undo is done all at once

Summary of useful tabs & tools:

1. **Home: Element/Level manager**
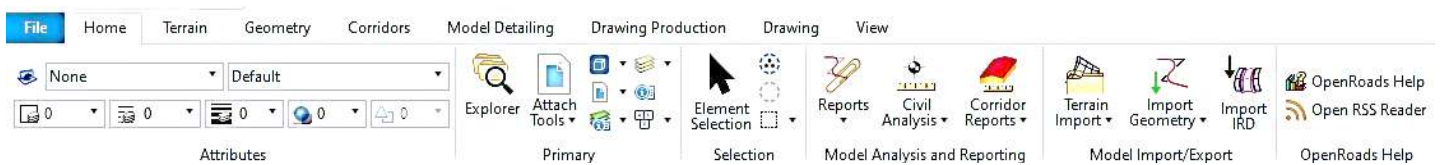
1. Explorer – 1) File: dgn file subsets, 2) Items, 3) Model & contents, 4) Sheet index, 5) Standards, libraries, 6) Subsurface utilities model, 7) Survey
2. Don't work directly on terrain – work separately on 2D alignment & attach.
3. Properties -sheet index
4. Element selection/escape – to come out of any command
5. Search ribbon – search for any forgotten command – displays the path also!
6. Notification window is attached to curser to indicate what our next action should be after entering into a particular command.
7. Using alignment & TCS (Template) – OR creates 3D engineered model.
8. Reports – complete quantities & much more
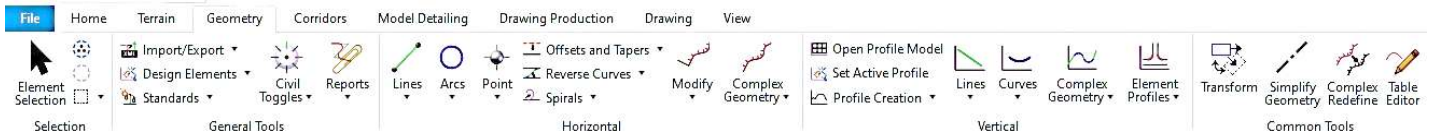9. Dropdown – Visualization – LumenRT

2. Terrain:
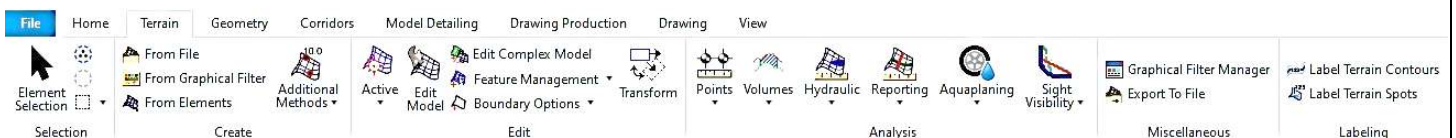
1. Create – 1) From file – import from various (12-14) file types,
2. 2) From elements – CAD file (XYZ system) – Triangulate & create, 3) Most common is the point cloud from total stations.
3. Edit – 1) Set active, 2) Surveyor's errors corrections etc.
4. Labeling – Contours/spots labels
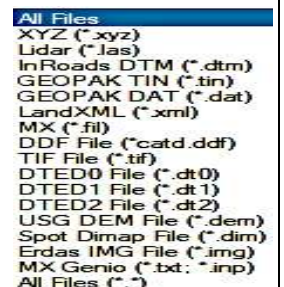
3. Geometry:

1. General tools – import/export geometry, set design standards, civil accudraw
2. Horizontal geometry design tools – lines, curves, reverse curves, tapers & offset
3. Vertical geometry design tools – lines, curves, complex geometry
4. Common tools – quick geometry in MX => table editor in ORD
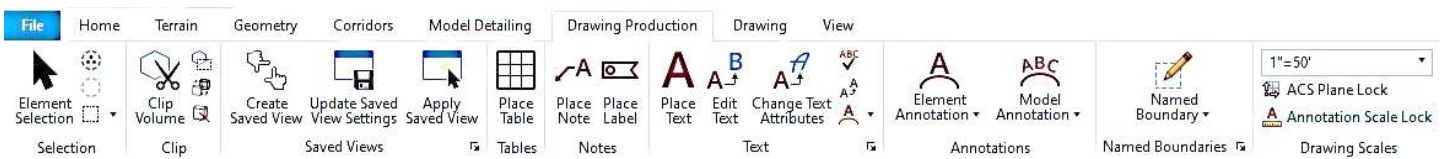
4. Corridor:

1. Template – only TCS – create/import/edit
2. Corridor – set of TCS + probable transitions
3. Superelevation – sections/lanes, edit, calculate, import, apply, assign

5. Model Detailing: Civil Cells:
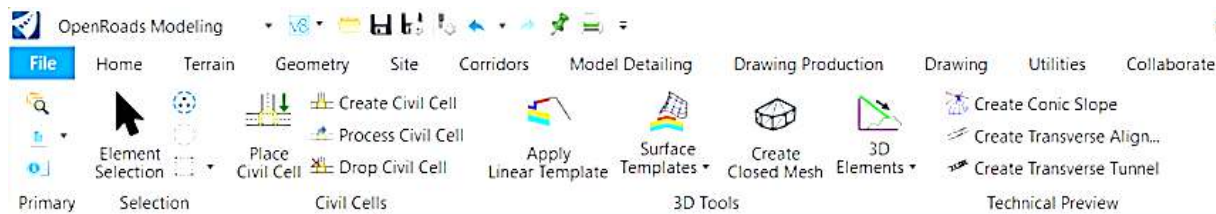

6. Drawing production: Named boundary

Steps to create Terrain (Digital Terrain Model) from Raw Survey Data

1. **From File**: various file type terrains direct import like dtm, xml, fil, tin, txt, inp
2. **Additional methods** – Ascii file (Total station – XYZ) (LIDAR/Drone – point cloud)
3. Browse > select file > window for import – create new text import setting file (.xml) – a) first line to import=2, b) feature type=spots, column delineators=comma, column mapping=assign titles, c) Geographic coordinate system all over world-click none if not sure, d) finish=save file like a std file to use repeatedly.
4. Feature definition > terrain > existing > boundary Import > complete > close window > Fit view
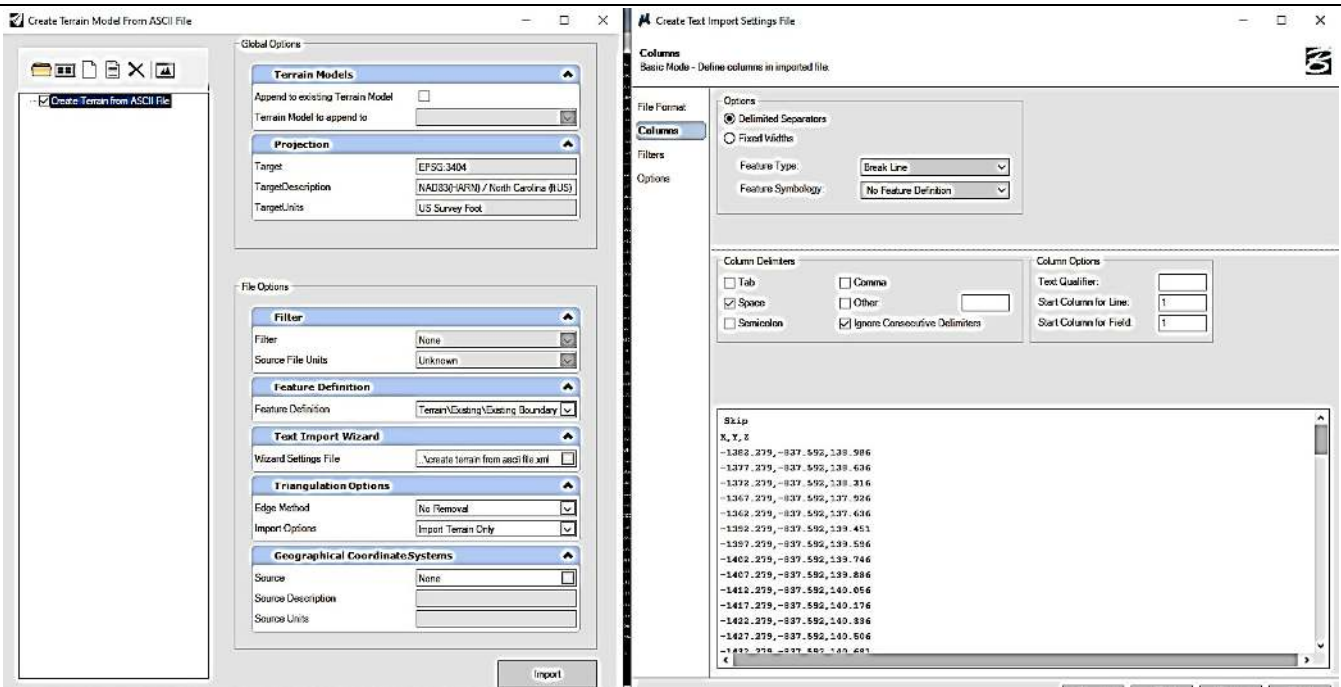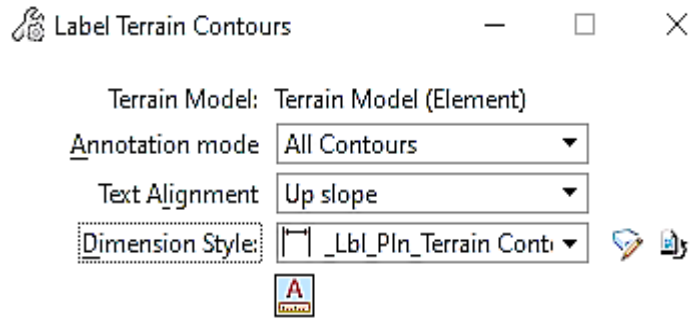
How to import CAD spot level terrain? (From graphical filter)

1. Home > Attach tools > references > attach CAD file >Attachment method - Coincident world > Fit view
2. Terrain > From graphical filter > terrain filter manager > Select existing filter OR create new filter (General – name, description, feature type (e.g., spot) & edit filter (preview); Filter by – e.g., Levels; then finish & again select created filter) > triangulation option – remove slivers > feature – existing boundary
3. Then select terrain > properties > Edge method – Max edge length (100).
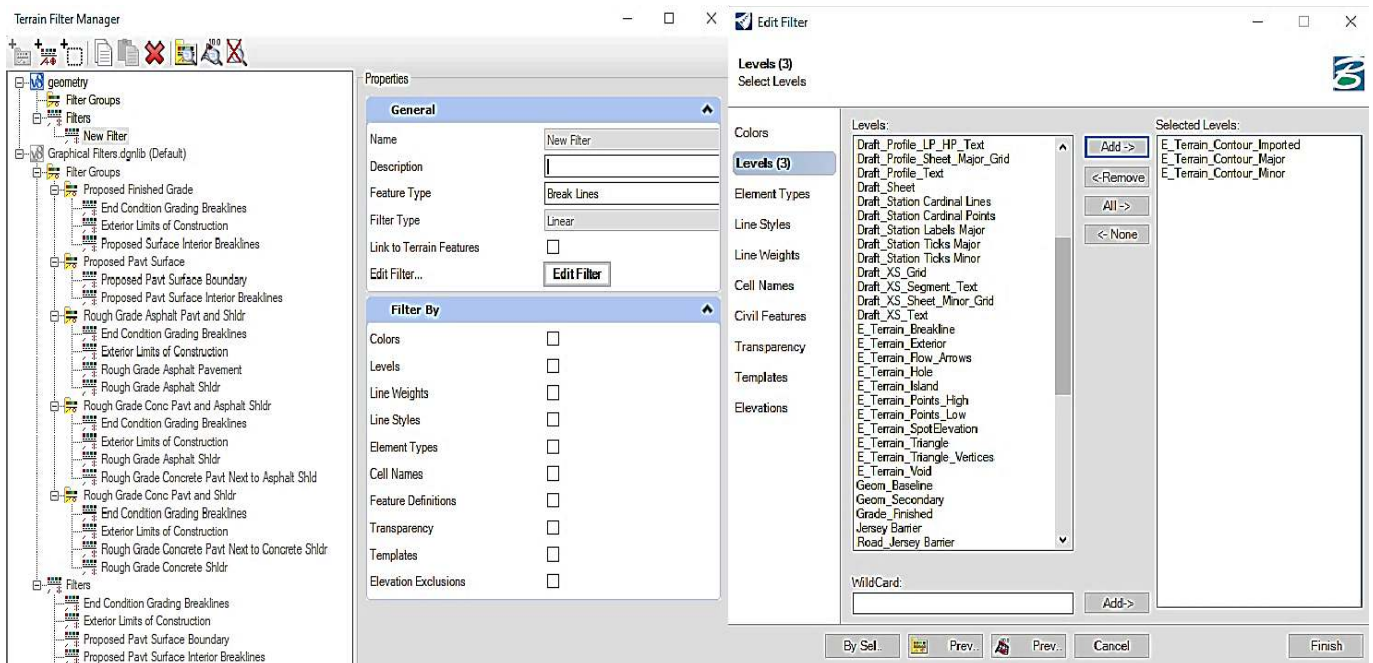
4. Element selection > select > hover > properties >toggle buttons > switch ON
5. To limit the boundary, Switch ON spots & set edge method to Max Edge method (Value in m)

Name	Active Terrain Model: Terr
Feature Name	Terrain Model (Element)
Feature Definition	Existing Boundary
Number of Points	52,215
Number of Point Featu	6
Number of Islands	0
Number of Voids	0
Number of Features	6
Number of Contours	0
Number of Breaklines	0
Number of Triangles	98,576
Edge Method	Max Edge Length
Length	40.000'
Major Contours	On
Minor Contours	On
Triangles	Off
Spots	Off
Flow Arrows	Off
Low Points	Off
High Points	Off
Breaklines	Off
Boundary	On
Imported Contours	Off
Islands	Off
Holes	Off
Voids	Off
Feature Spots	Off

Label Terrain Contours   —   ☐   ✕

Terrain Model: Terrain Model (Element)

Annotation mode   All Contours ▼

Text Alignment   Up slope ▼

Dimension Style: ⊢ _Lbl_Pln_Terrain Cont ▼

6. Labeling > label terrain contours > select terrain > all contours, follow line, Lbl_Pln_terrain contour elevations & Drawing annotation scale (increase to make visible).

7. Terrain import – From elements (CAD file) >select elements >Feature type break line>LC (Terrain filter manager Feature type break line for those features which we want to include in trial & drape void for those features which need not be included e.g., buildings – Levels: E_site_building & E_struc_building etc.), Feature definition – existing triangles.
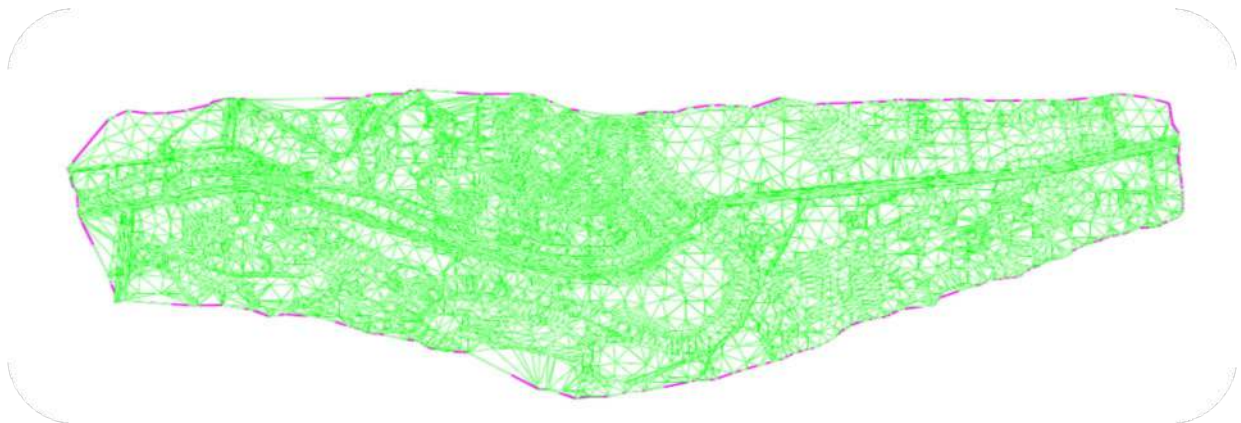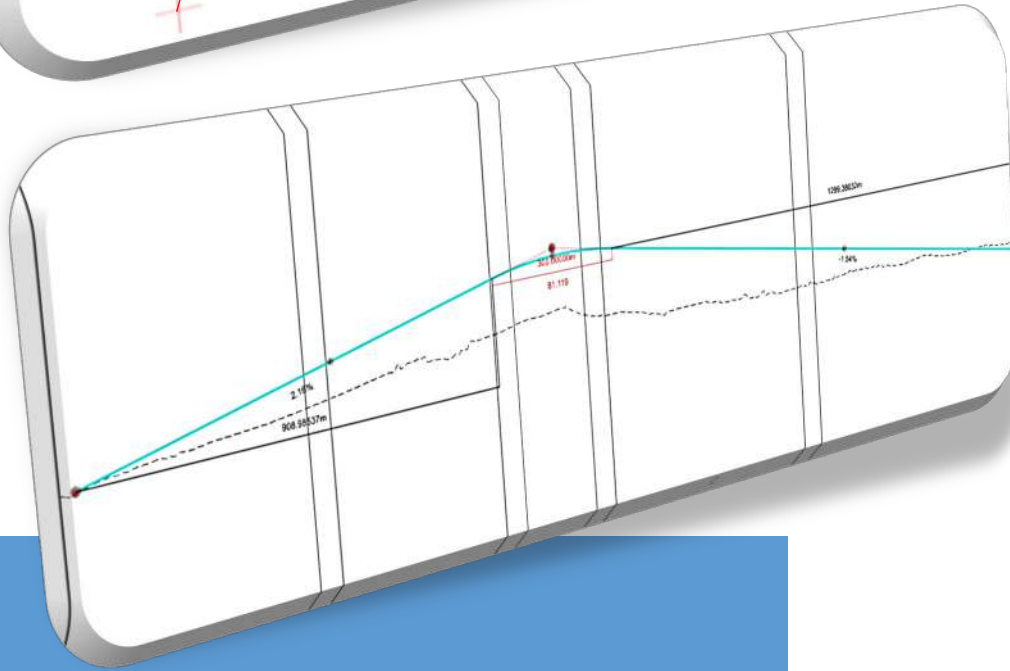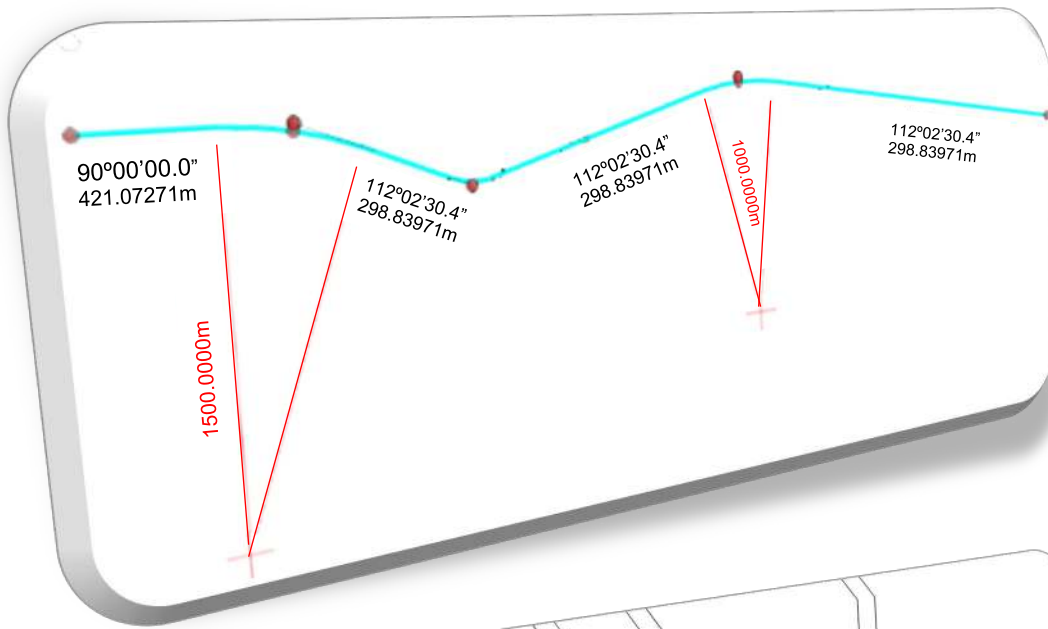
Alignment Design

Horizontal Plan & Vertical Profile

Geometry Design of Roads (Horizontal & Vertical Alignment)

Learn Series recording link (Session 2)

1. New > Seed 2D (2D – V8 DGN in the window top file name) (we can change/create seed file, default settings & view ports)
2. File > Settings > File > Design file settings – to set the working units.
3. Default views settings: Horizontal geometry – View 1; Vertical geometry –View 3; 3D – View 2; Dynamic sections – View 4.
4. Import 3D terrain as an attachment to 2D file for geometric design:
5. Home > Attach tools > references > attach DGN already created terrain file > Attachment method - Coincident world; Nested – Live nesting (depth=99) > Fit view
6. Select terrain & hover cursor > only 3 options should come > properties – no changes allowed, all options grey, if we want to display contours, override symbols=yes then switch ON.
7. Select terrain & hover cursor > Set as Active terrain model
8. Long right click anywhere > View control > 2 views Plan/3D
9. Home > Primary > Models > Check the default 2D model & the attached 3D model which gets displayed as a result of setting "Active terrain model" (it gives – default terrain for design & automatically creates 3D model).
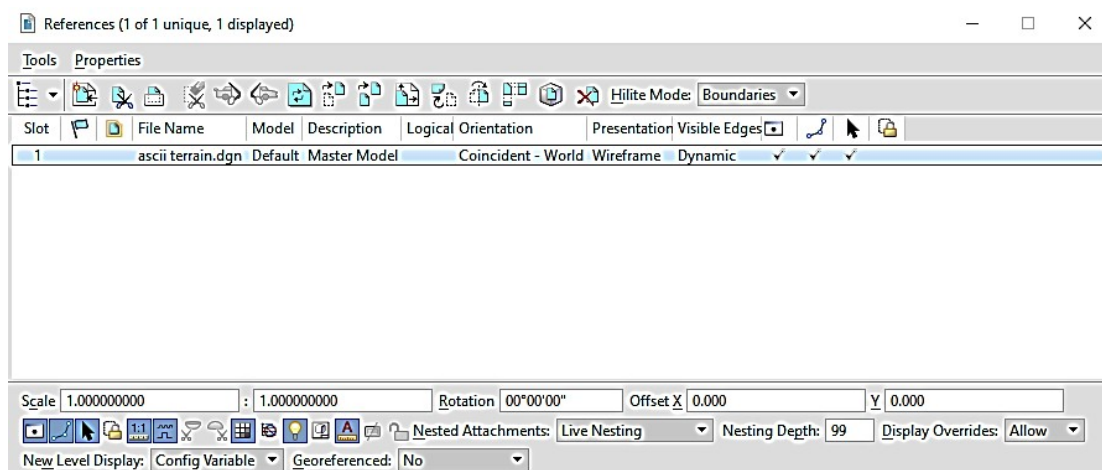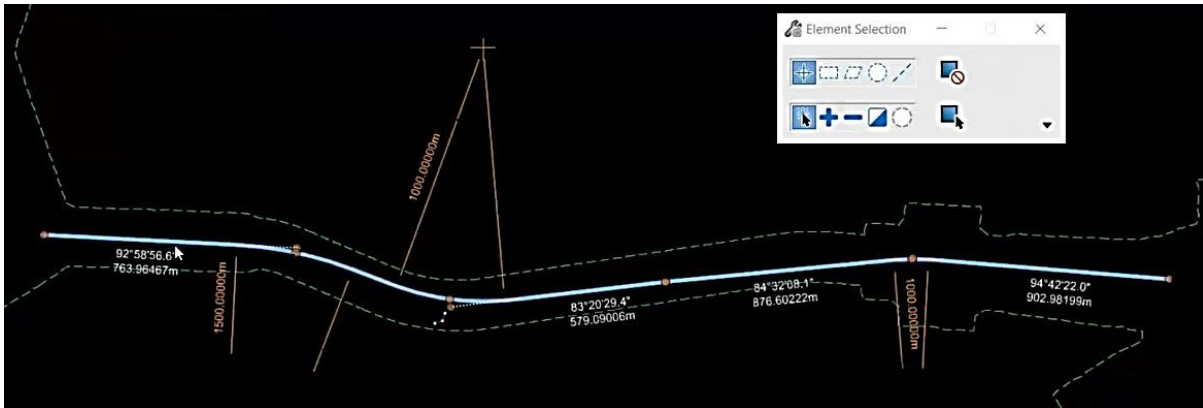

1. Horizontal Geometry:

1. Civil accudraw toggle for entering alignment manually, anytime toggle for command.

2. Line between points > select feature definition Geom baseline, then General tools > standards > feature
3. def toolbar > chain command for continuous line points
4. Arc > Arc between elements > Simple for radius, spiral arc spiral for radius with transitions > select FD
5. radius locking & trimming straights options available
6. All lines & arcs design values can be altered manually
7. Horizontal > Complex geometry > Complex by element > automatic & FD > select first element in proper direction by observing arrow direction.

8. Horizontal > Complex geometry > Complex by PI > fix curve specs & create complex directly saving time, if needed values can be changed later
9. Using handles alter geometry or enter values manually by clicking on the orange text. Select/hover for Geometry report.

2. Vertical Geometry:

1. Select Plan centerline, hover for context menu & select 2nd option – 'Open Profile Model' & select view port 3 & click in blank space of view port 3 window.
2. Civil accudraw toggle for entering alignment manually, anytime toggle for command.
3. Lines > profile line between points >select feature definition Geom baseline, then General tools > standards > feature def toolbar > chain command for continuous line points
4. Curves > profile curve between elements > Parabola between elements
5. All lines & arcs design values can be altered manually
6. Vertical> Complex geometry > profile Complex by element > method- automatic & FD Geom baseline
7. select first element in proper direction by observing arrow direction
8. Vertical> Complex geometry >profile Complex by PI > fix curve specs & create complex directly saving time, if needed values can be changed later
9. Set active profile for further report & work
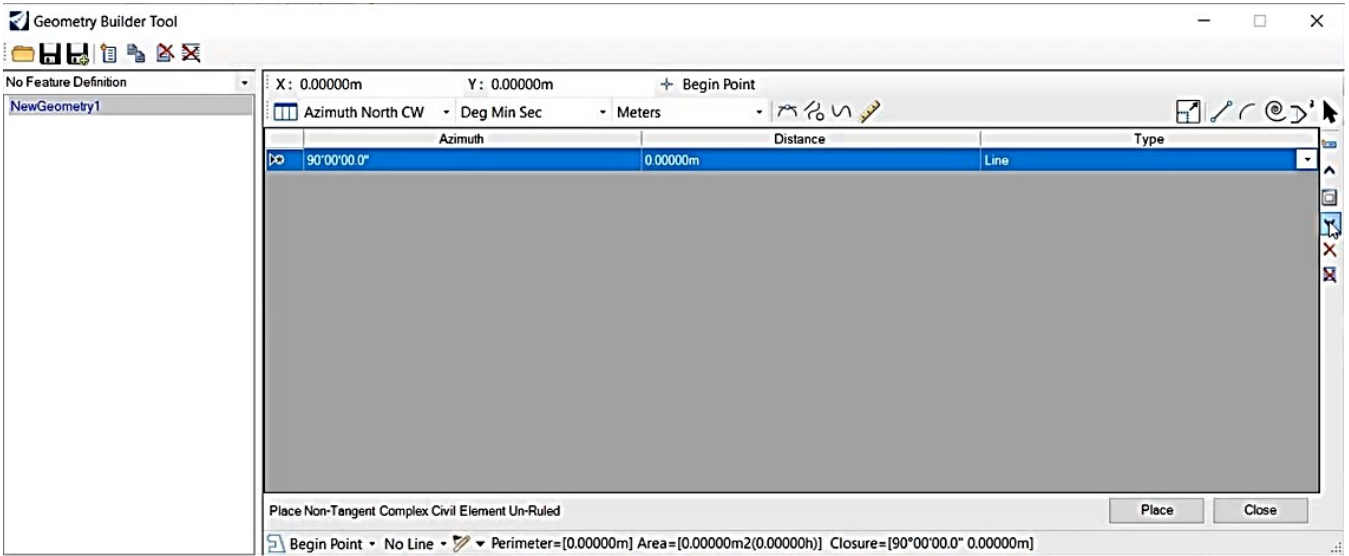10. Select/hover for Geometry report.

3. Other Important Geometry Tools:

1. Geometry > Common tools > Table editor – to manually edit the elements dimensions – Edit the required values and click Apply)
2. Geometry >Horizontal/Vertical>Geometry Builder – Coordinates manual editing for creating geometry
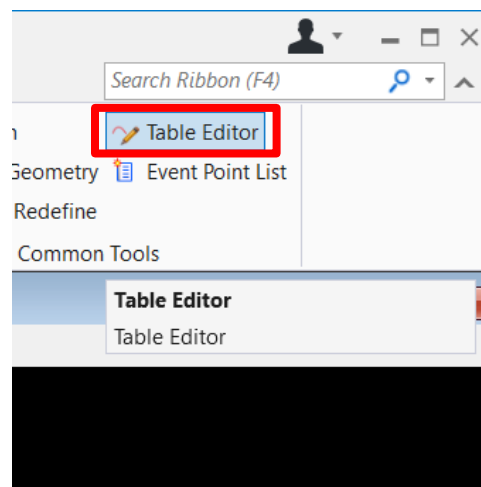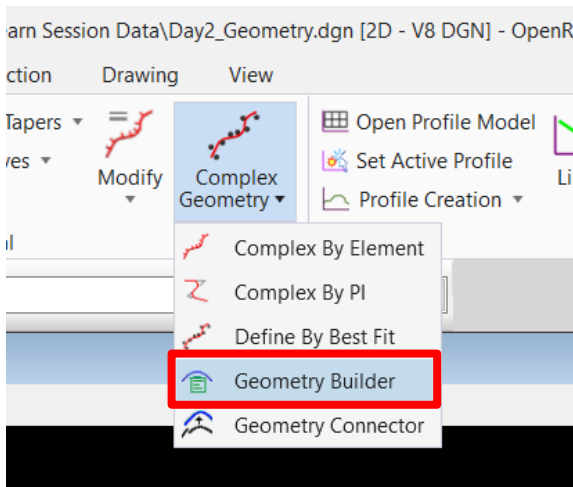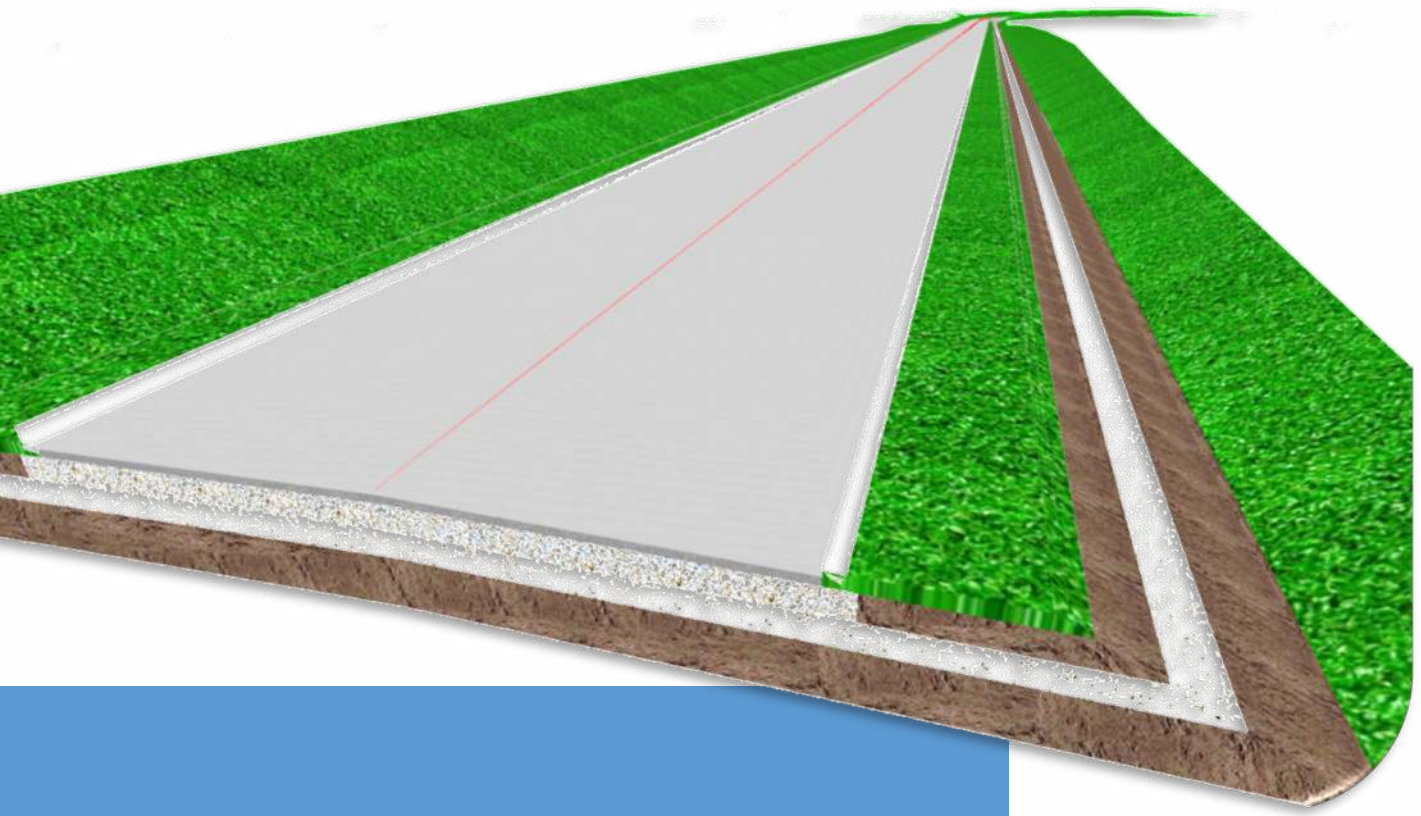
3. Geometry > Standards > Design standards toolbar > Select specific standard library file & click weighing balance symbol > Hover over warning symbol to see comment OR go to Geometry > Standards>Civil message center & check warning descriptions & do corrections.

4. Geometry > Standards > Speed table – for speed schemes – different speeds for different stretches

Corridor Modelling

## Templates (Typical Cross Sections)

1. Template Creation:

1. Template = TCS; Corridor = TCS schedule (Collection of templates)
2. Corridors > create > template > create template – opens new window
3. RC on any folder > New > template
4. Blank graph (Violet box = Origin – PCL (0,0)) – RC > Add new component
5. RC > Add component > Simple > Place the green point at origin and check/modify the constraints for other points (DC on point to open dialogue box)
6. Every point has 2 constraints – Mostly used are Horizontal, vertical & slope – to be taken from TCS diagram – obviously both the constraints can't be same category
7. Review & edit template
8. Assemble a New Template Backbone from Existing Components
9. Constraint's illustration (thumb rule – for a surface point, nearest left/right point or for a below point, top point).
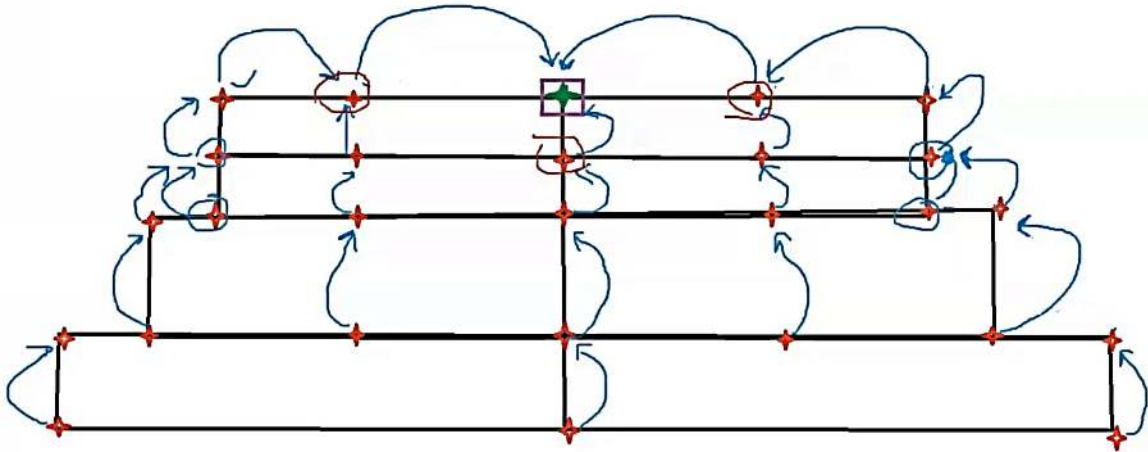
10. Point color coding – No constraint: Green, 1 constraint: Yellow , Both constraints: Red (All 3 colors come into picture for transition templates)
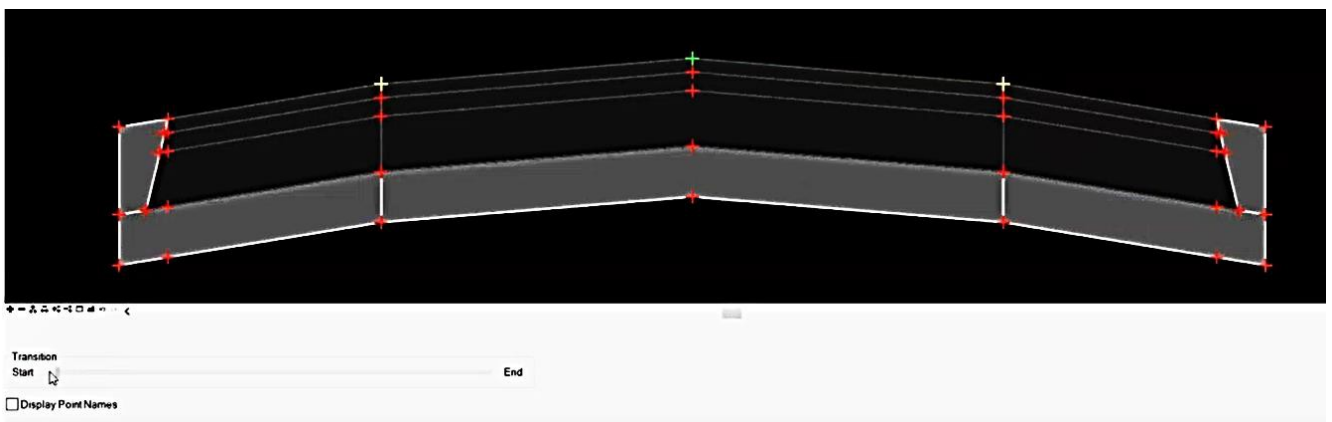

11. Create template (for one side of CL) using various components available in the library, we can change all the dimensions and constraints to suit our TCS.
12. End conditions: the slope of embankment outside the pavement structure w.r.t. the terrain. Hence end conditions are a set of sloped embankment lines. Choose a particular set from library and drag & apply.

13. After creating one side template, check its monolithic nature by moving the origin point (no layer should break).

14. Copy & paste template & then drag the same template into same template & while dragging on, just RC & click Reflect & join it to the existing template – both the sides of TCS are now complete.
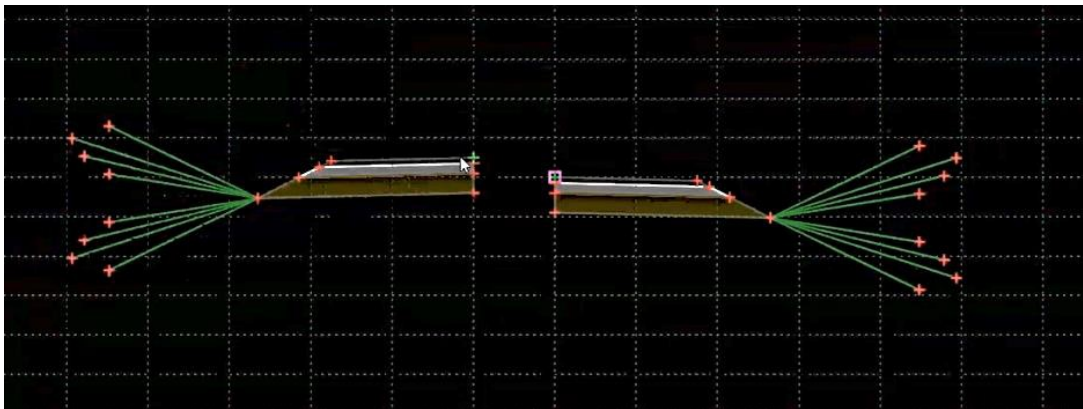

15. One more way to mirror is – create blank template & then drag one-side created template & while dragging on, RC & select mirror & click exactly on origin to join both sides.

16. After completing template creation, if needed, upto us to merge the LHS & RHS same layers by RC on central common boundaries & selecting merge components option.

17. Right bottom corner – Test: new dialogue box – set target as active terrain model & edit the surface slope if needed & click "draw", check the end conditions by hovering the cursor up & down. – Close.

18. End conditions also can be edited & dynamic.

19. For placing barriers, road markings etc., DC on the edge points at which we need barriers/markings & then select feature definition for that point accordingly. Then save the template and close template window. It will not reflect in the template view immediately, but it will be incorporated into plan and in subsequent 3D engineered model.

20. All template files in single .itl file, which can be the common central library for an organization using say, 10 OpenRoads licenses.

2. Corridor Modelling:

1. Since corridor is the collection of all templates in a project, we need to create a corridor FIRST.
2. Open profile model >select horizontal alignment > context menu – create corridor > name it ↵. (encasing appears around the horizontal alignment = corridor placed.)
3. Corridors > New template drop > alt+↓ > choose from template library > give start & end chainage for that particular template > optimum drop interval is 20/25 m > LC – template dropped.

3. Modelling of Approach Section (ROB/RUB) in OpenRoads Designer with Dynamic Retaining Wall Height & different Vertical Profile for Service Roads:
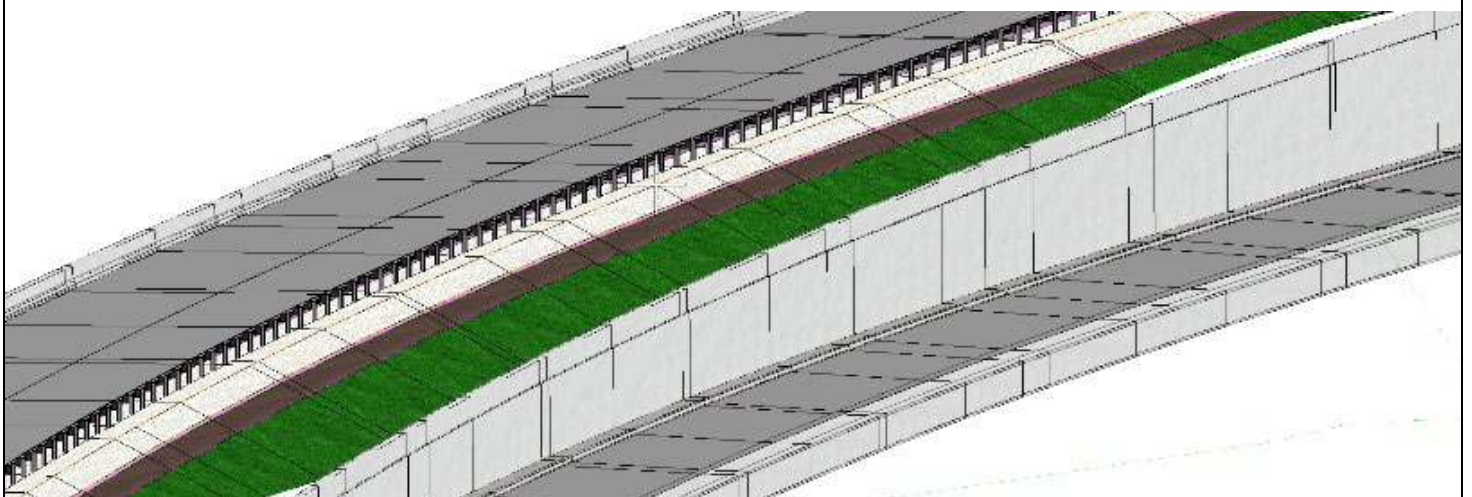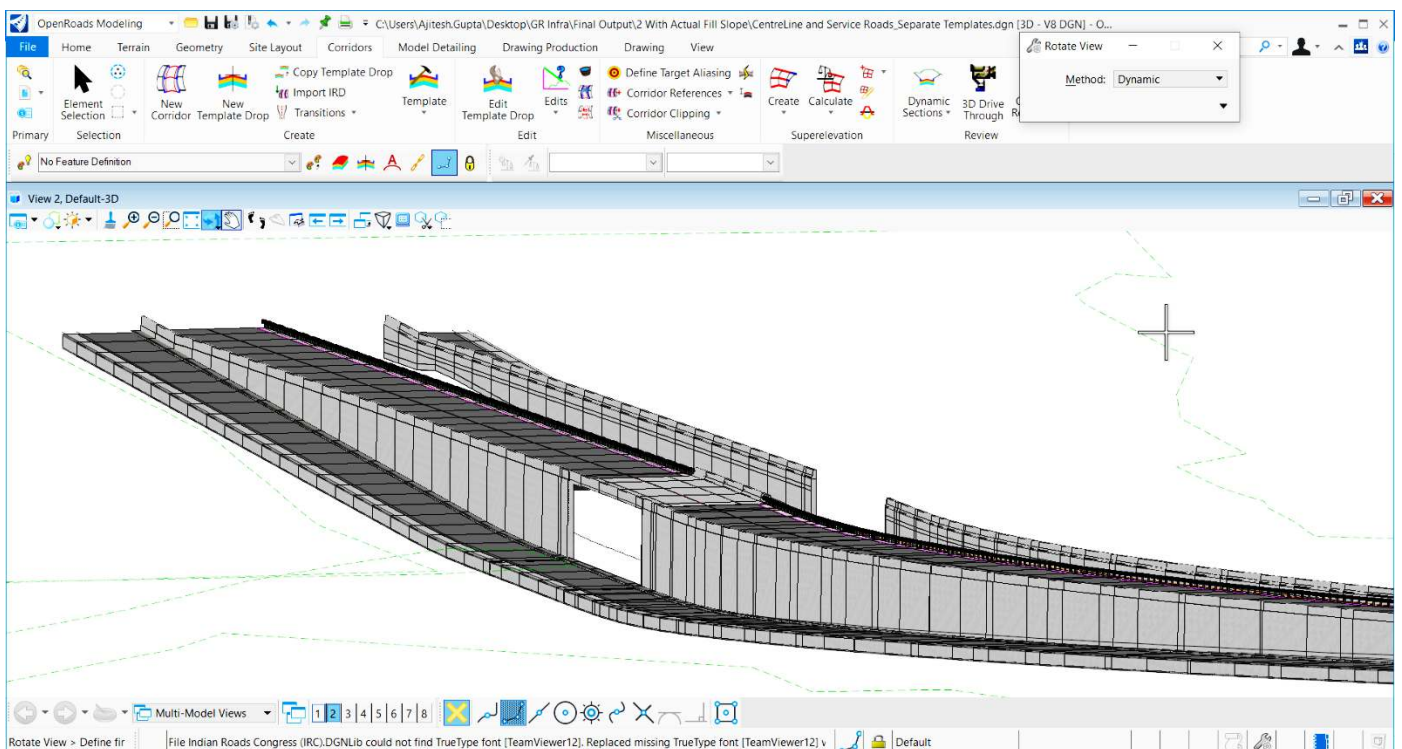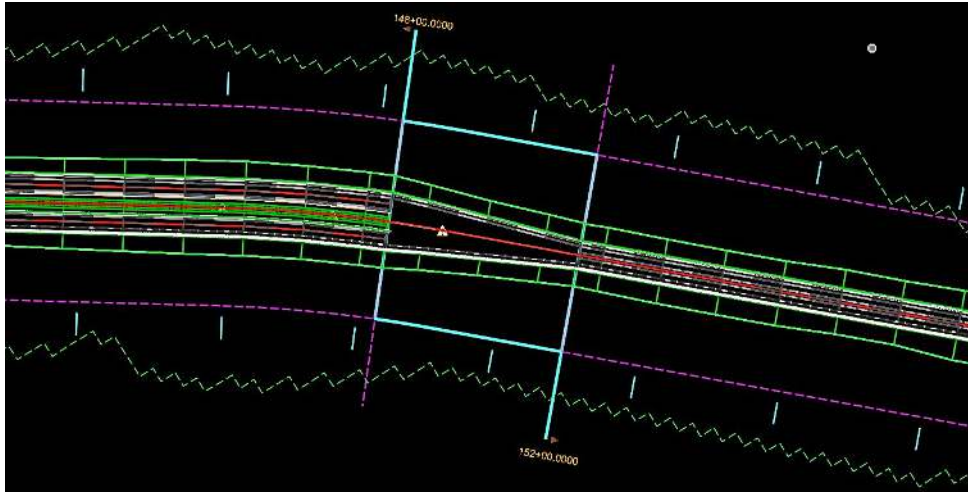
4. Violet dashed boundary& one sided large, dashed handle @ beginning (LHS)/end (RHS) – for template selection
5. Yellow/blue solid boundary &both sided small solid handles throughout – for corridor selection
6. Pale yellow solid boundary and one sided large solid handle @ beginning (LHS)/end (RHS) – for transition selection
7. Any change at any time, in the template just saves the template file in the library. To make it reflect in our actual design, select that template by clicking on violet boundary/handle & in context menu, select 4th option Synchronize with library.
8. Home > Primary > Explorer > Openroads model > dgn file > Corridors > RC on corridor name > Corridor creation tools > Corridor objects > multiple templates drop as per TCS schedule.
9. To change a particular template, just select by handle, & in context menu > properties > select another template from library.
10. Long LC on blank area – View control > 2 views plan/3D to view the 3D engineered model.

# Template Transition & Superelevation Applications

1. Template Transition:

1. OR automatically creates transition from one TCS to another, by intelligently recognizing the gap between two stretches with different TCS. If there is no gap as per TCS schedule, we need to decide to it & edit the corridor objects table accordingly.

2. Corridors > Transition > create transition > locate first then second template – created. (Transition is a separate kind of template denoted by Dark yellow solid boundary & one-sided large handle @ beginning (LHS)/end (RHS).

3. Corridors > Transition >edit transition > locate transition template> window for appropriate linking of points – delete/edit the connecting lines as per proper 3D schematic to be formed > ok > next window – transition template testing window (we can edit point controls as well as add some component if required in this window itself if template is not displaying proper transition change from start to end – Check once in 3D view also!)> ok. (At curve locations also we can have transitions, even along with superelevation.
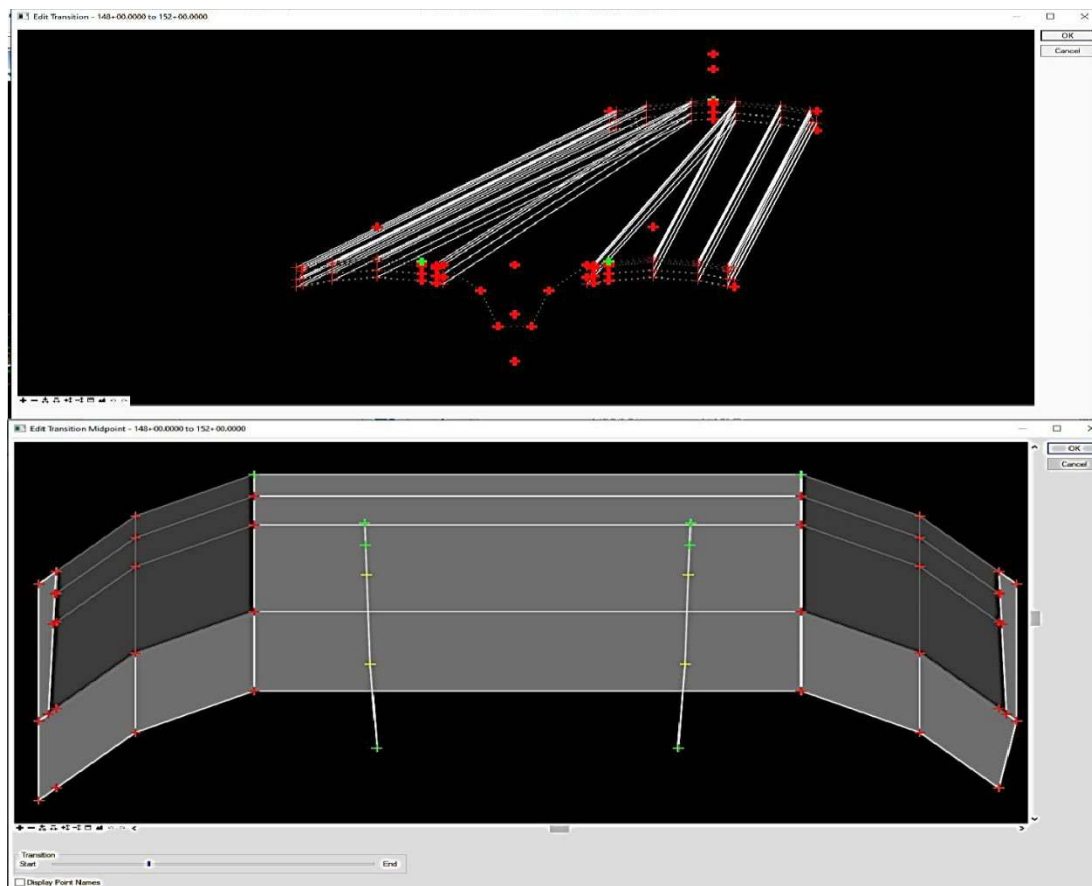
2. Dynamic sections:

1. Dynamic sections – how template follows ground profile – Corridors > Review > Dynamic sections > Open cross section view > Locate corridor or alignment > Select view 4 & click anywhere in view – Using controls view c/s at any chainage! (updates AUTOMATICALLY IMMEDIATELY as per revisions in P&P) – Toggle the view properties to see the cut & fill graphics (Red – filling; Green – Cutting) & to check Cut & Fill area values too.
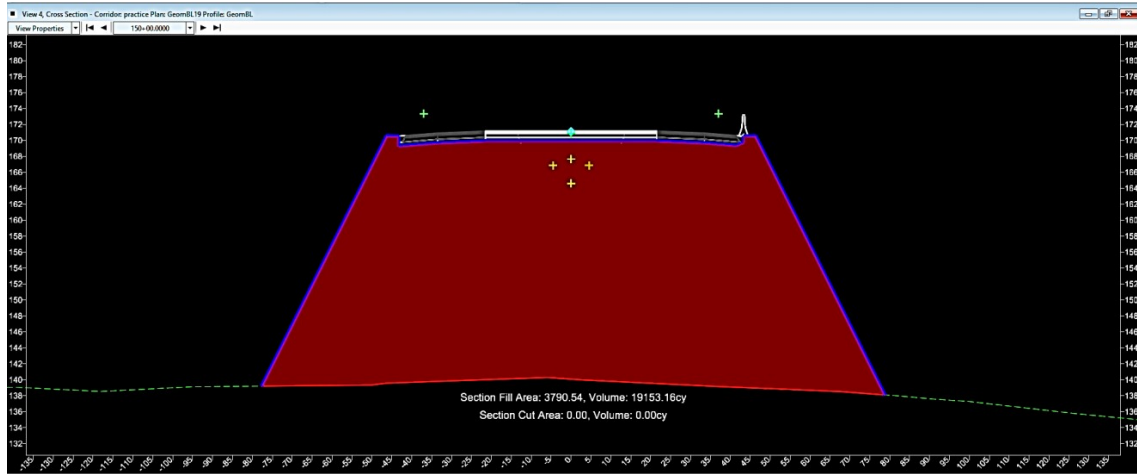
3. 3D Drive:

1. Corridors > Review > 3D drive through > select the 3D view (click anywhere in the blank area) > select centerline > dialogue box > go to presentation tab of view & change display style to 'smooth white background' for smooth traversing, no hanging > in dialogue box set parameters for traversing & play.

4. Corridor reports:

1. Corridors > Review >Corridor reports>Component quantities > Locate corridor > Following window will appear:

2. Cut & Fill volumes will reflect from the end conditions
3. Pavement layers volumes will reflect from the templates
4. Unit Cost is editable to get the Total estimated cost of the project
5. Click 'Report' for 25 m (Pre-defined Drop interval in the templates) wise full report (Bentley Civil Report Browser window will open) (Export – File > Save as > XML or HTML or Excel or Doc file)
6. If report required as per new parameters, Home > Model analysis & reporting > Civil analysis > Qty report by named boundary.

5. Superelevation:

1. Before creating Superelevation sections, Go to Edit template window and in the 'Point properties' (DC on point) of those points which are supposed to rotate at curves for superelevation – WHETHER 'Superelevation Flag' box is checked or not – In the library templates, it will be mostly checked; BUT while creating New Template we need to check it attentively. Such points are mostly the PCL origin point (which acts as crown), Edge of Pavement Left &Edge of Pavement Right.
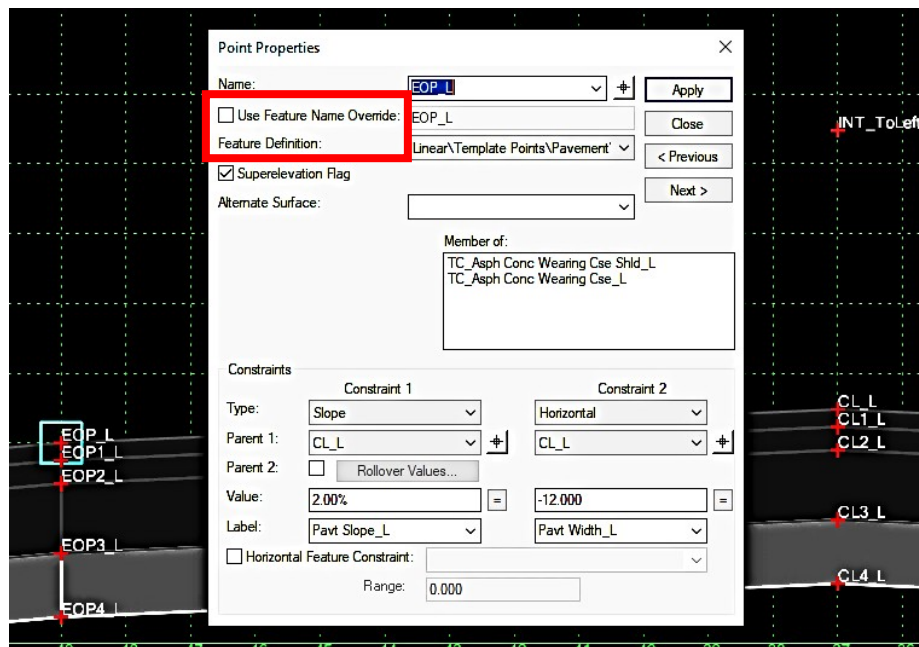

2. 1st way: If prepared SE .csv file already, Corridors > Superelevation > Calculate > Import Superelevation > import file.
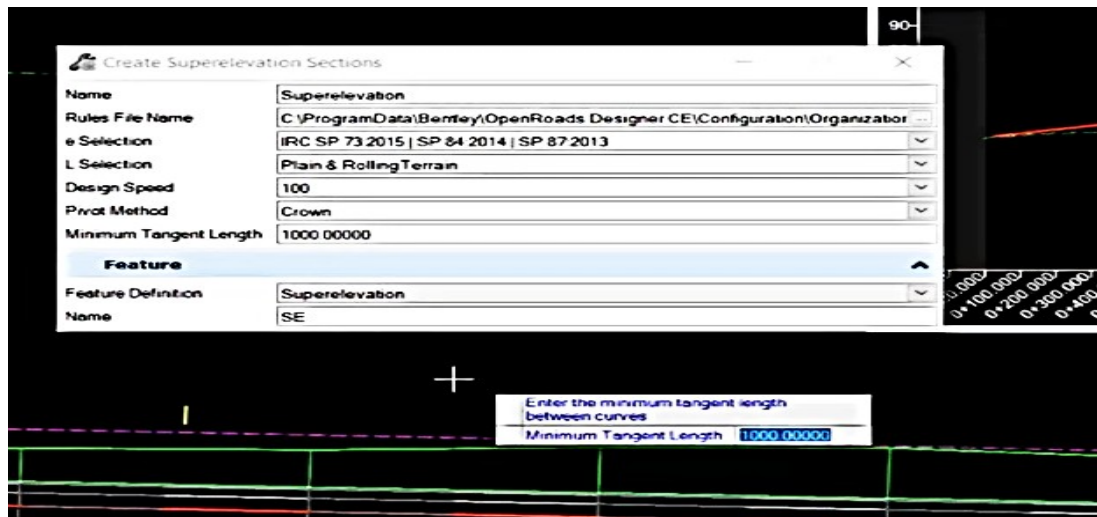
3. 2nd way: If want to create new as per standards, Corridors > Superelevation > Create >Create Superelevation sections >Edit name > Locate corridor or alignment > Select Rules file (India dataset)

4. SE Lanes color coding (RHC): Max SE at curves – Dark orange, Little SE – Yellow, No SE – Green. Colors are different for Left hand Curve (LHC) & Right-Hand Curve (RHC). Left Hand Curve, we see Blue color patches at max superelevation section.

5. View attributes (Top left corner of View) > Turn 'Fill' ON.
6. Check values & wedges by selecting (clicking on) superelevation lanes & edit chainages if required.
7. 3rd way: Now, if there is error in creation of SE lanes at few places, Go to Corridors > Superelevation > Create > Create Superelevation lanes > Locate SE section (by snap to that Outer Green Boundary)> Edit table = Create, then we can check again by snapping lanes.
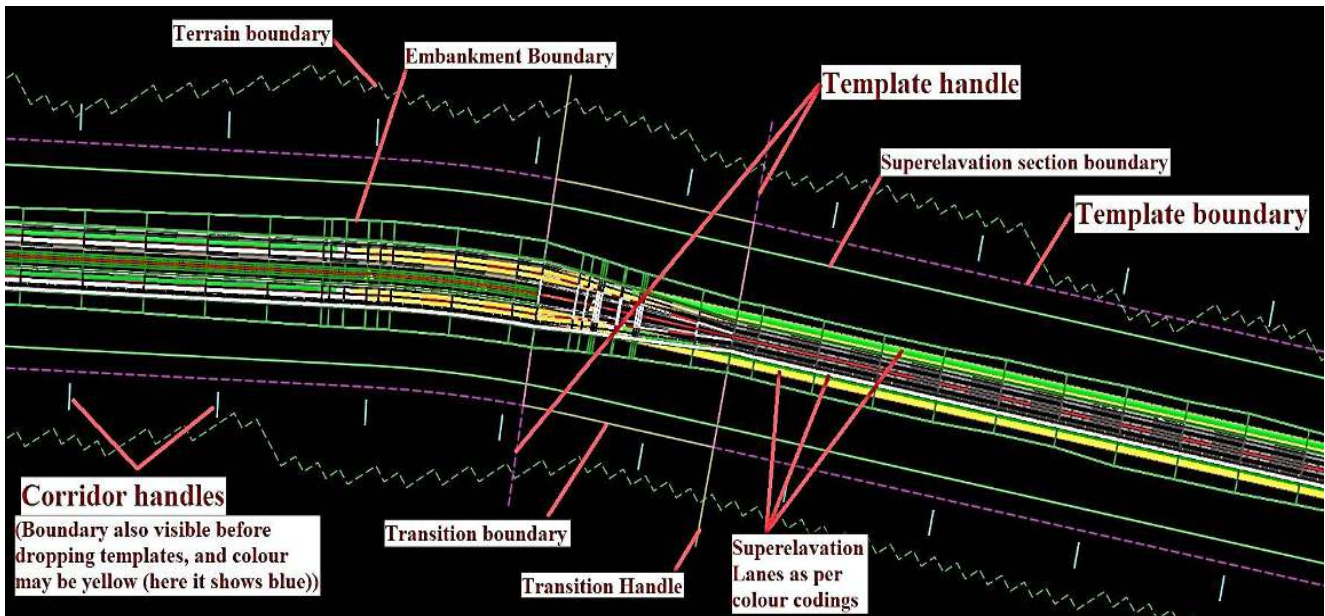
8. 4th way: even after doing all above SE is not created, it means sometimes Se doesn't get automatically assigned to corridor, so Go to Corridors > Superelevation > Calculate >Assign to corridor>Locate First Superelevation section > Locate next SE section (we can have multiple SE sections in a single corridor) OR Reset (RC) > Locate Corridor > Associate SE Dialogue Box >Edit > OK.
9. Finally, Check the Corridor behavior in Dynamic Sections View to confirm the Changes. (Long RC in Dynamic section window > Place Horizontal temporary dimension > select start & end points on CW to display the dimension & slope).
10. Superelevation editor: tabular form –

Drawing Production

## Plan & Profile Sheets (Deliverables)

K   DRAWING PRODUCTION

Drawing Production (Plan, Profile & Cross-Section Drawings)

Learn Series recording link (Session 5)

1. Used for deliverables like C/S or P&P Drawings.
2. Mostly used tabs under 'Drawing Production' are – Named Boundary (90%) & Annotations (10%) (Sometimes Text tab for some minor editing).
3. Named boundaries > Place named boundary civil profile > Dialogue box – 1st ⟨icon⟩ & 3rd ⟨icon⟩ icons for P&P and 4th ⟨icon⟩ icon for C/S.

1. Boundaries creation – PLAN:

1. Drawing production > Named Boundary >Place named boundary > Dialogue box> Click ⟨icon⟩ lan icon.

2. Drawing seed file naming convention– e.g. In Plan tab, A1_Plan = A1 sheet size & Plan at centre; A1_Plan & Profile Plan = A1 sheet size, what are we going to create? -P&P, Plan=First we will create plan & then corresponding profile, Deliverable to L&T. (Seed files & their settings vary as per workspaces)

3. Settings – Scale / Length = to be displayed on one sheet / Left & Right offsets from CL / Overlap = on Consecutive sheets / Boundary chords = curvature of the rectangular projection of sheet on actual alignment plan [This needs to be edited DURING PREVIEW as per the curvature of the alignment -We should give this value as 0(Before selecting centerline!) in order to avoid the plan curve going below in the profile section of the sheet, then there will be no more curvy rectangles, & if we want we can even ALTER those straight sided rectangular boundaries by using their handles separately to properly cover the particular unit length at curve locations!]
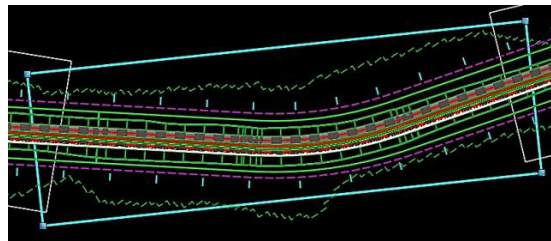
4. Very Important: Keep the 'Create Drawing' check box "Unchecked" during this phase of creating only Plan in the background because profiles are yet to be created; if it is checked, will immediately create the drawings with only the Plans at top!

5. Enter the Name & description & while in the Name tab, select the Centerline > Vertical attached line to define start location, click just before start chainage > every unit length (1000 m), a series of rectangles is created as we move cursor through the corridor (as mentioned in previous point, we can set boundary chord value to be 0 & adjust the rectangles)

6. After moving cursor and creating rectangular plan cuttings through entire corridor > 2 LC – Boundaries created.
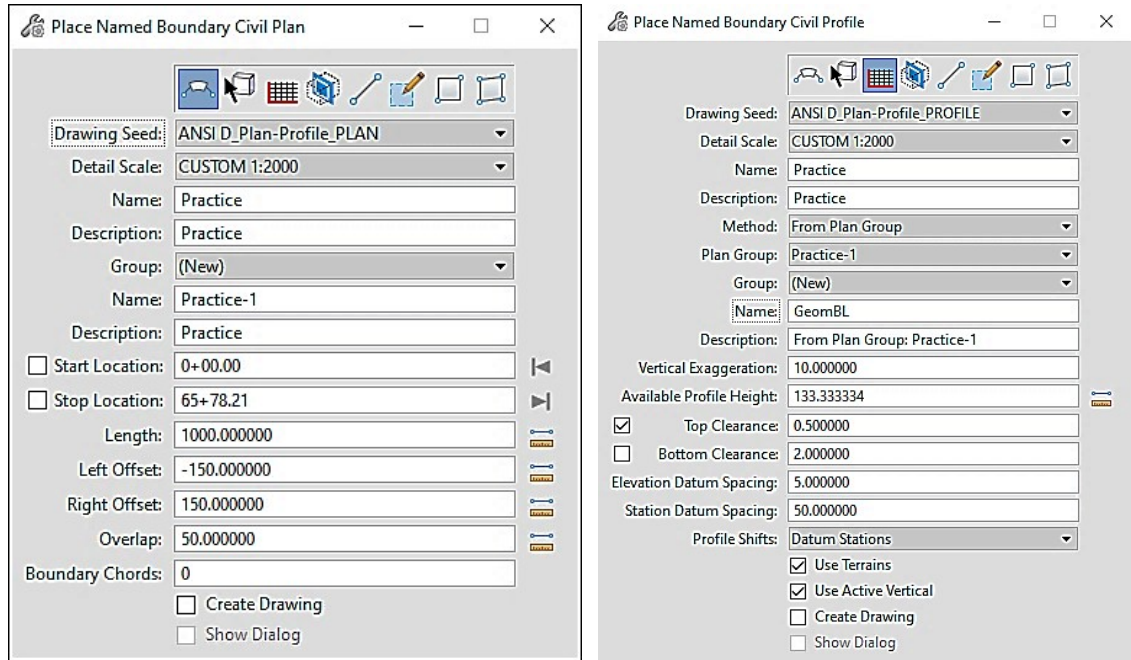
2. Boundaries creation – PROFILE:

1. Open profile model first! (Select Horizontal alignment > Hover cursor > Open profile model > View 3)

2. Drawing production > Named Boundary > Place named boundary > Dialogue box> Click on Profile

3. Vertical exaggeration = 10 => Available profile height = 20

4. Give name & description & Select the Vertical geometry's centerline from view 3 (NOT the horizontal one!).

5. The profile boundaries rectangular boxes will immediately appear automatically in view 3 as soon as we select the Vertical geometry's centerline – because the 'Method' in the dialogue box is set to 'From Plan Group' will directly Synchronize with the boundaries in the Plan

6. Profile shifts = Datum stations

7. Check boxes: Check first 2 boxes – 'Use terrains' & 'Use active vertical' & accept by single LC in view 3.

3. Drawing sheets production:

1. Open Named boundaries dialogue box
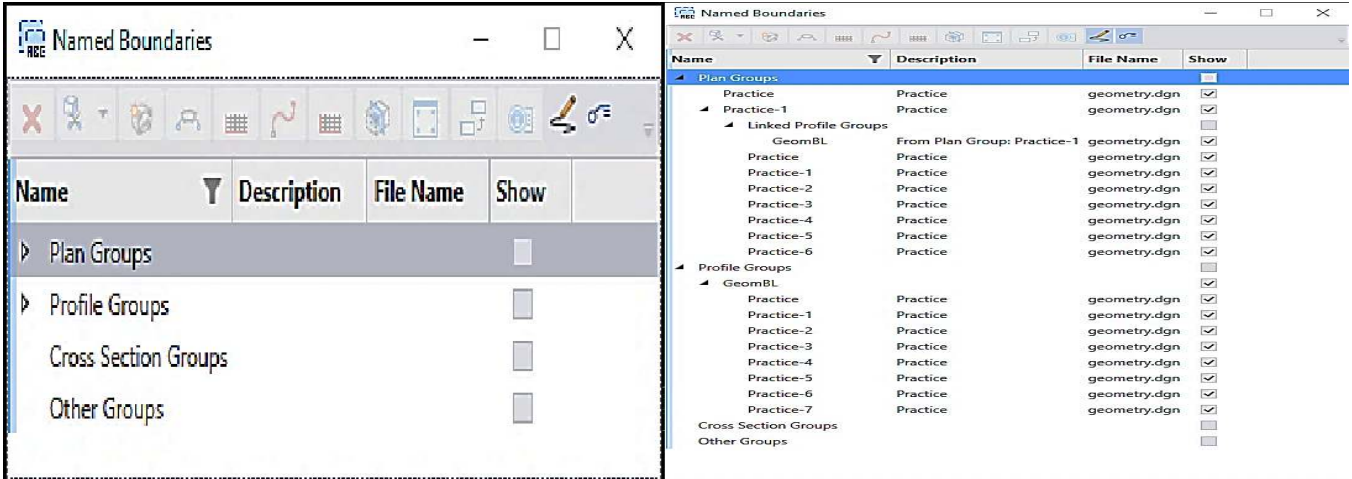
2. ▷ This dropdown arrow confirms the background creation of Plan/profile boundaries. If not present, go back to P&P boundaries creation stages.

3. V Imp: Check mark 2 tools (last 2 in the row) in the toolbar: 'Show the create drawing dialogue'& 'Annotate plan drawing models. (Each time when you reopen this window after corrections!)

4. RC on Profile group name > Create plan/profile drawing = 'Create Drawing' dialogue box will open.
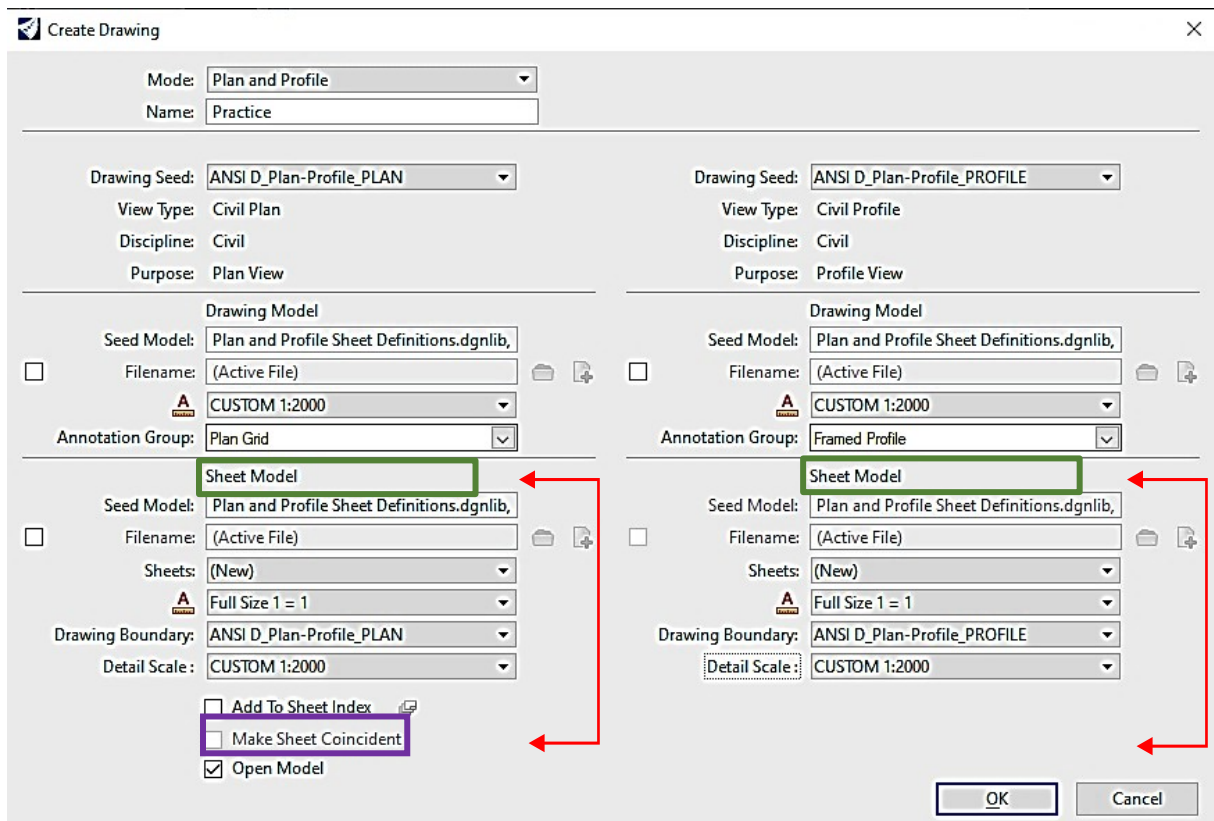
5. Annotation group for Plan view = Plan Grid; Annotation group for Profile view =Framed profile or Any other custom created as per requirement.

6. Drawing Model scale must be changed & kept same as the Sheet model Detail scale for both Plan view and Profile view. (here, e.g., CUSTOM 1:2000)

7. Keep Sheet model scale as Full-size 1=1.> OK.

8. Processing > For any superelevation/Curve widening, one dialogue box will appear – 'Resolve aliases for definition' (Drawing production will be paused) – Give targets > OK> Drawing sheets created.
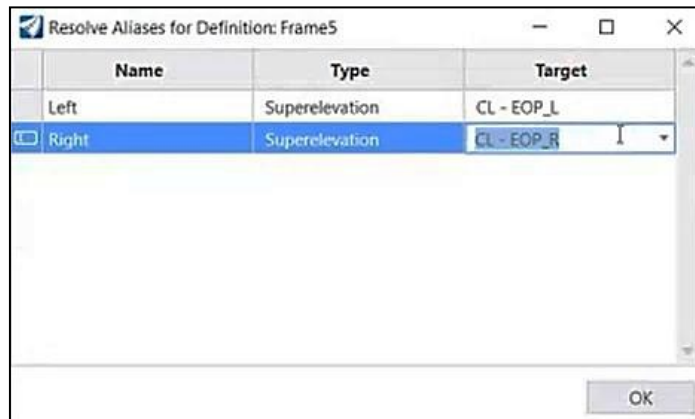
9. Outer boundary (title box etc.) – is created in the dgn library, we can create as per our requirement. All editing possible for all boxes as well as for drawing annotations.

10. File > Export > Exchange file types > PDF OR File > Export > Common file types >DWG/DGN.

11. Open bottom Model's bar – Grey color icons = Boundaries (separate Plans and profiles) and White color icons = Final P&P drawing sheets. Any change in design causes updating in boundaries and subsequently in drawings.
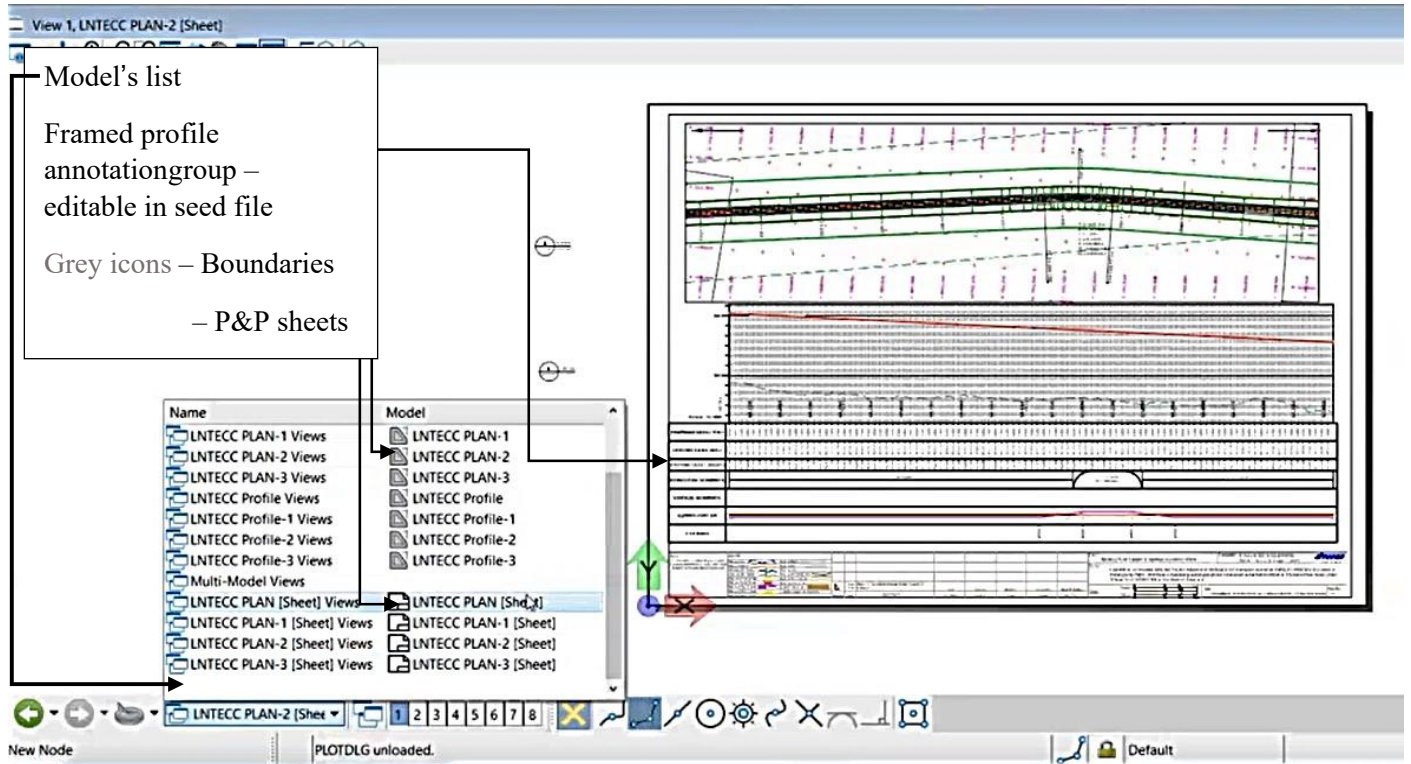
4. Cross-Section drawing production:

1. (Imagine corridor as a loaf of bread & we're going to cut into transverse pieces!)

2. Open view 2 (3D) >Drawing production > Named Boundary > Place named boundary

> Dialogue box > Click on C/S icon – Drawing seed: A1_XS-Frame annotation = Pre-Setting file of how to generate the deliverable (We can create new drawing seed file in dgn library & even edit the existing seed file's settings as per our requirements!)

3. Enter the Name & description & while in the Name tab, select the Centerline > Vertical attached line to define start location, click just before start chainage > Check box 'Include control points' to be checked.

4. every interval (say, 20 m), a series of slices (c/s) is created as we move cursor through the corridor > LC to accept. (Sliced c/s will reflect in 3D view, in which we can alter their sizes as per our requirement).
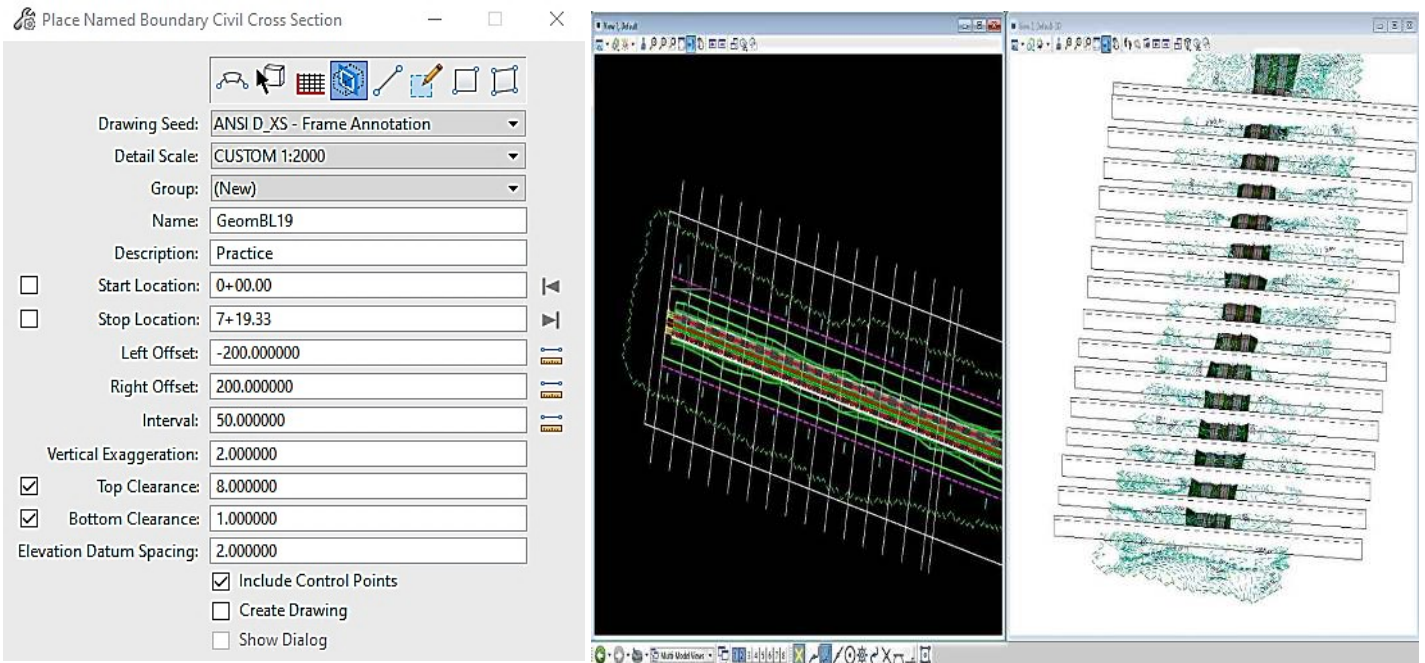
5. ▷ This dropdown arrow confirms the background creation of C/S boundaries. Toggle ON both the tools - 'Show the create drawing dialogue' & 'Annotate plan drawing models'
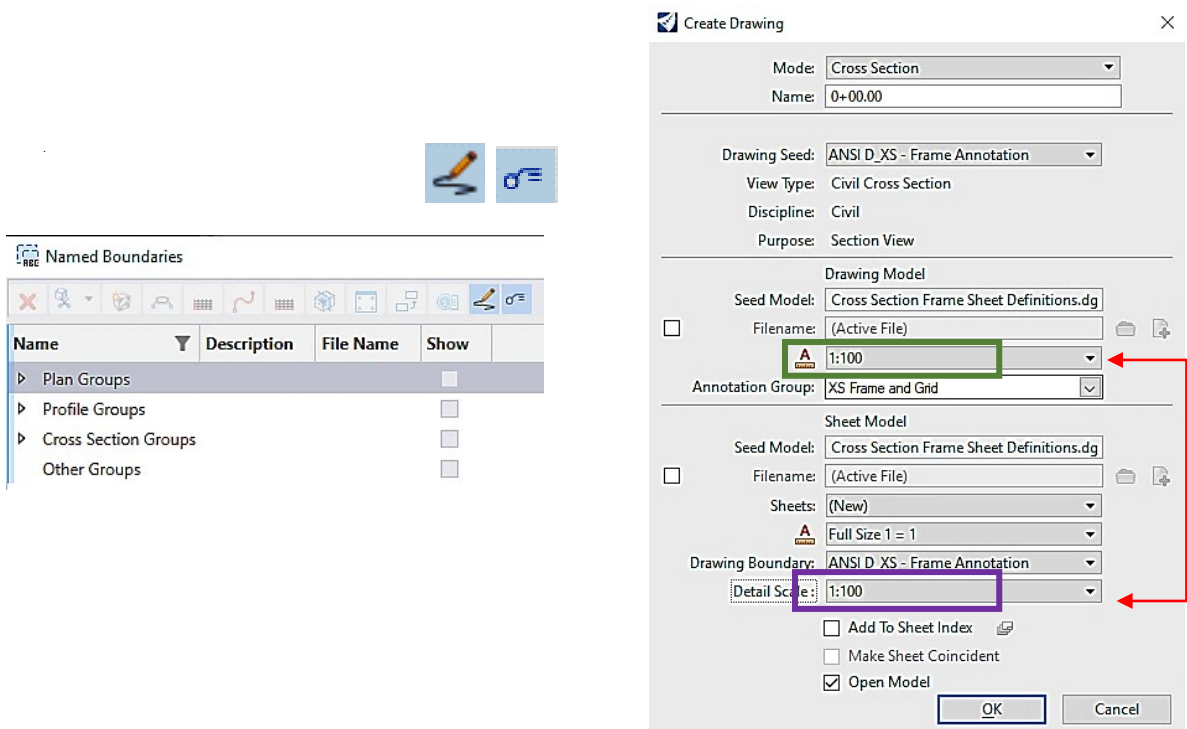
6. Annotation group = XS Frame and Grid.

7. Drawing Model scale must be changed & kept same as the Sheet model Detail scale for both Plan view and Profile view. (here, e.g., CUSTOM 1:100)

8. Keep Sheet model scale as Full-size 1=1. > OK.

9. All outer boundary (title boxes etc.) editable, drawing seed file editable/create new & ANY CHANGE IN ALIGNMENT automatically reflects in boundaries and drawings.

5. Intersection Modelling:

1. First, we need the geometry of the intersecting alignment (both horizontal and vertical) to be imported or created into our design model. (Feature definition – Geom Baseline secondary)

2. Model detailing > Place civil cell (We can create our own specific by 'Create civil cell') > Pick civil cell browser > Select > Locate reference element (through road EOP) (main alignment CW's Edge of Pavement) >Locate reference element Secondary Road's CL> Select elements to view (Flow direction as per need) > LC to accept > Intersection will be placed along with its corridor modelling > Edit dimensions.

Component Quantity Reports are the key to make decisions for billing & estimates.

SHORT SUMMARY

Component quantity tool provides you summary of total project cost with quantity (volume & surface area) calculations of all pavement layers, bitumen, aggregates, soil, concrete, cut/fill earthwork with respect to unit rate inputs.
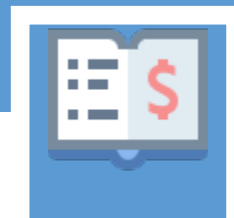
DETAILED REPORT

Detailed Report gives complete quantity calculations of all pavement components including pavement markings, safety barriers, retaining walls volumes, cut/fill slopes surface area, at desired intervals of start and end chainages.

L COMPONENT QUANTITY REPORTS

HORIZONTAL ALIGNMENT REPORT

HorizontalAlignmentArea.xsl
HorizontalAlignmentCheckIntegrity.xsl
HorizontalAlignmentControlLineDataTable.xsl
HorizontalAlignmentCurveDataTable.xsl
HorizontalAlignmentCurveSetElementReview.xsl
HorizontalAlignmentCurveSetReview.xsl
HorizontalAlignmentEventPointList.xsl
HorizontalAlignmentIntervalXYZ.xsl
HorizontalAlignmentLength.xsl
HorizontalAlignmentReview.xsl
HorizontalAlignmentReviewASCII.xsl
HorizontalAlignmentReviewWithPI.xsl
HorizontalAlignmentStationEquations.xsl
HorizontalAlignmentToTIW.xsl
HorizontalAndVerticalAlignmentReview.xsl
HorizontalElementsTable.xsl
HorizontalElementsTableSimplified.xsl
HorizontalElementsXYZ.xsl
HorizontalRegressionPointsNSlews.xsl
HorizontalRegressionPointsReview.xsl

20 Report Formats

VERTICAL & STATION BASE REPORT

VerticalAlignmentCheckIntegrity.xsl
VerticalAlignmentIntervalStationElevation
VerticalAlignmentIntervalStationElevation
VerticalAlignmentPointsXY.xsl
VerticalAlignmentReview.xsl
VerticalAlignmentReviewASCII.xsl
VerticalAlignmentReviewXY.xsl
VerticalAlignmentSightDistanceReview.xsl
VerticalAlignmentToTIW.xsl
VerticalRegressionLiftsNLowers.xsl
VerticalRegressionPointsReview.xsl

StationBaseOffset_IND.xsl
StationBaseOffset_Points_XYZ_IND.xsl
StationBaseOffset_XYZ_IND.xsl
StationOffsetAlignmentReport1.xsl
StationOffsetAlignmentReport2.xsl

17 Report Formats

SUPERELEVATION & EVALUATION REPORTS

SuperelevationCalculation.xsl
SuperelevationCrossSlope.xsl
SuperelevationData.xsl
SuperelevationDesign.xsl
SuperelevationStations.xsl
SuperelevationToCSV.xsl

CrossSectionGradebook.xsl
CrossSectionGradebookfromCL.xsl
CrossSectionGradebookNE.xsl
CrossSectionGradebookWide.xsl
EarthworkQuantities.xsl
ElementsComponentQuantitiesReport.x
ElementsComponentQuantitiesReportS
EndAreaVolume.xsl
MassHaulToTIW.xsl
Quantities by Named Boundary Report.
SightVisibilityAlternateReport.xsl
SightVisibilityReport.xsl
TerrainCheck.xsl
Volumes.xsl

20 Report Formats

Horizontal Elements XYZ Report

Report Created: Monday, October 4, 2021
Time: 1:28:06 PM

Project: Default
Description:
File Name: C:\Users\Ajitesh.Gupta\Desktop\India Kit 2021\5 April 2021\H_Testing_India_Kit_2021 - Copy (8).dgn
Last Revised: 10/3/2021 23:57:16

Note: All units in this report are in meters unless specified otherwise.

Alignment Name: CENTRELINE_IND_STD

Point	Easting (X)	Northing (Y)	Elevation	Station	Direction	Radius
1	702745.457	231903.657	42.035	0.000	N90.000°E	
2	703238.484	231903.657	52.205	493.027	N90.000°E	
3	703238.484	231903.657	52.205	493.027	S90.000°E	
4	703288.481	231903.241	53.286	543.027	S88.568°E	0.000
5	703288.481	231903.241	53.286	543.027	S88.568°E	1000.000
6	703660.656	231821.297	61.574	926.461	S88.568°E	1000.000
7	703660.656	231821.297	61.574	926.461	S66.598°E	1000.000
8	703706.205	231800.677	62.530	976.461	S65.166°E	1000.000
9	703706.205	231800.677	62.530	976.461	S65.166°E	0.000
10	703866.355	231726.562	63.447	1152.929	S65.166°E	
11	703866.355	231726.562	63.447	1152.929	S65.166°E	
12	703911.904	231705.942	63.009	1202.929	S66.598°E	0.000
13	703911.904	231705.942	63.009	1202.929	S66.598°E	-1000.000
14	704432.336	231631.312	54.883	1734.938	S66.598°E	-1000.000
15	704432.336	231631.312	54.883	1734.938	N82.920°E	-1000.000
16	704481.844	231638.301	54.115	1784.938	N81.487°E	0.000
17	704481.844	231638.301	54.115	1784.938	N81.487°E	
18	705701.912	231820.918	40.546	3018.597	N81.487°E	
19	705701.912	231820.918	40.546	3018.597	N81.487°E	
20	705751.420	231827.907	40.575	3068.597	N81.487°E	
21	705751.420	231827.907	40.575	3068.597	N82.920°E	0.000
22	705923.692	231834.331	40.677	3241.203	N82.920°E	1000.000
23	705923.692	231834.331	40.677	3241.203	N82.920°E	1000.000
24	705973.583	231831.048	40.706	3291.203	S87.191°E	1000.000
25	705973.583	231831.048	40.706	3291.203	S85.758°E	1000.000
	707381.005	231726.664	46.122	4702.491	S85.758°E	0.000
					S85.758°E	

3D Drive Through 🎬

Get 3D look & Feel of

- Embankment Cut/Fill
- Transitions & Tapering
- Intersection Civil Cells
- Pavement Layers
- Pavement Markings
- Crash Barrier (Safety items)
- Typical Cross Sections
- Sight Distance Visionary

3D Engineered Model is developed simultaneously while designing of road

Openroads Designer created 3D Model add value to precision as engineers & modelers can now have a look & feel of highway sections with shoulders, drains, medians, intersections, safety barriers, pavement markings, bridge decks, retaining walls, embankment heights.

M   3D DRIVE THROUGH

QUICK QUESTIONS?

ANSWERS TO SOME MIND TINGLING CURIOSITY

CONCEPT DESIGN AND PROTOTYPE

Can we export designed alignment in Concept Station?	**YES**
Can we import conceptual alignment from Concept Station?	**YES**
Can we import 3D terrain mesh from concept to detail design?	**YES**

DETAILED DESIGN AND DELIVERABLES

Can we import designed centreline from MX Roads & continue?	**YES**
Can we get customize Plan & Profile Sheets & annotations?	**YES**
If I change my alignment, will all drawings be updated in one go?	**YES**

IMPORT & EXPORT COMPONENTS

Can we import terrain mesh from Google Earth?	**YES**
Can we export reports in excel or any other formats?	**YES**
Can we publish i-model of our whole design?	**YES**

FREQUENTLY ASKED QUESTIONS (FAQ)

1. Please provide minimum system configuration for operating ORD for larger models more than 20km road sections at one go.

   Ans - There is no limit as such for road length design. Road of any length can be designed in one go. Below is the recommended system configuration.

Operating System	Windows 10 (64-bit) Windows 8 and 8.1 (64-bit) Windows 7 (64-bit)
Processor	Intel® or AMD® processor 1.0 GHz or greater. OpenRoads Designer is not supported on a CPU that does not support SSE2.
Memory	8 GB minimum 16 GB recommended. More memory almost always improves performance, particularly when working with larger models.
Hard Disk	9 GB free disk space (which includes the 5.6 GB install footprint for a complete installation)
Screen Resolution	1600 x 1200 or higher

2. Since multiple users work in a single project, please demonstrate how to split terrain model into smaller files. (Example 20km continuous road corridor to be broken into smaller sections like 1.5km, 3km etc.

   Ans - Use the Terrain "Create" Tab group and click on "Additional Methods" and choose "Create Clipped Terrain Model"

3. What is the difference between Edge line method & Sliver method for Triangulation? Which mode of Triangulation is more accurate?

   Ans - **Remove Slivers** - Long, thin triangles are dissolved based on a formula hard coded within the software. Note the Maximum Triangle Side Length is ignored. There are no user defined parameters. **Max Triangle Length**- External triangles whose external edge is longer in length than the user specified distance is deleted. Note the side option does not apply to internal triangles, only those on the edge of the model. Specify the Maximum Triangle Side Length in master units.

4. What is the concept behind keeping terrain and alignments separately in 3D & 2D seed files and how do they coordinate later?

   Ans - 3D Seed file - to used when dealing with TERRAIN and SURVEY data ONLY, as these are 3D creations. 2D Seed file - to be used with geometry, corridors, superelevation etc. You create your geometry etc in the 'Default' 2D model, and ORD will look after the 3D world in the model 'Default-3D'.

5. Both Horizontal and vertical alignment design, can it be done based on specific IRC requirement at the   time of alignment design itself, instead   of   checking   in   the last?

Ans - You can use Geometry Builder tool available under Horizontal and Vertical section of Geometry tab. Or even Table Editor can be used for fixing element attributes prior and then check later with design standards. This will reduce the number of warnings.

Geometry Builder Window

Table Editor Window

6. Is it possible to develop the existing AutoCAD centerline into alignment design model with geomantic features? If possible pls explain the same.

7. Ans - You can import geometry with following file extensions directly using Import Geometry in General Tools section of Geometry tab. Yes, any geometry can be imported directly here and then later on assigned a feature definition. Also, we need to switch on/activate "Civil Rule" Feature.
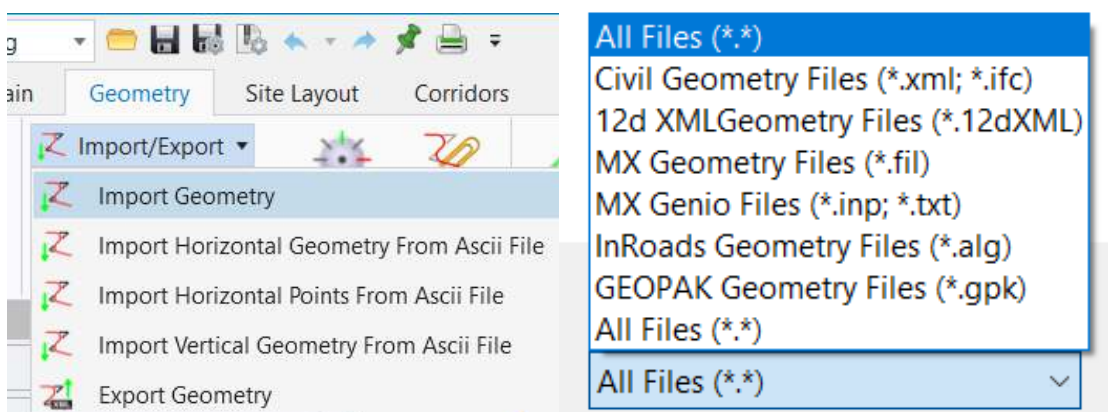
8. Is it possible to change the curve features based on Speed modification? pls explain the same.

    Ans - Yes, there is a Speed Table Option present under Geometry Tab→ General Tools→ Standards→ Speed Table
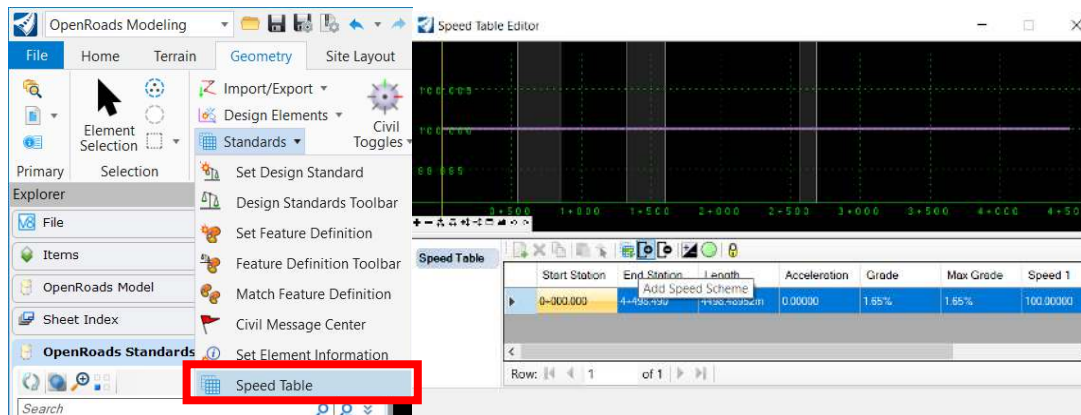

9. I have Horizontal alignment designed in MX Road, the same can it be used for profile design in Open Road?

    Ans - Yes of course, horizontal as well as vertical alignment designed in MX can be imported directly using import geometry tool.

10. In both horizontal or vertical geometry design, the straight lines and curves are designed separately, and the continuous alignment is formed connecting these individual units by using complex geometry. Once complex geometry command is applied, is it possible to reverse back to get the alignment with separate lines (other than undo is there any method to drop the complex geometry). For example, in vertical alignment design, I have designed one alignment, the design steps till complex geometry is done. After some time, I have to edit the profile by adding some extra VIPs, so how it can be done.

    Ans - Yes of course you can, just break the civil geometry rules by going to context menu and selecting option- "Remove Rule". After removing rule, select back again your centerline which is red in color and simply press delete key on keyboard.

    Step 1:
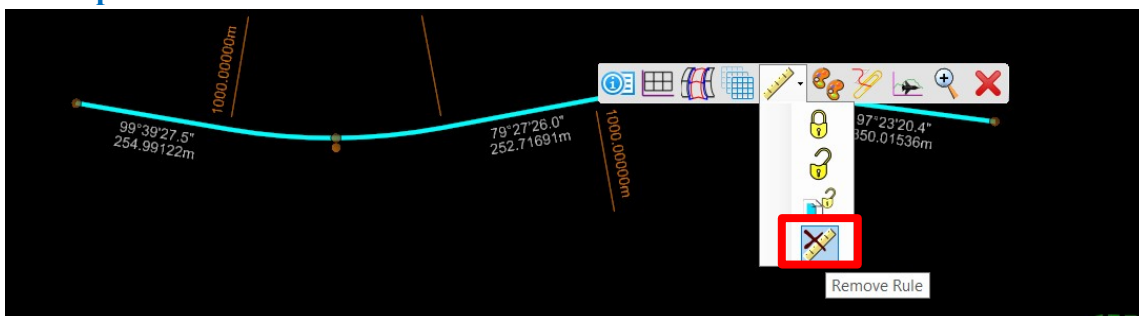
    Step 2:
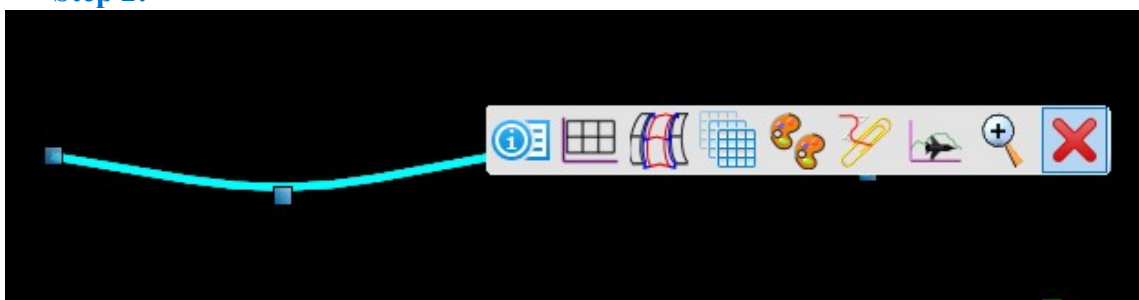
11. For almost every highway project, as far as considered for flexible and rigid pavement, the pavement layers remain almost the same, only the thickness of each layer varies based on requirement. So is there any method to change the layer thickness of all layers all at once without editing in the template control points.

    Ans - There is no as such quick way but yes you can use Macros to simply do that. Macros are inbuilt within ORD. Simply record the steps till the point of opening the point properties where you assign the vertical constraint. Make 4 macros for 4 layers.

12. What is "superelevation flag" in template creation?

    Ans - Those Points whom you want to participate in Superelevation application like EOP_L, EOP_R and CL, superelevation flag is checked marked for them so that they can be rotated while applying superelevation over corridor and we can see in dynamic cross-section as well.

13. How to create new feature definition for a component?

    Ans- We can create a new feature definition by editing our "Features_Annotations_Levels_Elem Temp Metric.dgnlib" file present at C:\ProgramData\Bentley\OpenRoads Designer CE\Configuration\Organization-Civil_Civil Default Standards - Metric\Dgnlib\Feature Definitions. Open this file→Goto Explorer→Openroads Standards → Features_Annotations_Levels_Elem Temp Metric.dgnlib → Feature Definitions→ Mesh→ Right click and select new on required folder. Also assign Feature Symbology in properties.

14. In MX roads, if we hover the mouse point through a string, we can know the X, Y and Z coordinates of all points in a string. In ORD, how can this be done?

    Ans - Pls type in quick search box= Label coordinates

15. Default cut and fill slope is explored, please also explain if any modification required of cut and fill slope based on the project requirement.

    Ans - Yes, they can be modified as per requirement. Simply double click on the end point of your end condition and define its slope or any other condition like it needs to be infinite or restricted to any horizontal or vertical distance.

16. Please explain one Typical cross section with RE/RET wall at both edge of Carriageway and another one is RE wall/RET wall for the edge of the slope at ROW constrain location.

    Ans - Pls use default components→ walls—RE Wall within template creation window

17. How the template will be made for Divided carriageway (median)?

    Ans - Please check within default Template library. Under Template→ Rural Divided→ copy this template and paste and rename and make changes as required or make a completely new one

18. How can we create a simple Civil Cell Step by step?

    Ans - Model detailing > Place civil cell (We can create our own specific by 'Create civil cell') > Pick civil cell browser > Select > Locate reference element (through road EOP) (main alignment CW's Edge of Pavement) >Locate reference element Secondary Road's CL> Select elements to view (Flow direction as per need) > LC to accept > Intersection will be placed along with it's corridor modelling > Edit.

19. How to generate skewed cs w.r.t skew angle?

    Ans - Use 2- Point method for any particular CS at any station or after cutting down the cross section, one needs to rotate those slices or named boundaries.

20. How to create a new drawing seed for a specific sheet size if we are using for the first time and we don't have library files?

    Ans - Please refer to Chapter: Workspace Development of OpenRoads On-Boarding Guide v1.0

21. How can we insert different structures in horizontal and vertical profile? Do we need to create separate templates for it?

    Ans - If the structures are modelled in 3d and referenced then they will automatically appear, else we need to draft and place them using drawing tools available in Drawing tab or even we can attach them by placing them as cells.

THANK YOU
FOR YOUR LEARNING

Prepared For:

Beginner Level

Prepared By:

SUCCESS SERVICE TEAM – CIVIL CONSULTANTS INDIA

Key Use

Highway/Road Design
Geometrical Design
Project Cost Estimates
3D Engineered Model
Terrain Modelling (DTM)
Automated Plan Profile

Who Can Refer?

Highway Design Engineers
CAD Engineers, Students
Transportation Professionals
Pavement Design Engineers
MX Road/Civil 3D Users
Quantity & Billing Engineers