Road Rehabilitation Made Easy

Tomas Lendvorsky, Peter Ingels

Senior Technical Specialists - AEC

AUTODESK. UNIVERSITY

About the speakers

Tomas Lendvorsky

Tomáš *joined Autodesk, 13 years ago and currently is working as Senior Technical Specialist, responsible for AEC Autodesk solution in Eastern Europe. Tomas has a master's degree in land surveying. In his current role he is promoting Autodesk BIM solution.*

About the speakers

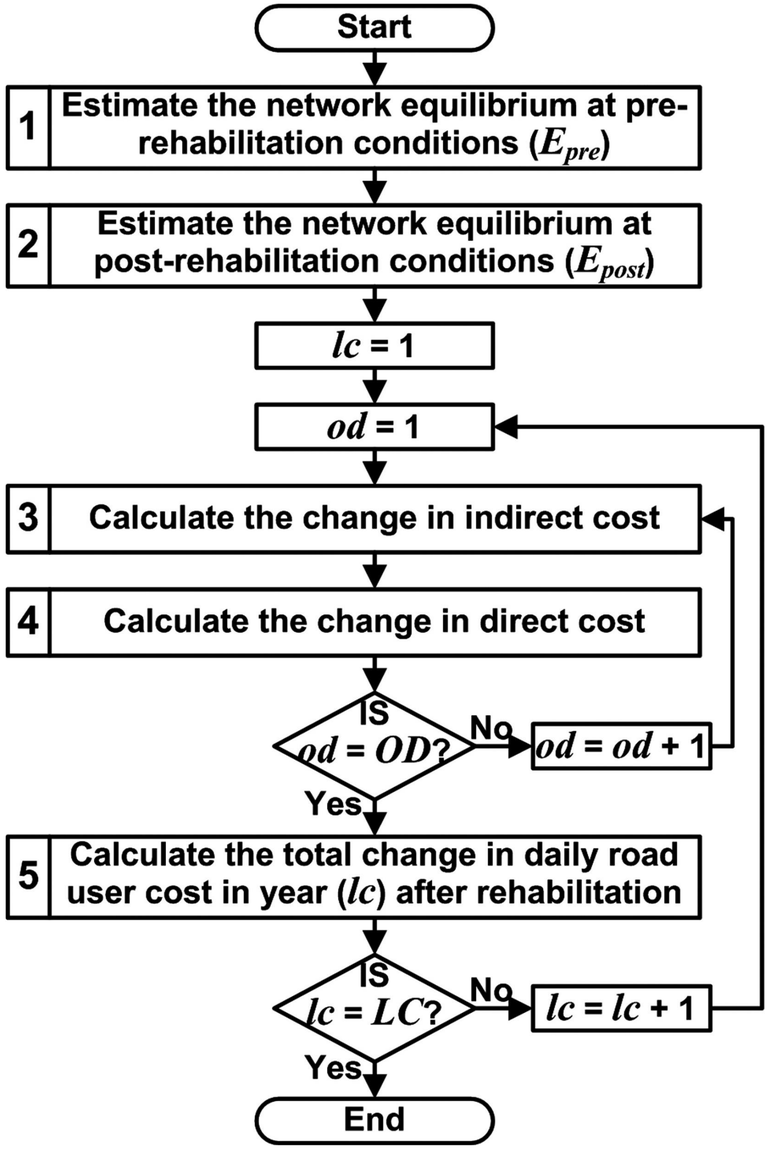
Peter Ingels

Senior Technical Specialist focusing on Autodesk, Inc.’s, Civil Engineering and Infrastructure Solutions. With a background in engineering and surveying, and over 15 years’ experience implementing Autodesk solutions, I'm well positioned to advise on Autodesk’s Building Information Modeling BIM for infrastructure strategy.

Road Rehabilitation

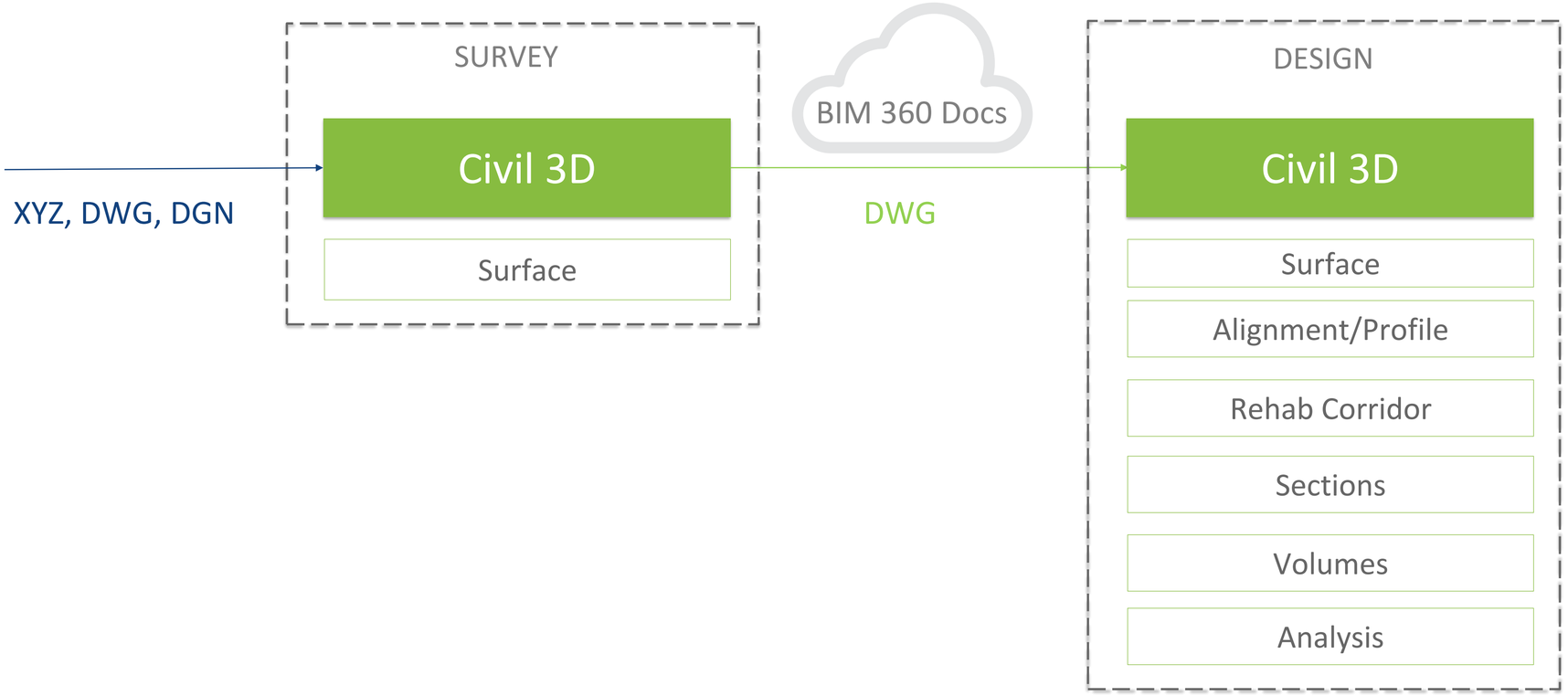
- Very tight budgets.
- Meet standards for:
  - Road type
  - Design speed
  - Pavement structure.
- Too many constrains.
- Designers must constantly prioritize multiple alternatives, their cost and benefit.
- Designers often find ‘creative’ solutions to meet needs…
- There is no ‘typical section’ in Roadway Rehabilitation
- CAD SW + Excel +.....

Road Rehabilitation

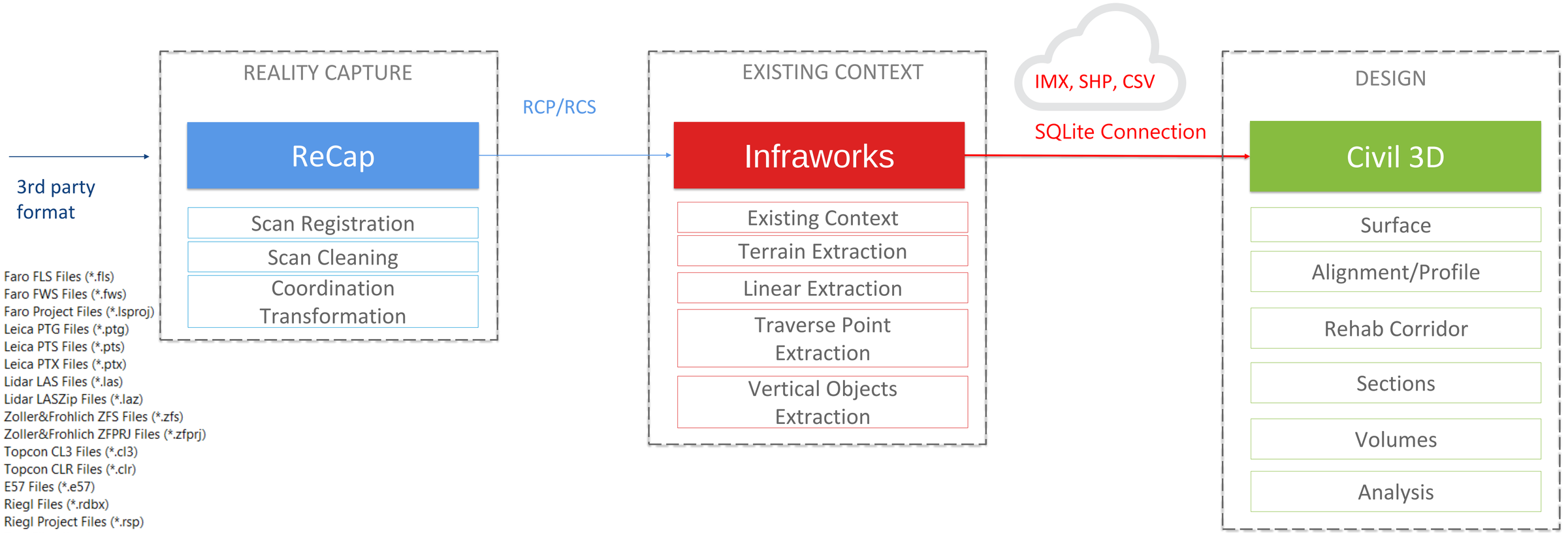


Existing Conditions

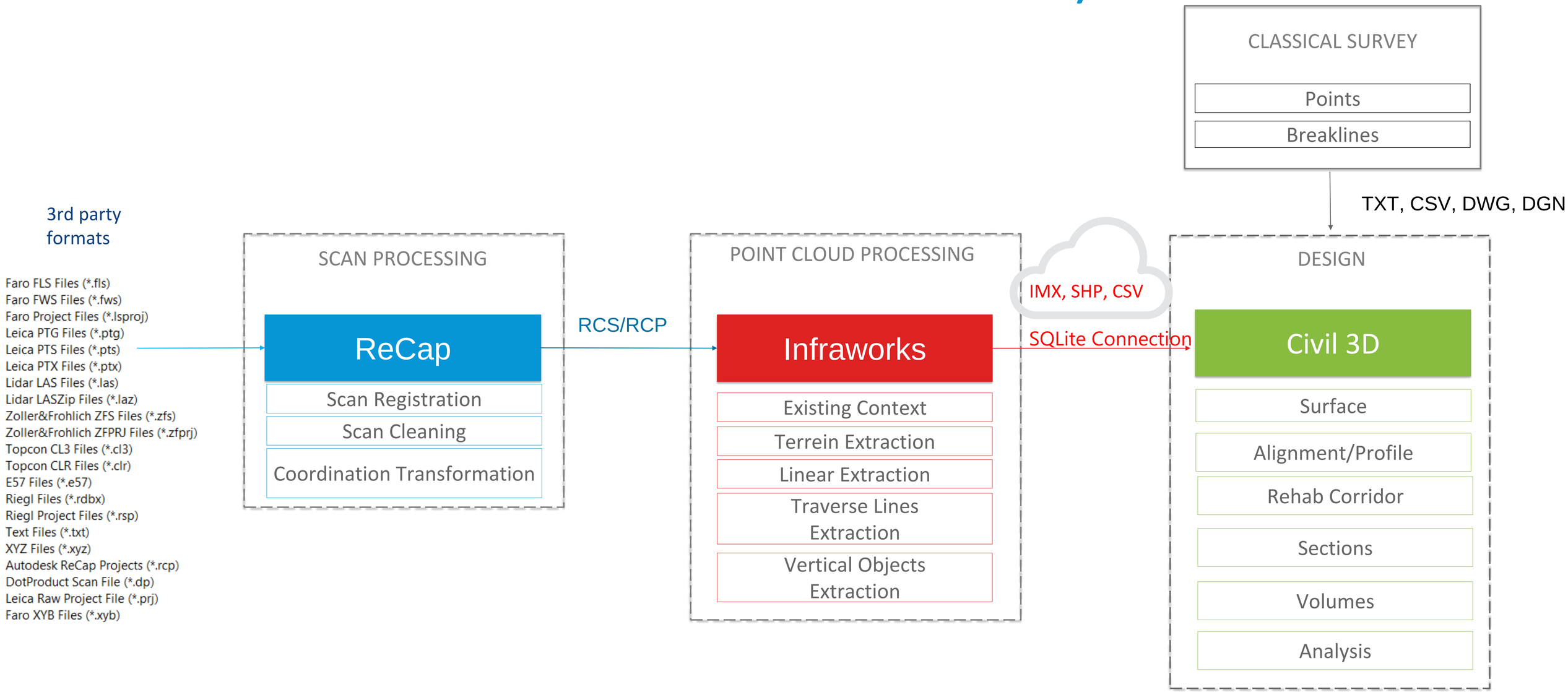
Classical Survey

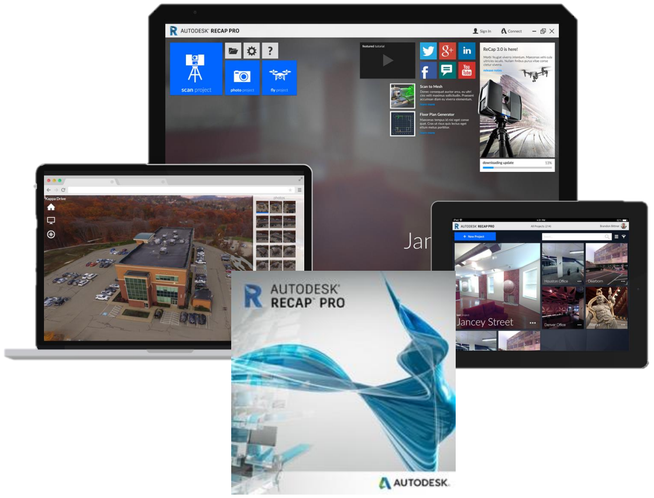


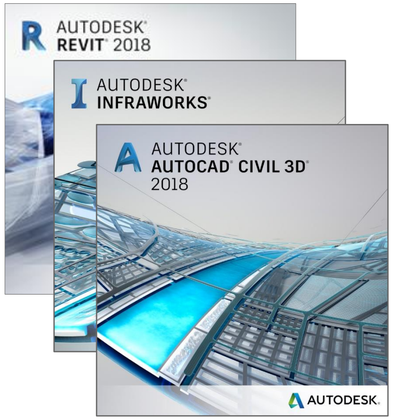
Point Cloud


REALITY CAPTURE
ReCap
Scan Registration
Scan Cleaning
Coordination Transformation
3rd party format
Faro FLS Files (*.fls)
Faro FWS Files (*.fws)
Faro Project Files (*.lsproj)
Leica PTG Files (*.ptg)
Leica PTS Files (*.pts)
Leica PTX Files (*.ptx)
Lidar LAS Files (*.las)
Lidar LASZip Files (*.laz)
Zoller&Frohlich ZFS Files (*.zfs)
Zoller&Frohlich ZFPRJ Files (*.zfprj)
Topcon CL3 Files (*.cl3)
Topcon CLR Files (*.clr)
E57 Files (*.e57)
Riegl Files (*.rdbx)
Riegl Project Files (*.rsp)
Text Files (*.txt)
XYZ Files (*.xyz)
Autodesk ReCap Projects (*.rcp)
DotProduct Scan File (*.dp)
Leica Raw Project File (*.prj)
Faro XYB Files (*.xyb)
RCP/RCS
EXISTING CONTEXT
Infraworks
Existing Context
Terrain Extraction
Linear Extraction
Traverse Point Extraction
Vertical Objects Extraction
IMX, SHP, CSV
SQLite Connection
DESIGN
Civil 3D
Surface
Alignment/Profile
Rehab Corridor
Sections
Volumes
Analysis

Point Cloud + Classical Survey







Capture

Compute

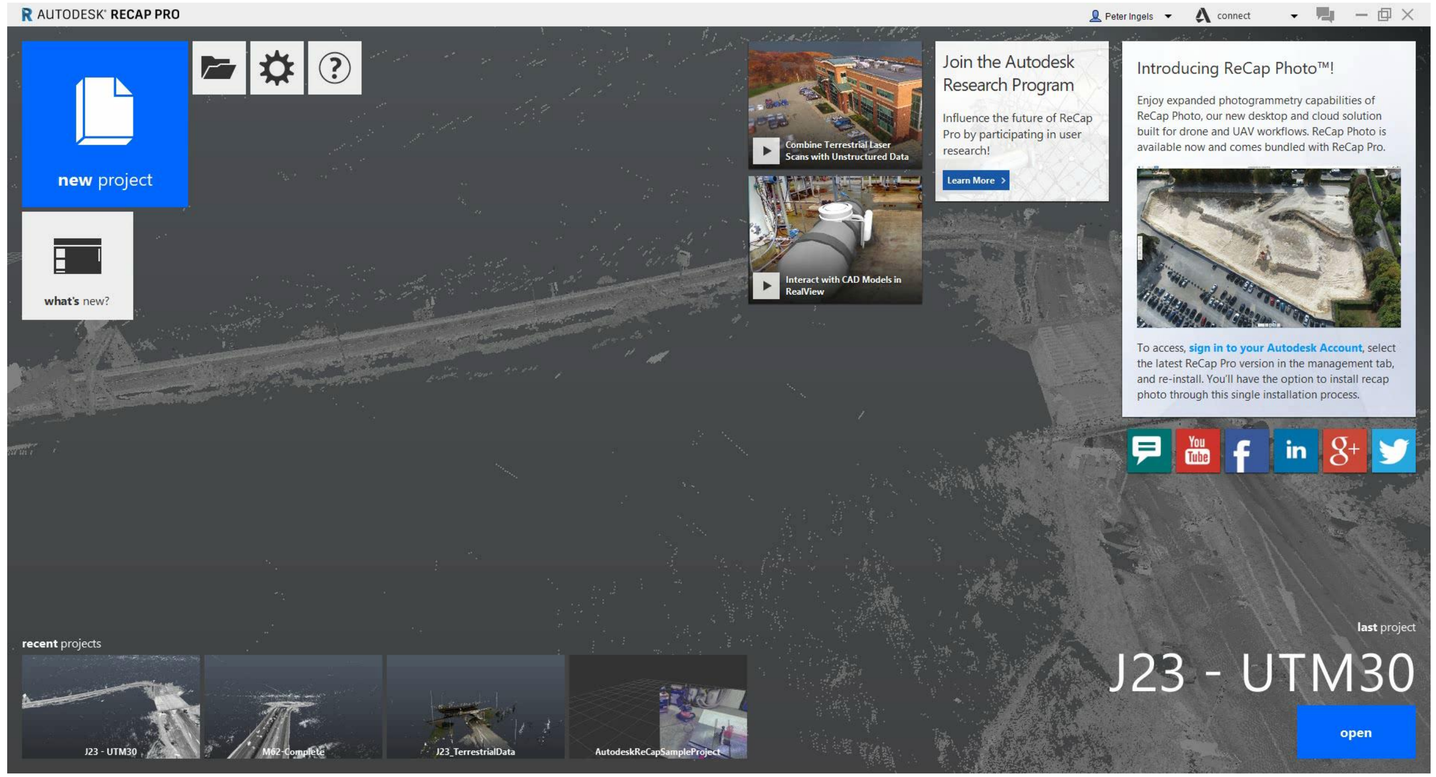
Create

Photo and Laser

Automatic scan registration
Intelligent cleanup service

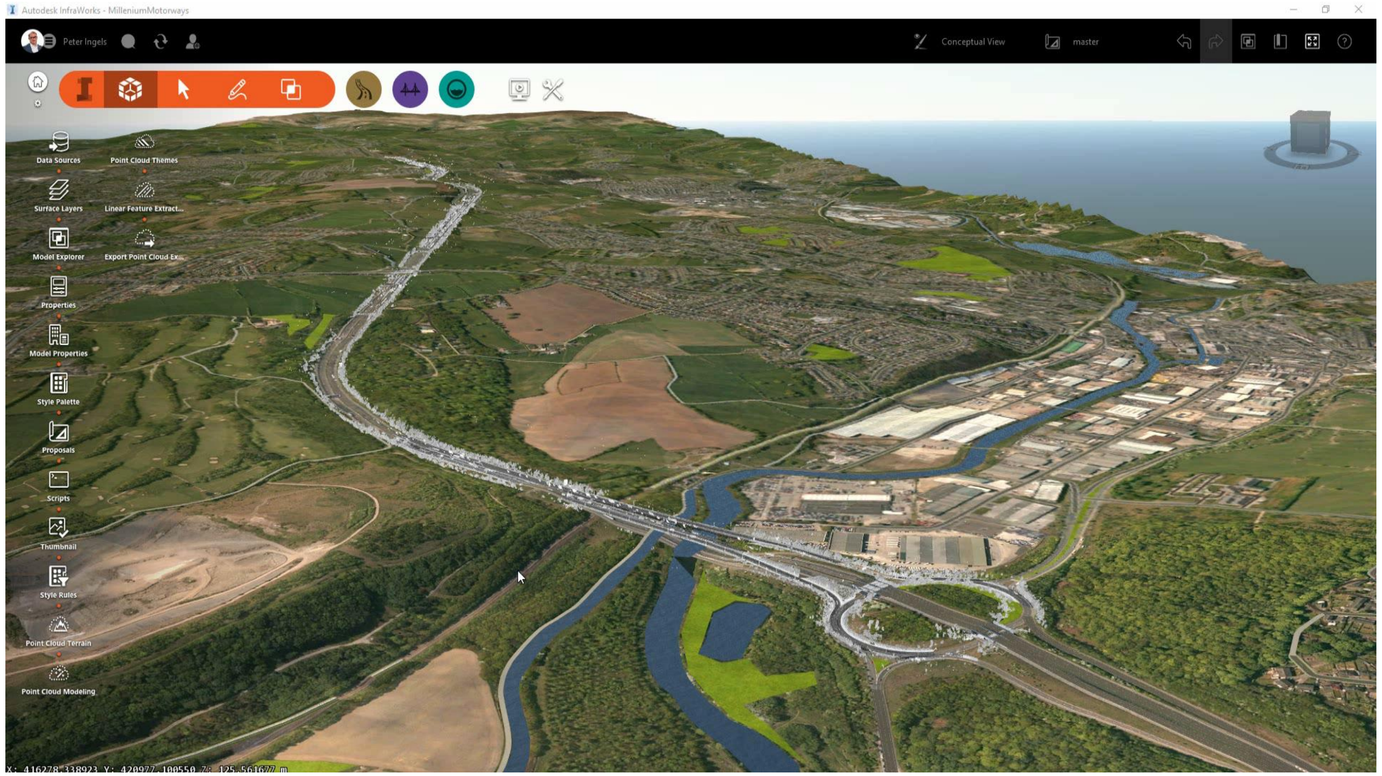
Workflow Integration

Scan Processing



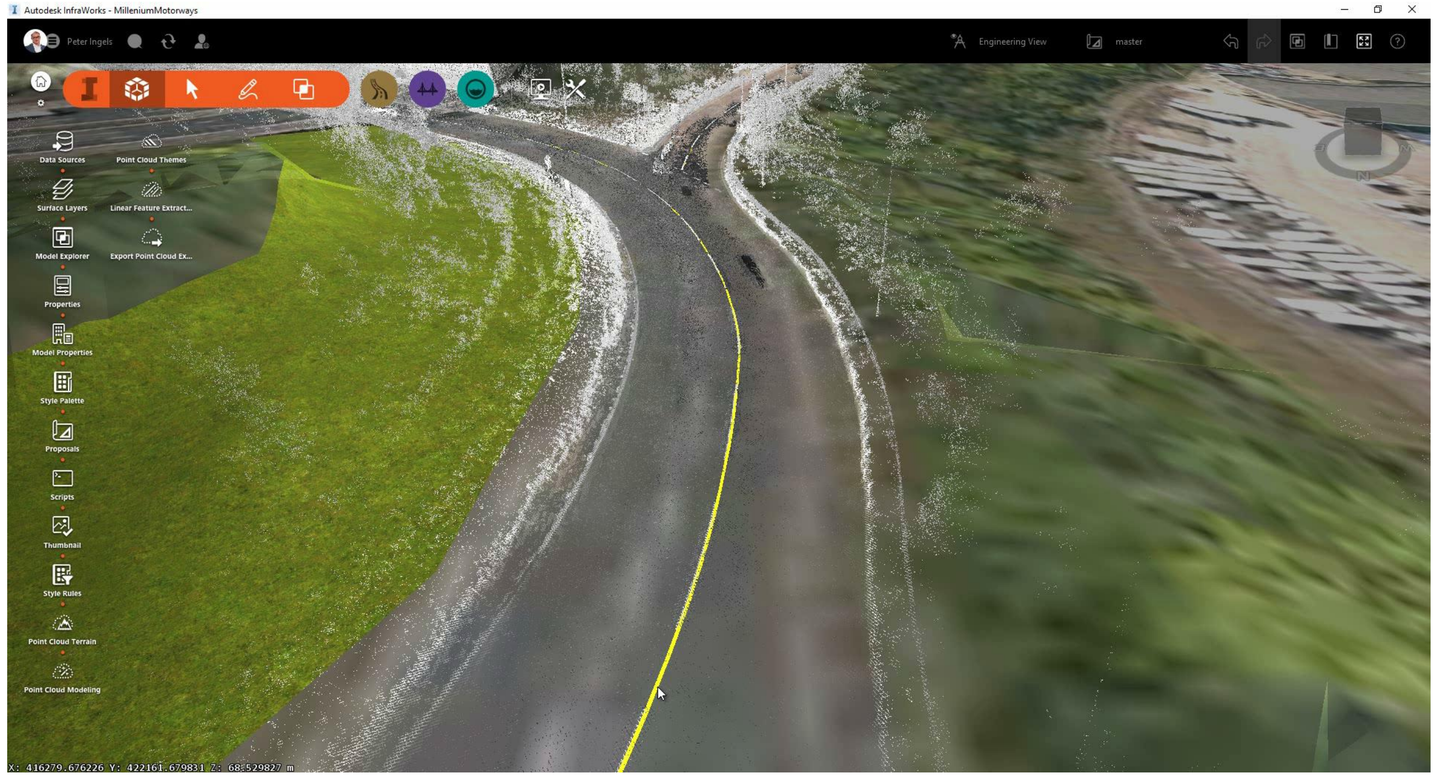
Import Point Cloud

Terrain Extraction

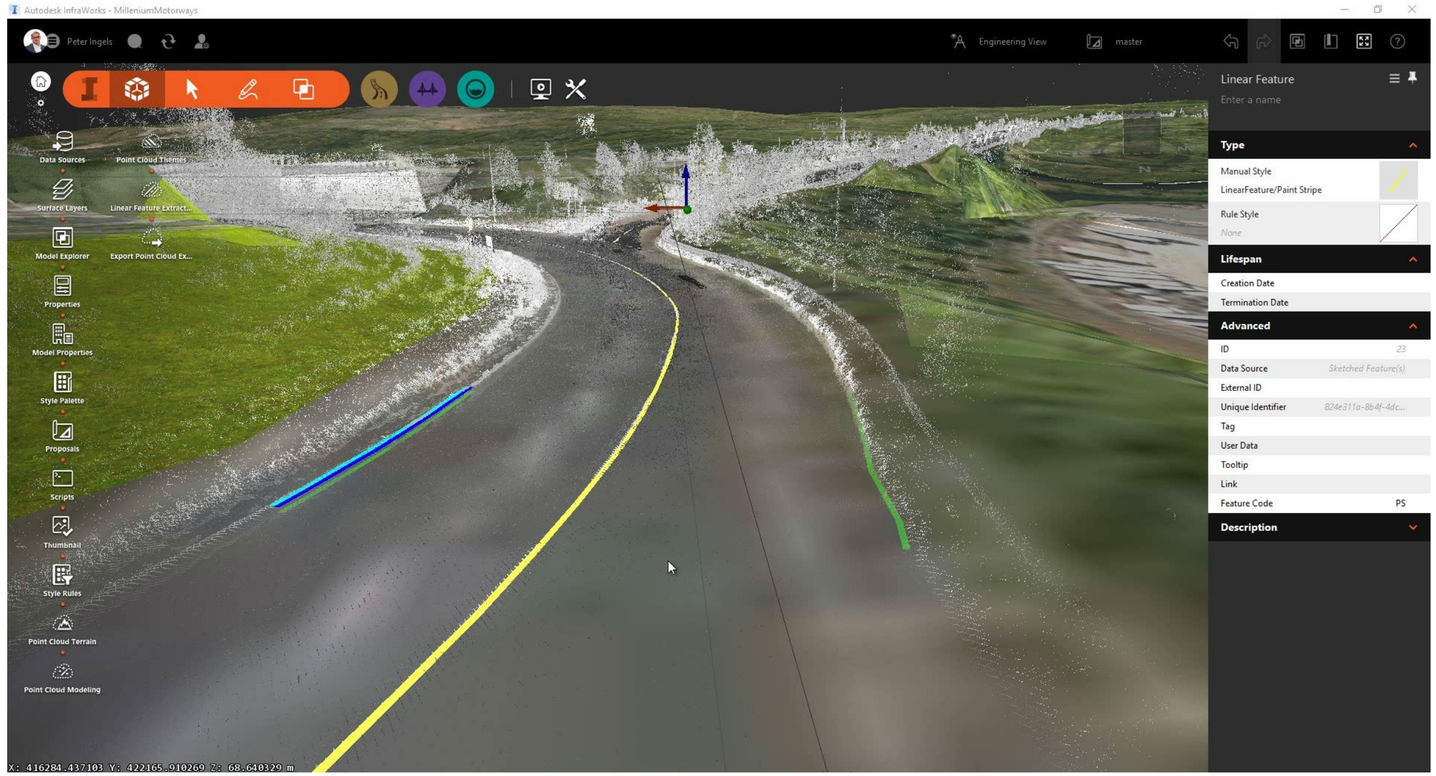


Linear Extraction

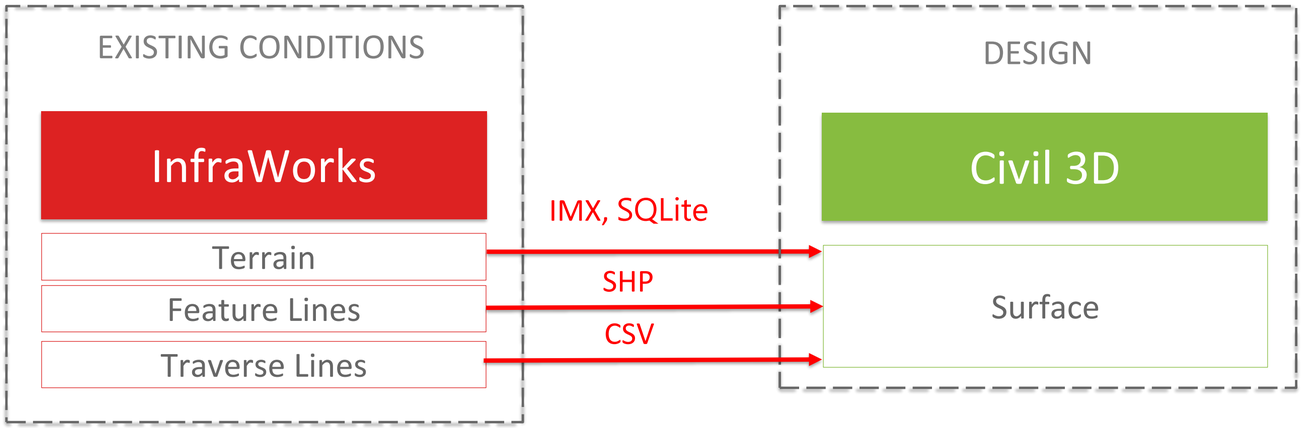
Cross Section Analysis

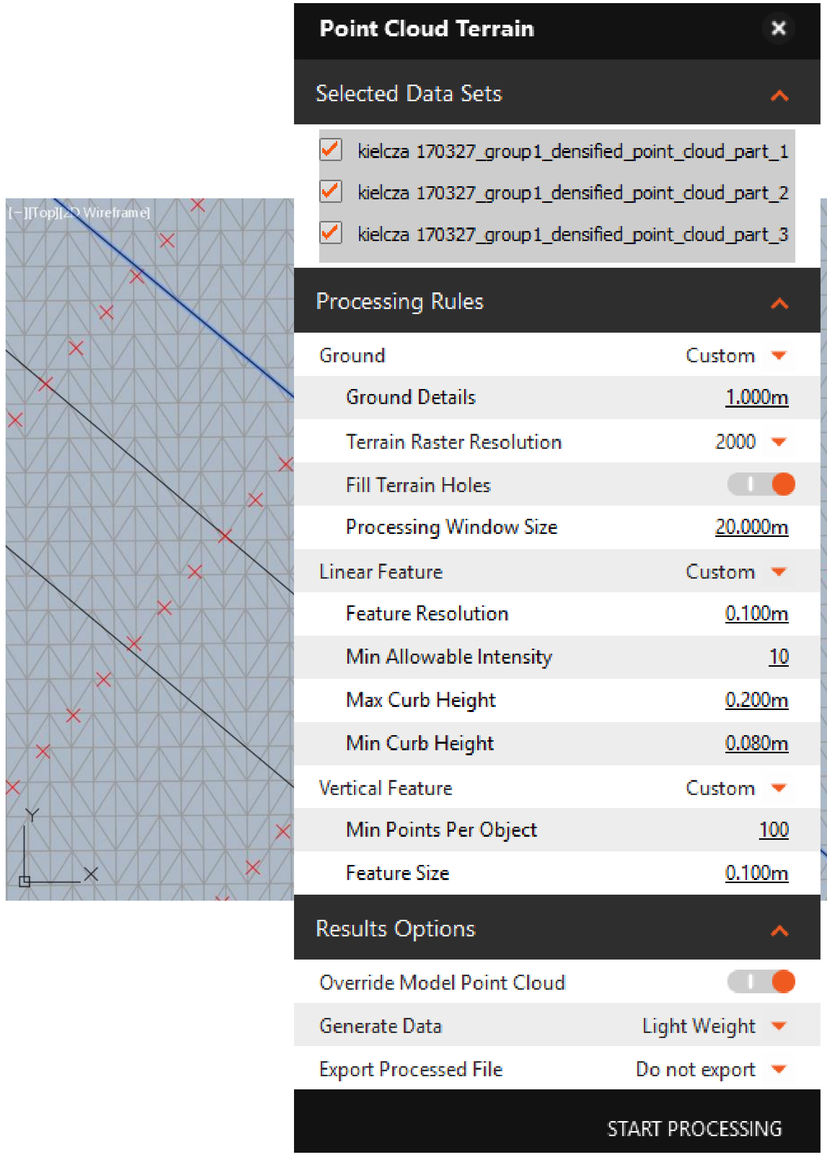


Traverse Point Creation & Export



Civil 3D Surface model

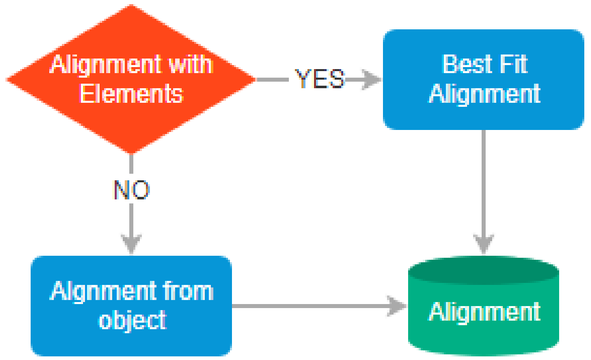


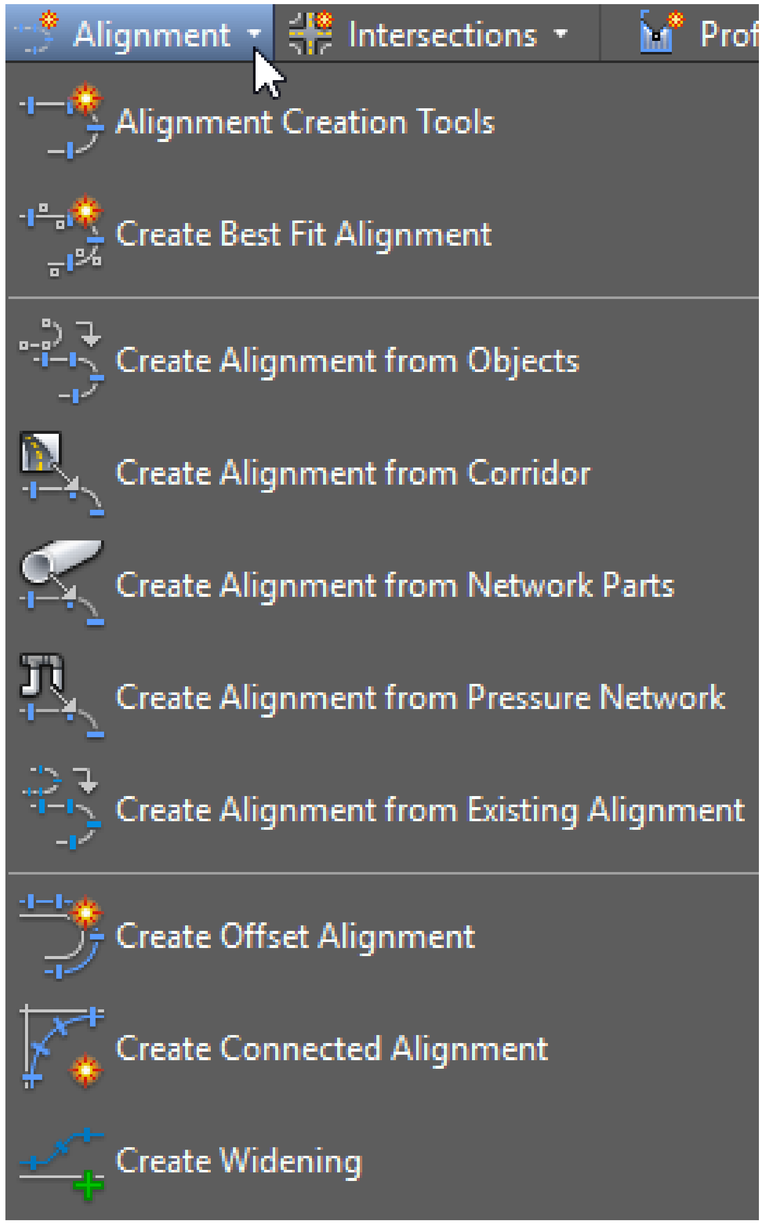


Design

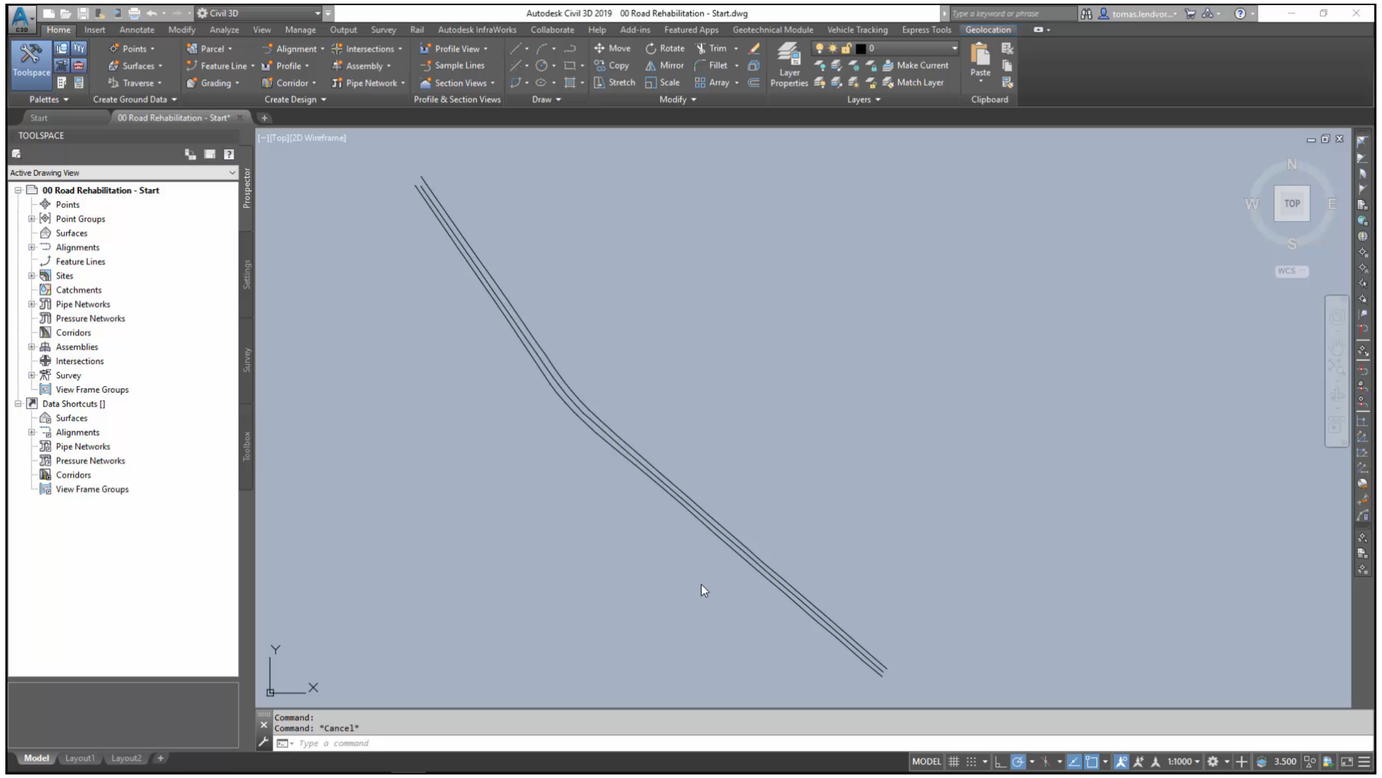
Alignment

- Alignment Creation Tools
  - Fixed/Float Best Fit Line
  - Fixed/Float/Free Best Fit Curve
- Create Best Fit Alignment
- Create Alignment from Object



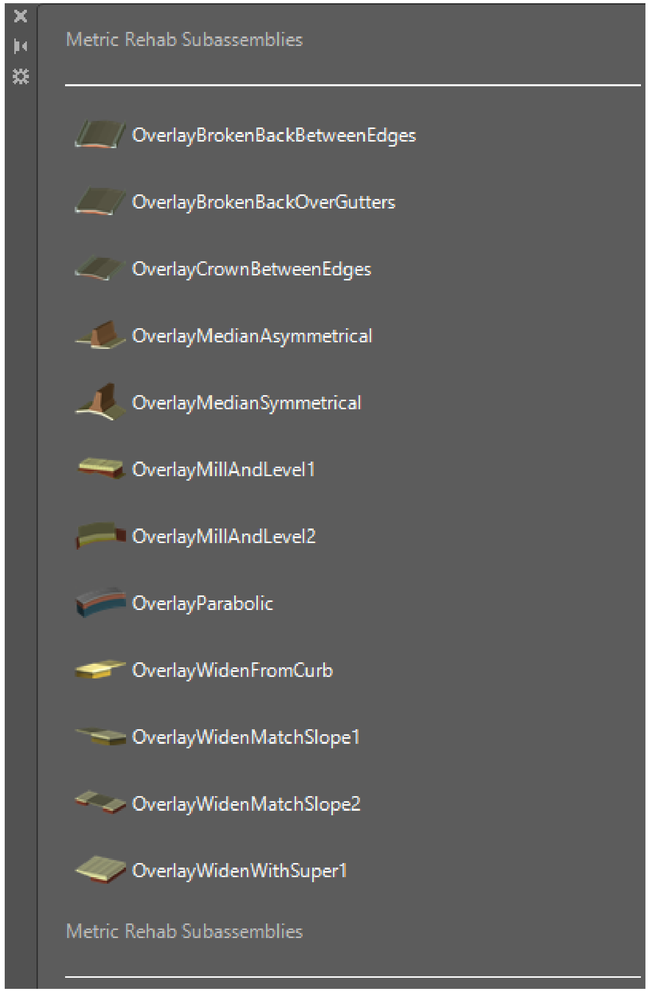


Surface & Alignment



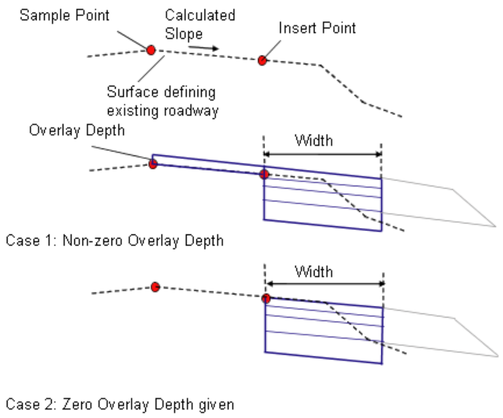
Subassemblies

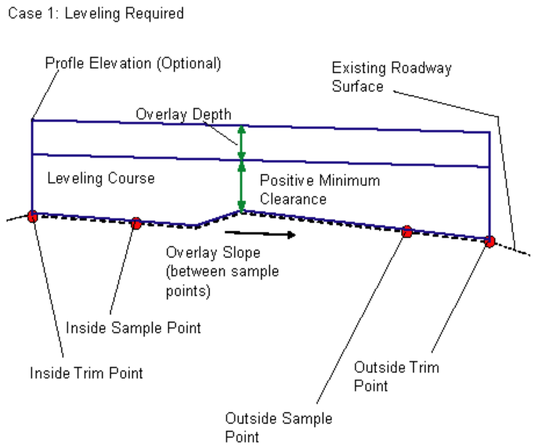
- Rehab
- New Rehab
- Subassembly Composer
- Standard

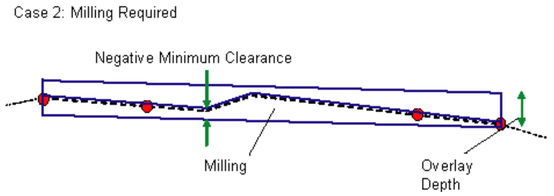


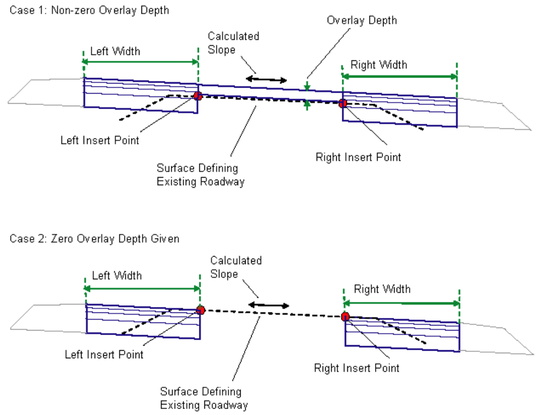
Rehab Subassemblies

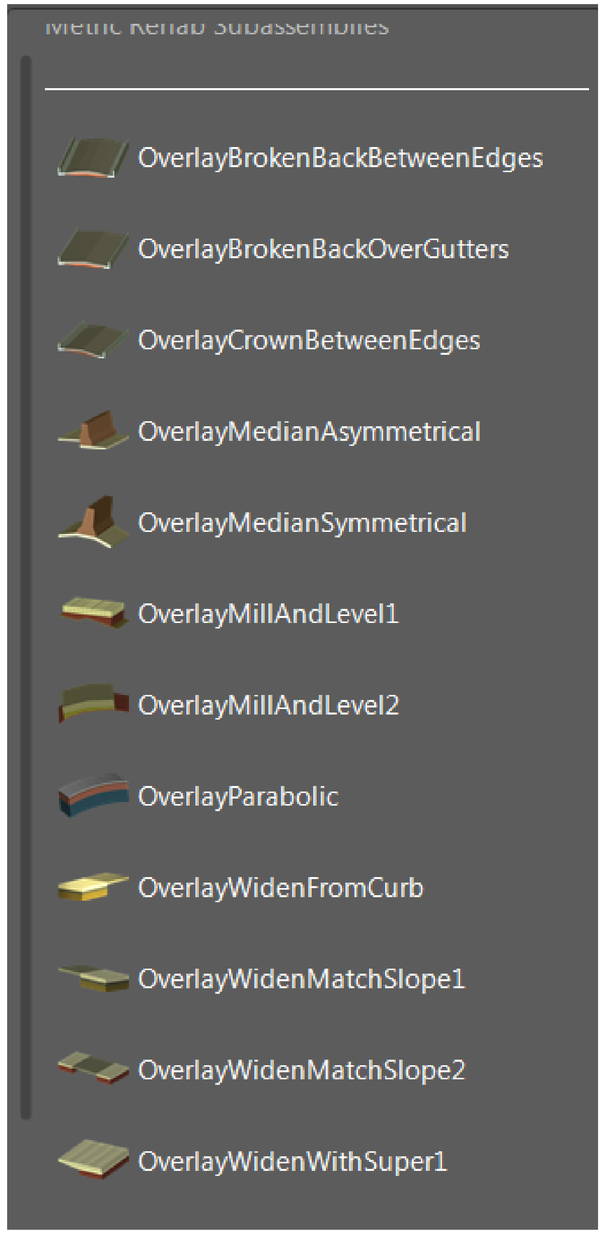
- OverlayMillAndLevel1
- OverlayMillAndLevel2
- OverlayWidenMatchSlope1
- OverlayWidenMatchSlope2
- OverlayWidenWithSuper1





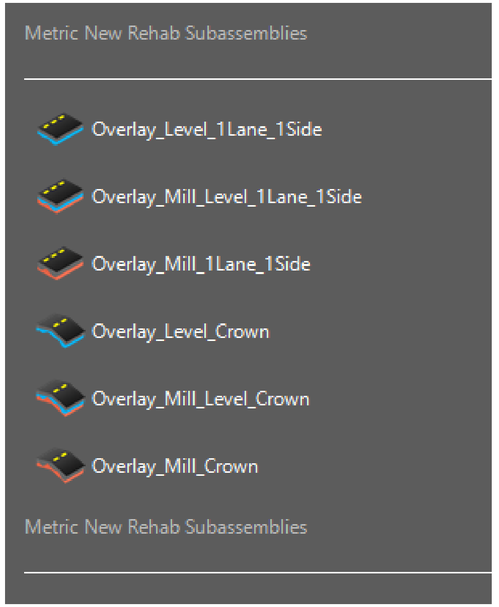


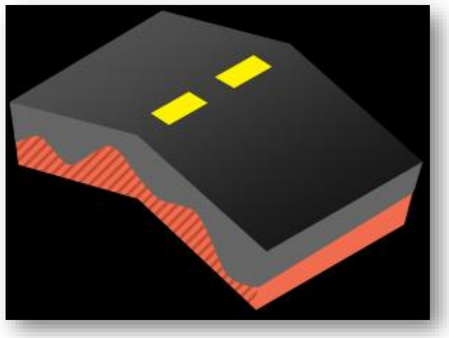


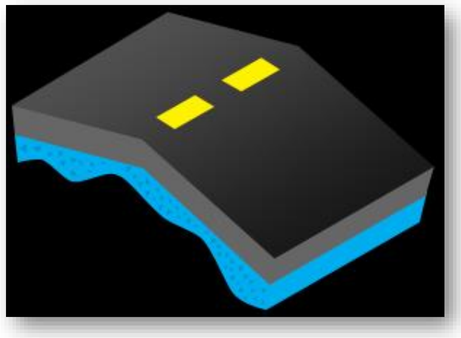


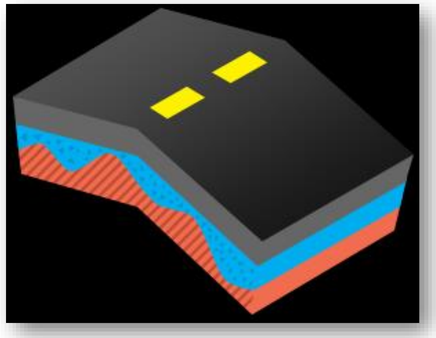
New Rehab Subassemblies

- Overlay and Level
- Overlay and Mill
- Overlay and Mill and Level

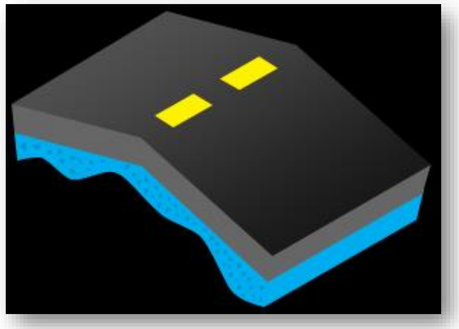


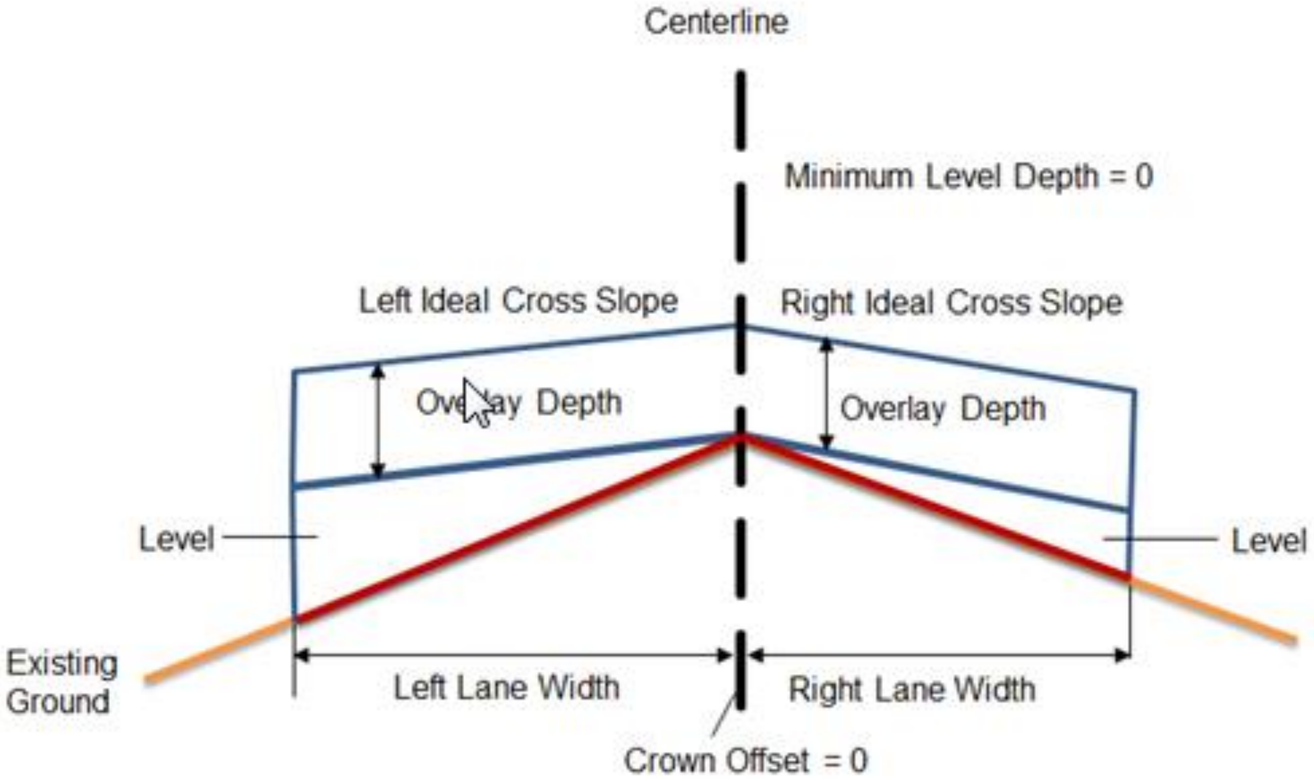




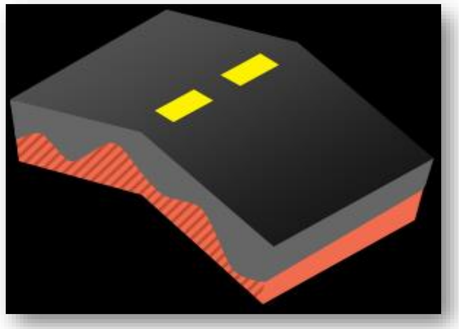


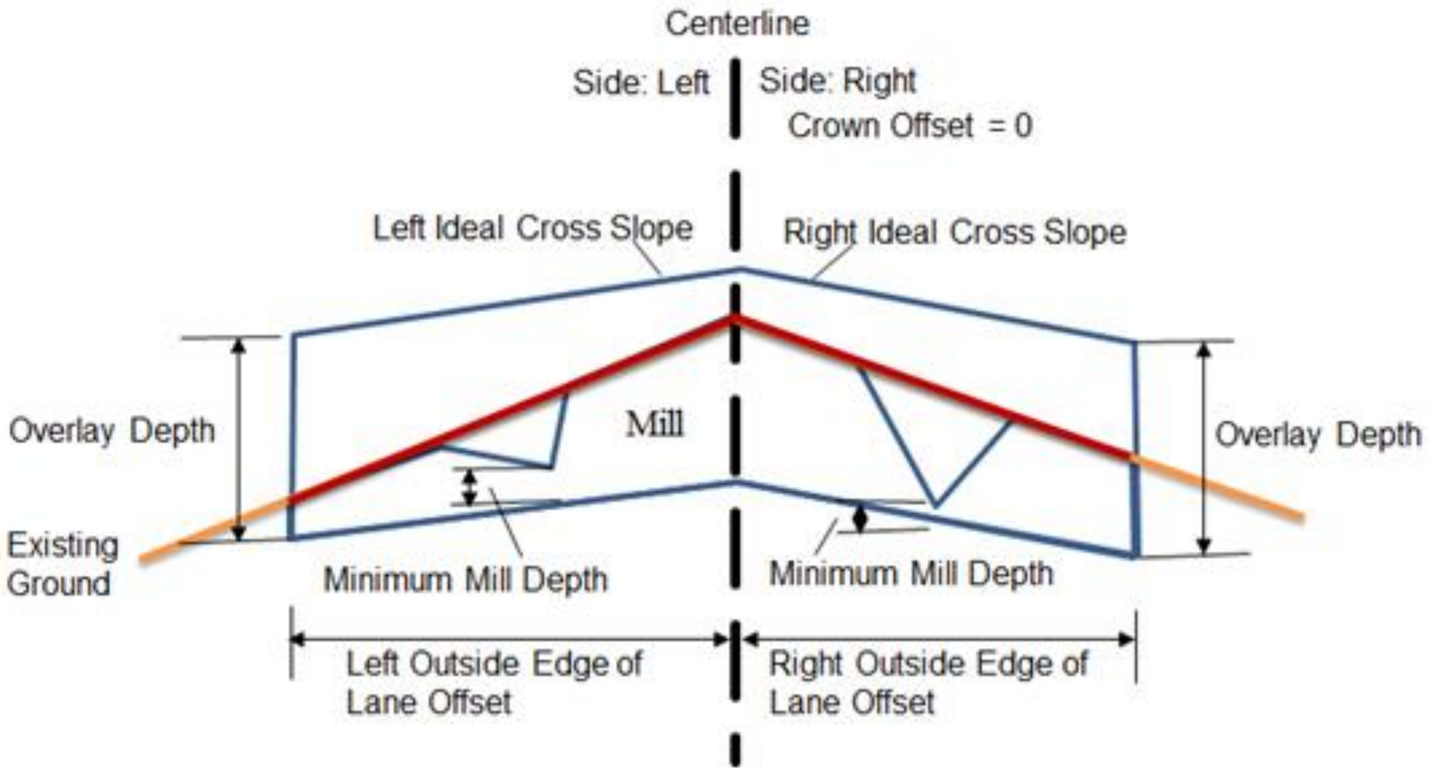
OverlayLevelCrown



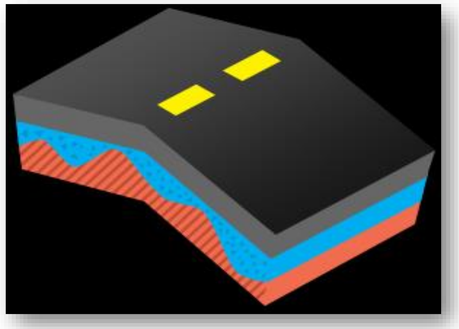


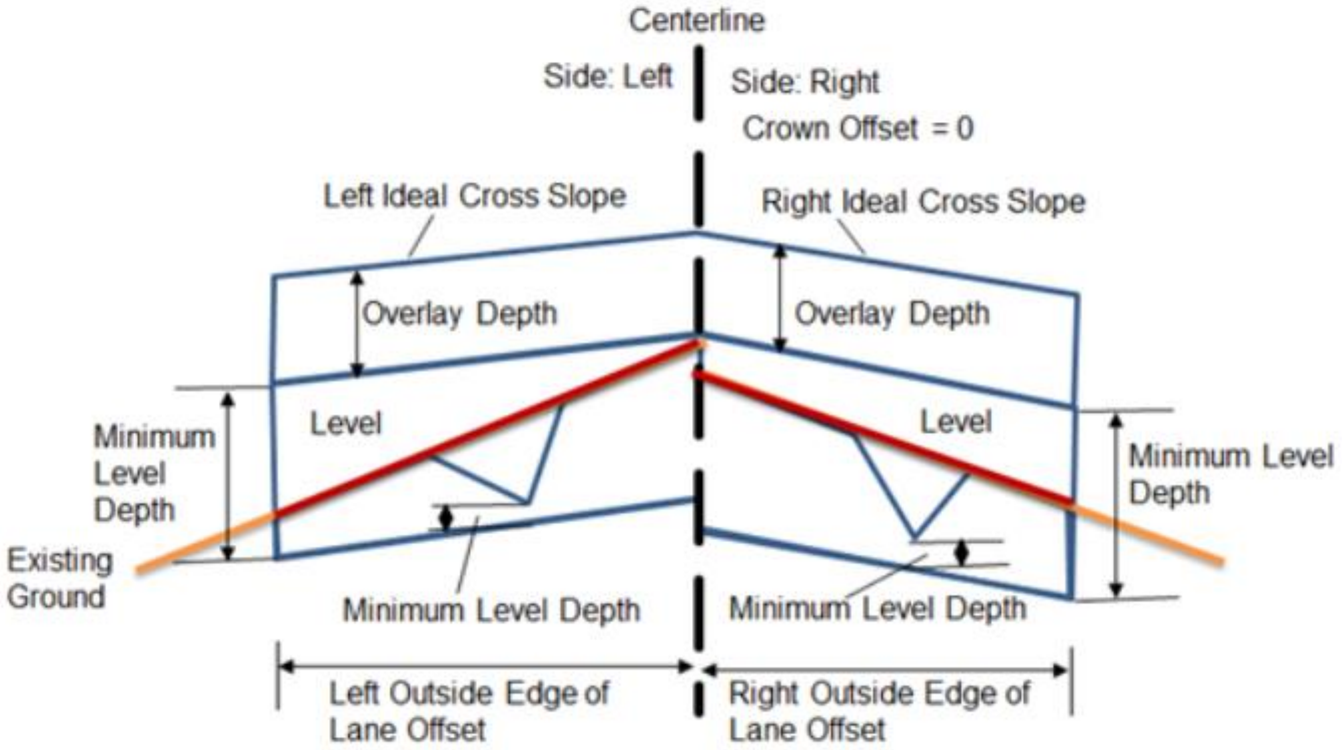
OverlayMillCrown



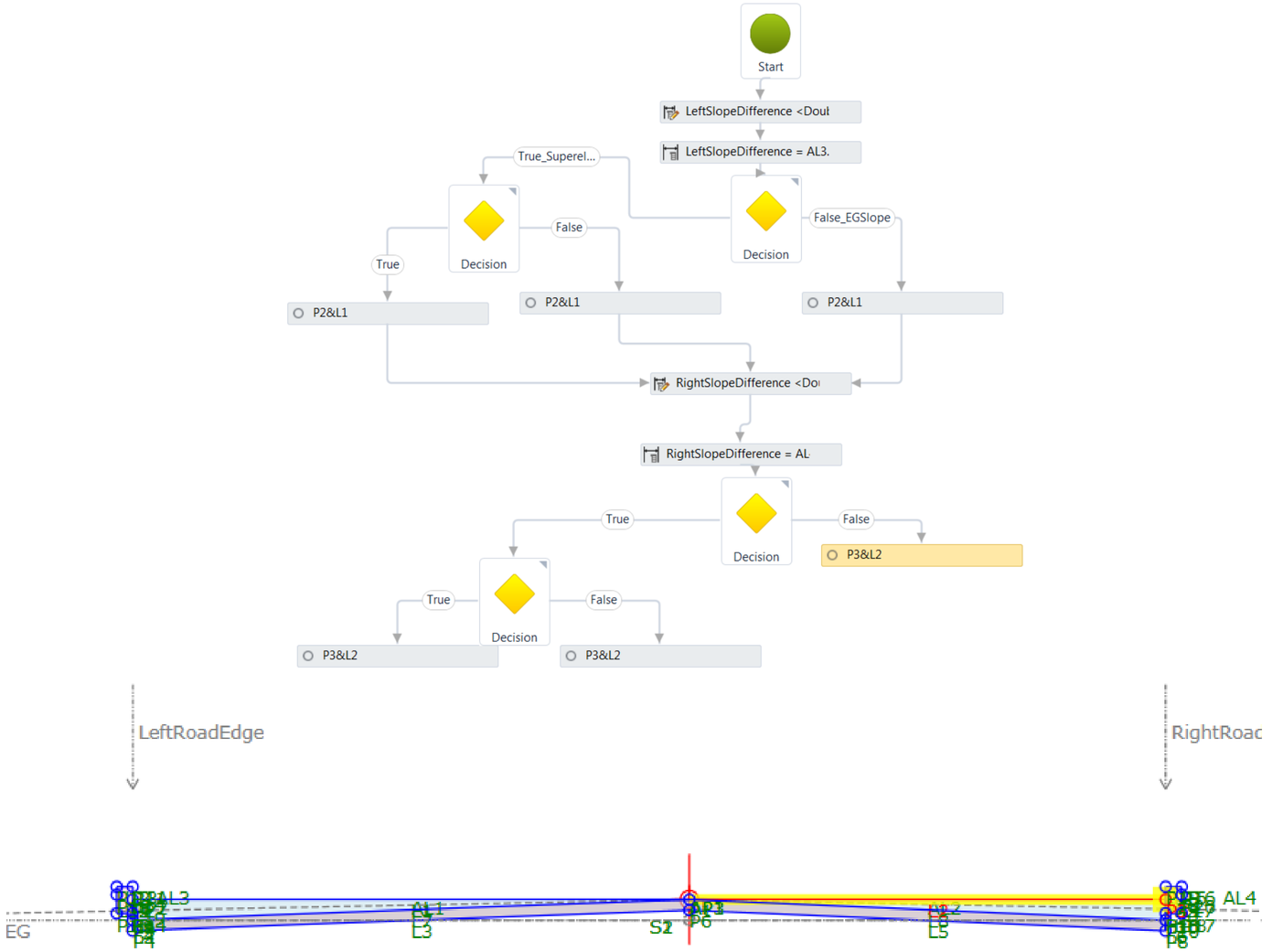


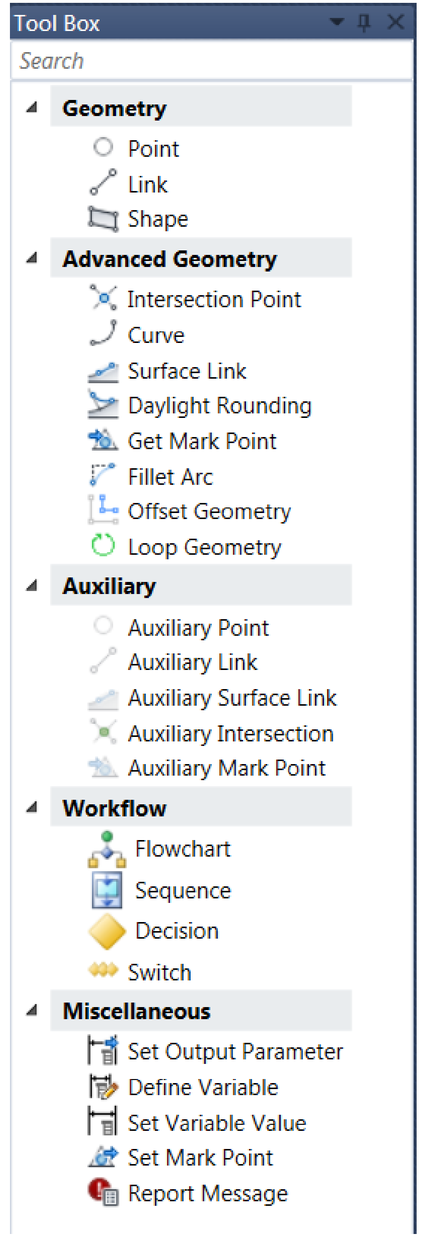
OverlayMillLevelCrown



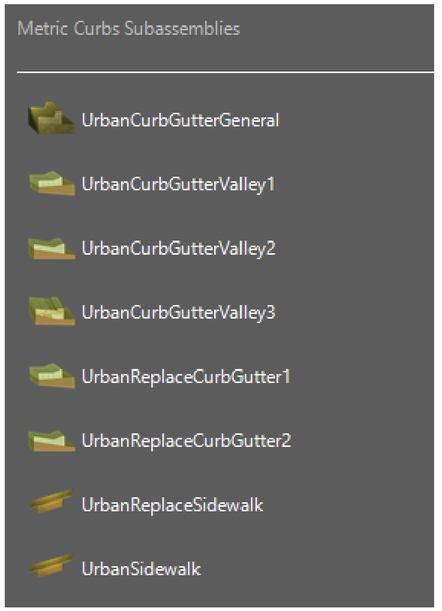


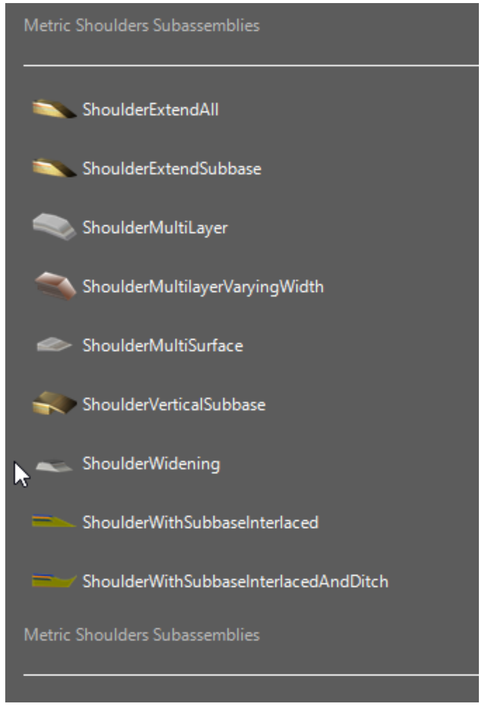
Subassembly Composer

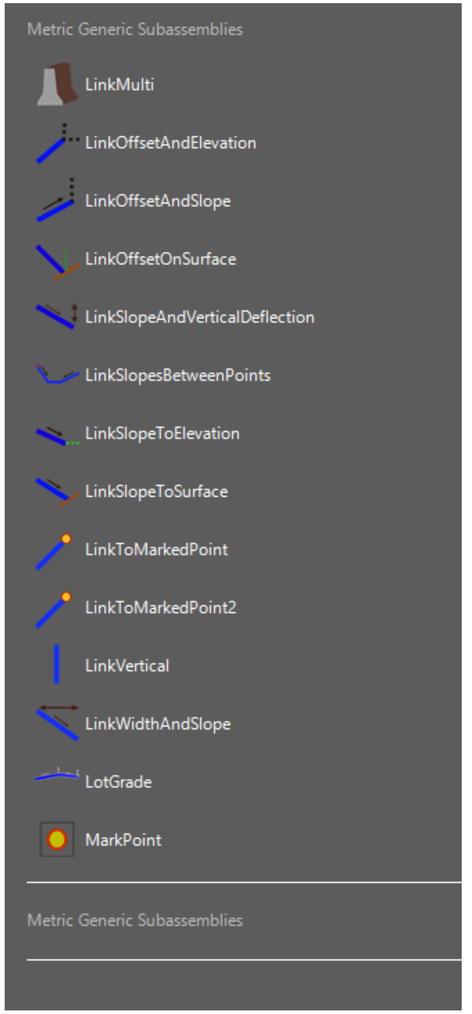


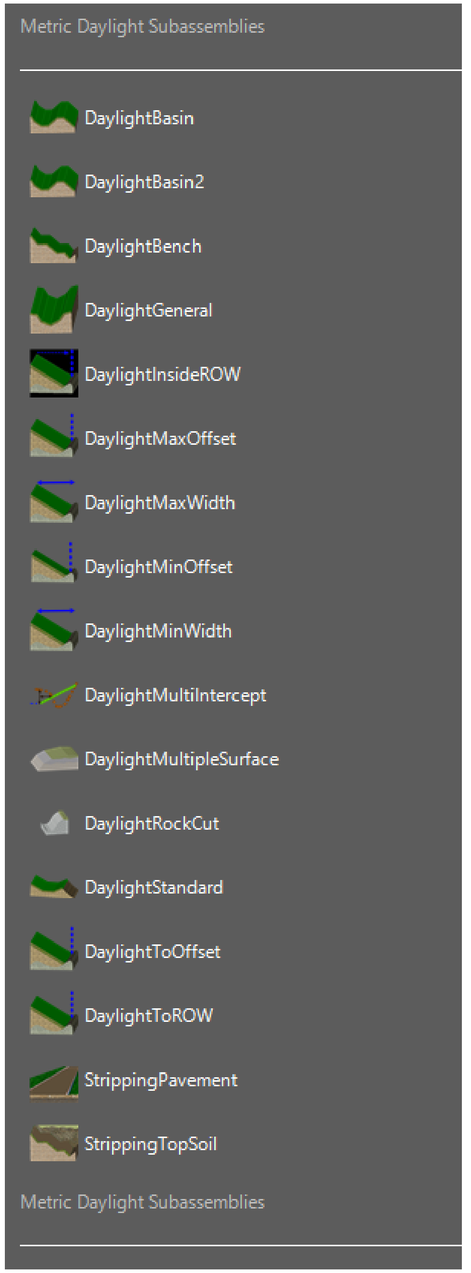


Standard Subassemblies



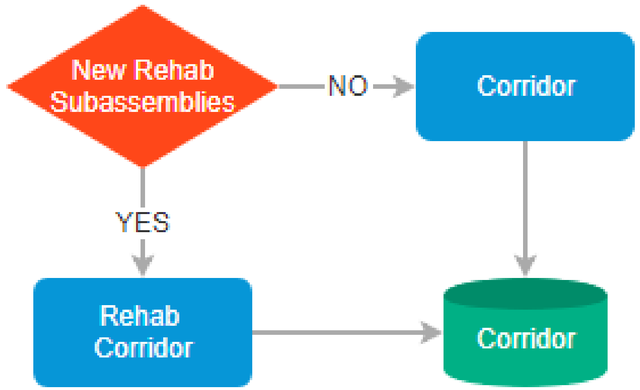




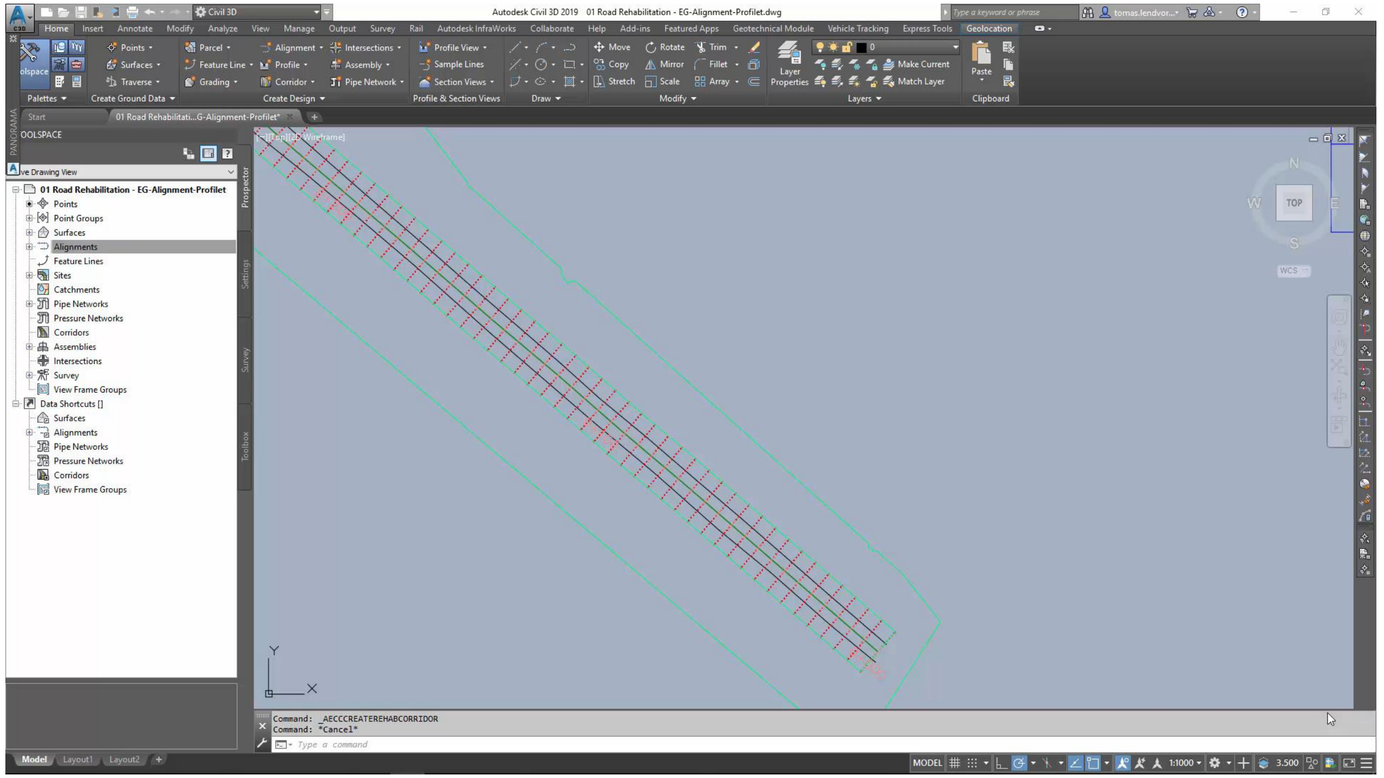


Corridor

- Corridor
  - Standard
  - Rehab



Corridor & Reports

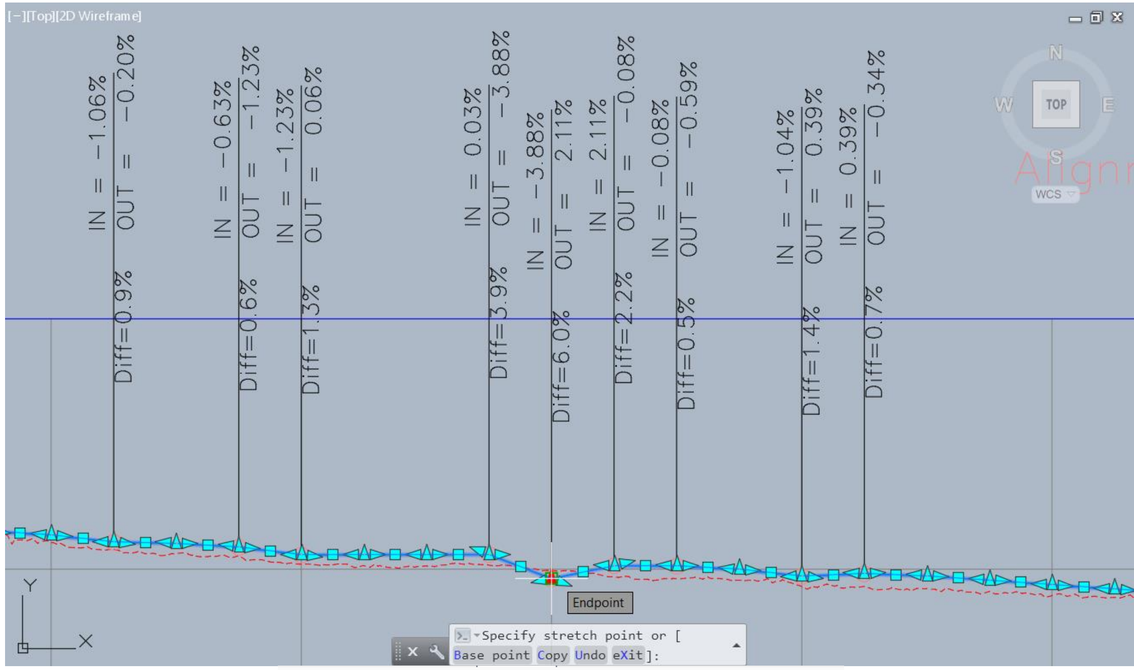


Road Crown

- Derived from Rehab Subassembly, EG and parameters
- Might be “bumpy“, eg. IN/OUT grade exceeds defined value
- Smoothing might be requiered

Expressions:

- GradeDifference
  - (ABS({Grade Out}-{Grade In}))*100
- TextHeight
  - IF(((GradeDifference))<0.5,0,0.0025)
- LineLength
  - IF((GradeDifference)<0.5,0,0.075)

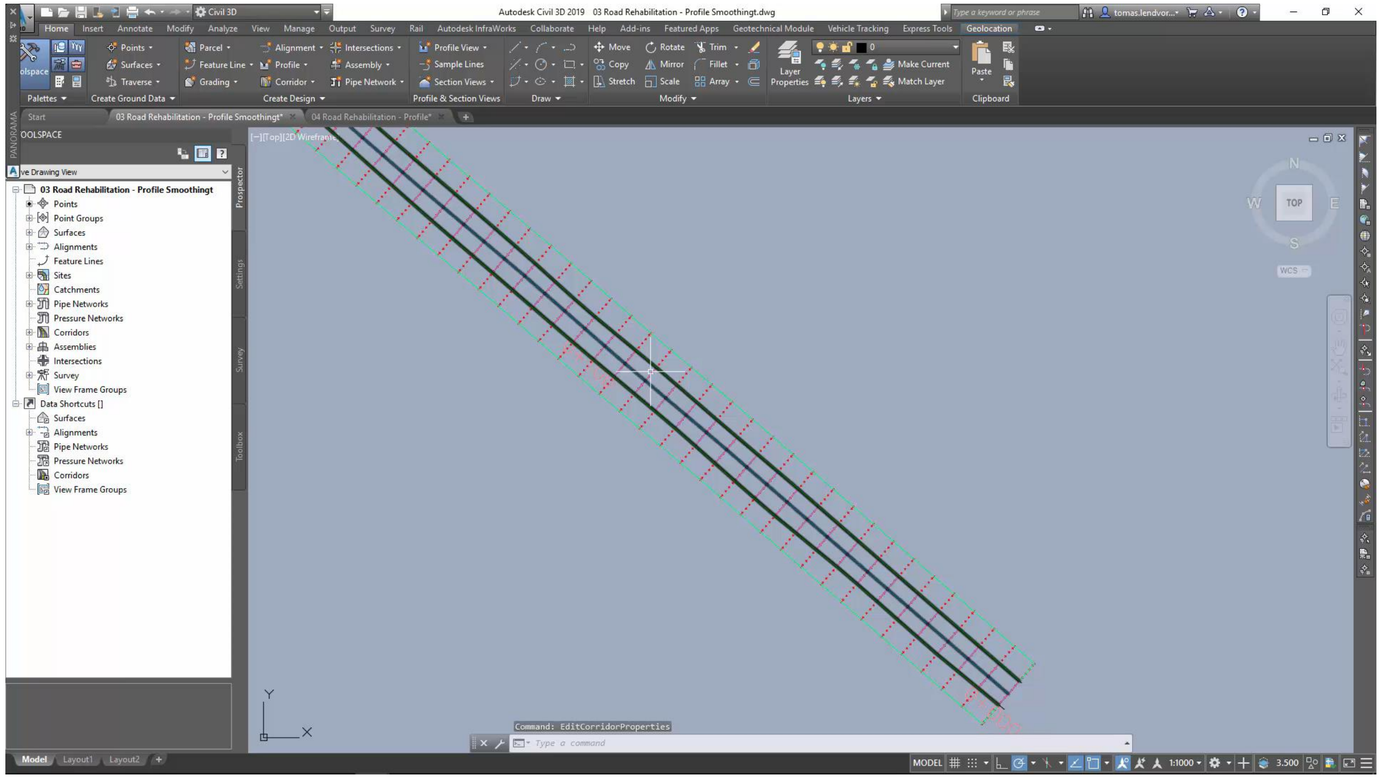


Component name:

GradeDifference

Property	Value
General	
Name	GradeDifference
Visibility	True
Anchor Component	PVIE
Anchor Point	Top Left
Text	
Contents	{\Fsimplex.shx|c...
Text Height	TextHeight
Rotation Angle	0.0000 (d)
Attachment	Middle center
X Offset	-15.00mm
Y Offset	-1.50mm
Color	BYLAYER
Lineweight	ByLayer
Maximum Width	0.00mm

Profile Smoothing



Analysis

Reports

- Standard

CHAINAGE 0+025.000

POINT	X	Y	Z	OFFSET	STRING CUT
1	6,540,483.7059	5,601,407.0893	234.2550	-3.335m	P2
2	6,540,483.7774	5,601,407.1709	234.3093	-3.226m	KN
3	6,540,483.7774	5,601,407.1709	234.2093	-3.226m	KN_Nałożenie
4	6,540,485.9031	5,601,409.5978	234.0573	0.000m	Korona
5	6,540,485.9031	5,601,409.5978	233.9573	0.000m	Korona_Nałożenie
6	6,540,487.9409	5,601,411.9245	233.7668	3.093m	KN_Nałożenie
7	6,540,487.9409	5,601,411.9245	233.8668	3.093m	KN
8	6,540,488.0348	5,601,412.0317	233.7955	3.235m	P2

- Rehab Corridor Reports

Koridor - (1) > BL - Alignment - Rehab - (2) > RG - Vzorový > Start station: 50.00m End station: 150.00m

Cross Slope Correction Report | Milling and Leveling Report

Offset: 5.00m

Station	Edge Point 2		Edge Point 1		Control Point 1		Incremental Offset Report			Control Point 1		Edge Point 1		Edge Point 2	
	Offset	Mill/Level Depth	Offset	Mill/Level Depth	Offset	Mill/Level Depth	-5.00m	0.00m	5.00m	Offset	Mill/Level Depth	Offset	Mill/Level Depth	Offset	Mill/Level Depth
50.00m	-3.61m	-0.34m	1.00m	-0.47m	1.00m	-0.47m		-0.48m		3.82m	-0.30m	1.00m	-0.47m	3.82m	-0.30m
53.10m	-3.52m	-0.34m	1.00m	-0.46m	1.00m	-0.46m		-0.47m		3.84m	-0.30m	1.00m	-0.46m	3.84m	-0.30m
58.31m	-3.35m	-0.33m	1.00m	-0.44m	1.00m	-0.44m		-0.46m		1.98m	-0.30m	1.00m	-0.44m	3.85m	-0.33m
59.42m	-3.42m	-0.33m	1.00m	-0.46m	1.00m	-0.46m		-0.48m		1.58m	-0.30m	1.00m	-0.46m	3.86m	-0.32m
63.76m	-3.68m	-0.30m	1.00m	-0.50m	-3.68m	-0.30m		-0.50m		1.00m	-0.50m	1.00m	-0.50m	3.87m	-0.32m
63.80m	-3.68m	-0.30m	1.00m	-0.50m	-3.68m	-0.30m		-0.50m		1.00m	-0.50m	1.00m	-0.50m	3.87m	-0.32m
64.45m	-3.72m	-0.30m	1.00m	-0.51m	-3.72m	-0.30m		-0.51m		1.00m	-0.51m	1.00m	-0.51m	3.87m	-0.32m
73.02m	-3.60m	-0.31m	1.00m	-0.50m	-3.60m	-0.31m		-0.51m		2.89m	-0.30m	1.00m	-0.50m	3.89m	-0.30m
75.00m	-3.57m	-0.31m	1.00m	-0.50m	-3.57m	-0.31m		-0.51m		3.51m	-0.30m	1.00m	-0.50m	3.89m	-0.30m
76.18m	-3.55m	-0.30m	1.00m	-0.50m	-3.55m	-0.30m		-0.51m		3.87m	-0.30m	1.00m	-0.50m	3.89m	-0.30m
76.24m	-3.55m	-0.30m	1.00m	-0.50m	-3.55m	-0.30m		-0.51m		3.89m	-0.30m	1.00m	-0.50m	3.89m	-0.30m
76.61m	-3.54m	-0.30m	1.00m	-0.50m	-3.54m	-0.30m		-0.51m		3.86m	-0.30m	1.00m	-0.50m	3.89m	-0.30m
78.60m	-3.55m	-0.31m	1.00m	-0.50m	-3.55m	-0.31m		-0.51m		3.68m	-0.30m	1.00m	-0.50m	3.90m	-0.30m
100.00m	-3.58m	-0.33m	1.00m	-0.49m	1.00m	-0.49m		-0.50m		1.79m	-0.30m	1.00m	-0.49m	3.91m	-0.30m
117.37m	-3.61m	-0.32m	1.00m	-0.47m	1.00m	-0.47m		-0.47m		1.00m	-0.47m	1.00m	-0.47m	3.93m	-0.30m
118.86m	-3.61m	-0.32m	1.00m	-0.47m	1.00m	-0.47m		-0.47m		1.00m	-0.47m	1.00m	-0.47m	3.93m	-0.30m
119.52m	-3.62m	-0.32m	1.00m	-0.47m	1.00m	-0.47m		-0.47m		1.38m	-0.30m	1.00m	-0.47m	3.93m	-0.30m
120.93m	-3.62m	-0.32m	1.00m	-0.48m	1.00m	-0.48m		-0.47m		1.00m	-0.48m	1.00m	-0.48m	3.93m	-0.30m
125.00m	-3.64m	-0.32m	1.00m	-0.46m	1.00m	-0.46m		-0.46m		1.00m	-0.46m	1.00m	-0.46m	3.83m	-0.31m
126.03m	-3.65m	-0.32m	1.00m	-0.46m	1.00m	-0.46m		-0.45m		1.00m	-0.46m	1.00m	-0.46m	3.81m	-0.31m
128.64m	-3.66m	-0.32m	1.00m	-0.46m	1.00m	-0.46m		-0.45m		1.00m	-0.46m	1.00m	-0.46m	3.82m	-0.31m
129.47m	-3.67m	-0.32m	1.00m	-0.46m	1.00m	-0.46m		-0.45m		1.00m	-0.46m	1.00m	-0.46m	3.83m	-0.31m
142.71m	-3.74m	-0.32m	1.00m	-0.45m	1.00m	-0.45m		-0.44m		1.00m	-0.45m	1.00m	-0.45m	3.92m	-0.31m
142.76m	-3.74m	-0.32m	1.00m	-0.46m	1.00m	-0.46m		-0.44m		1.00m	-0.46m	1.00m	-0.46m	3.92m	-0.31m
143.68m	-3.74m	-0.30m	1.00m	-0.55m	-3.74m	-0.30m		-0.52m		1.00m	-0.55m	1.00m	-0.55m	3.93m	-0.34m
150.00m	-3.75m	-0.34m	1.00m	-0.68m	-1.39m	-0.46m		-0.63m		1.00m	-0.68m	1.00m	-0.68m	3.96m	-0.38m

Analysis

- Section views and annotation
- Volumetric calculation
- Coridor surfaces
- TIN Volume surface
- Surface Analysis
- Surface labels

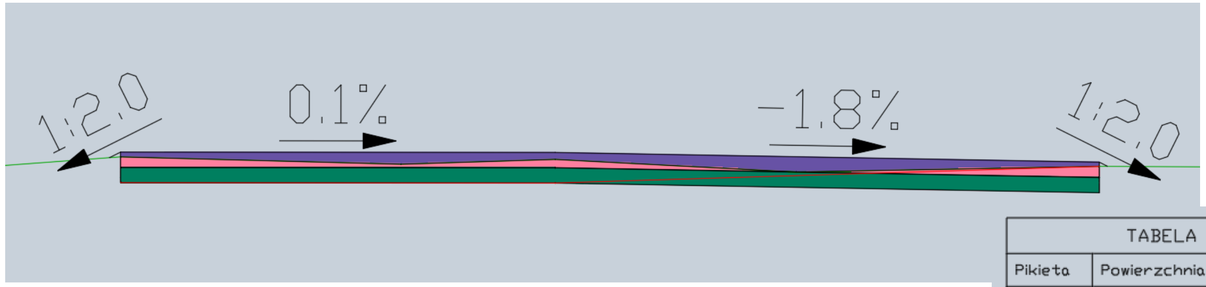
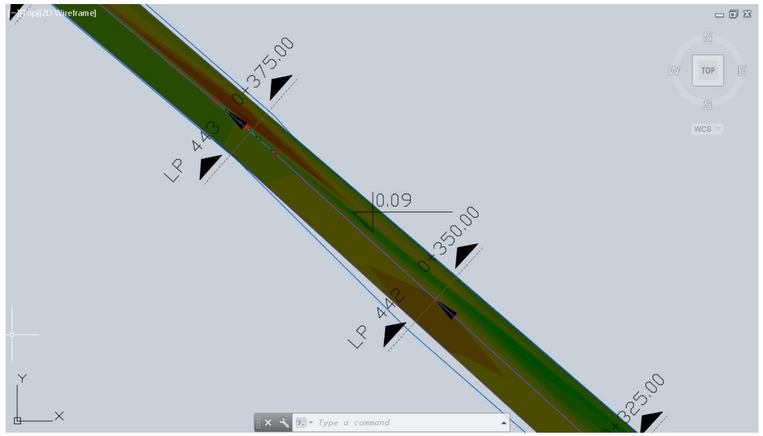
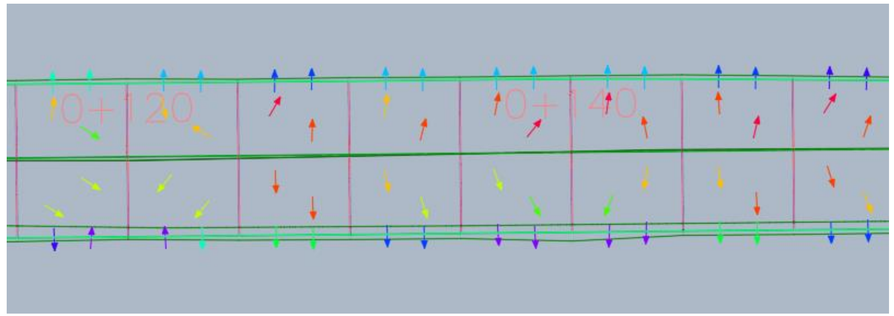
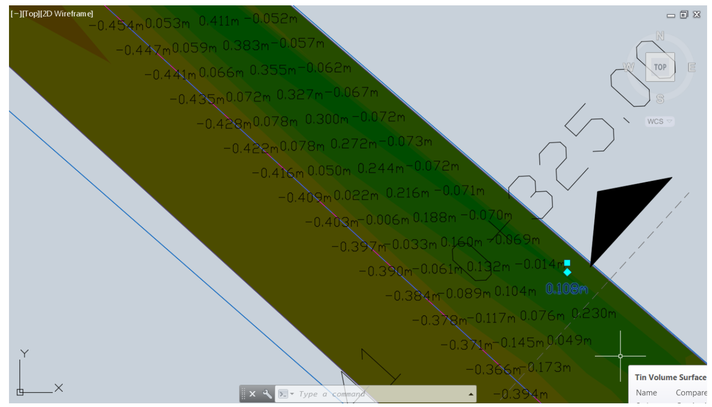


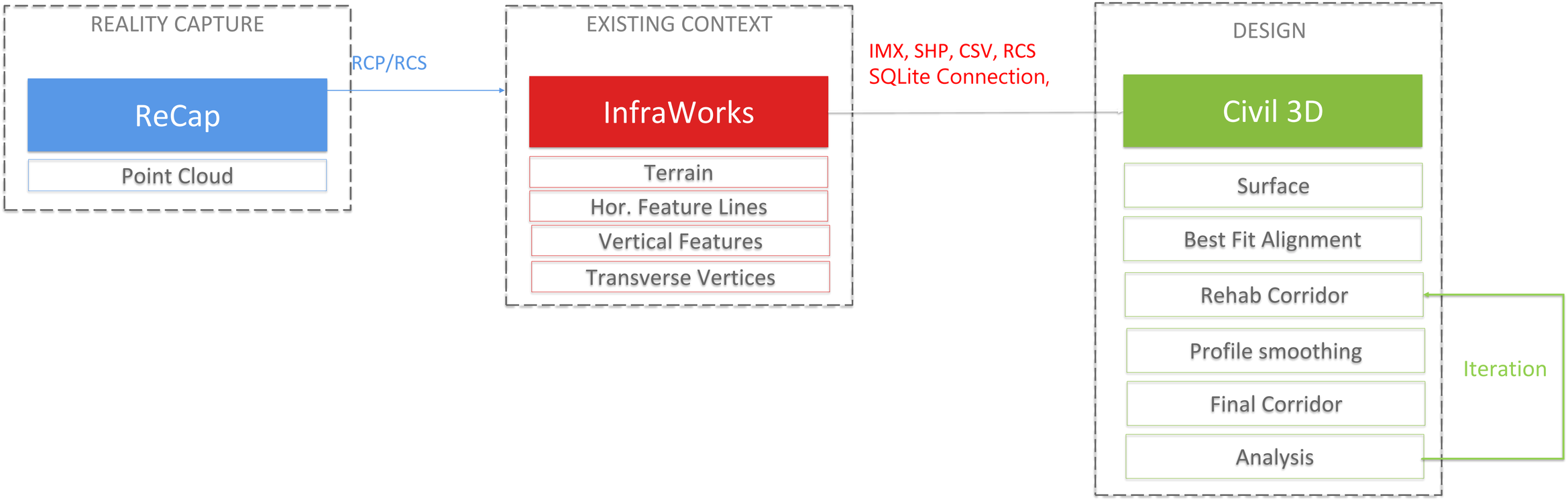
TABELA MATERIAŁU FREZ			
Pikieta	Powierzchnia	Objetość	Objetość całkowita
0+025.00	0.75	0.00	0.00
0+050.00	0.90	20.58	20.58
0+075.00	0.72	20.29	40.87
0+100.00	0.75	18.42	59.29
0+125.00	0.76	18.86	78.16
0+150.00	0.68	18.00	96.15
0+175.00	0.80	18.45	114.60
0+200.00	0.77	19.55	134.15
0+225.00	0.67	17.93	152.09
0+250.00	0.70	17.08	169.17
0+275.00	0.88	19.76	188.93
0+300.00	0.83	21.44	210.37
0+325.00	2.37	40.08	250.45



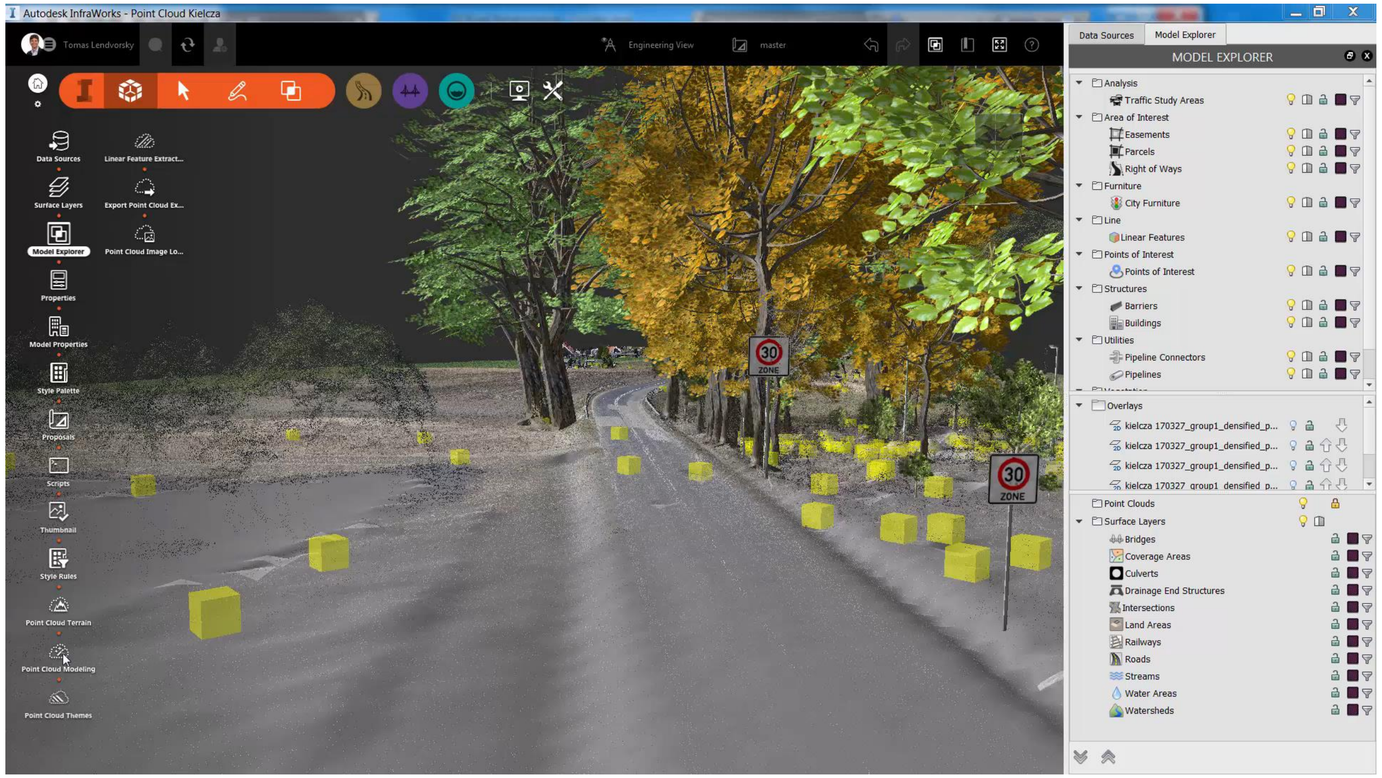




Road Rehabilitation Workflow



Vertical Features

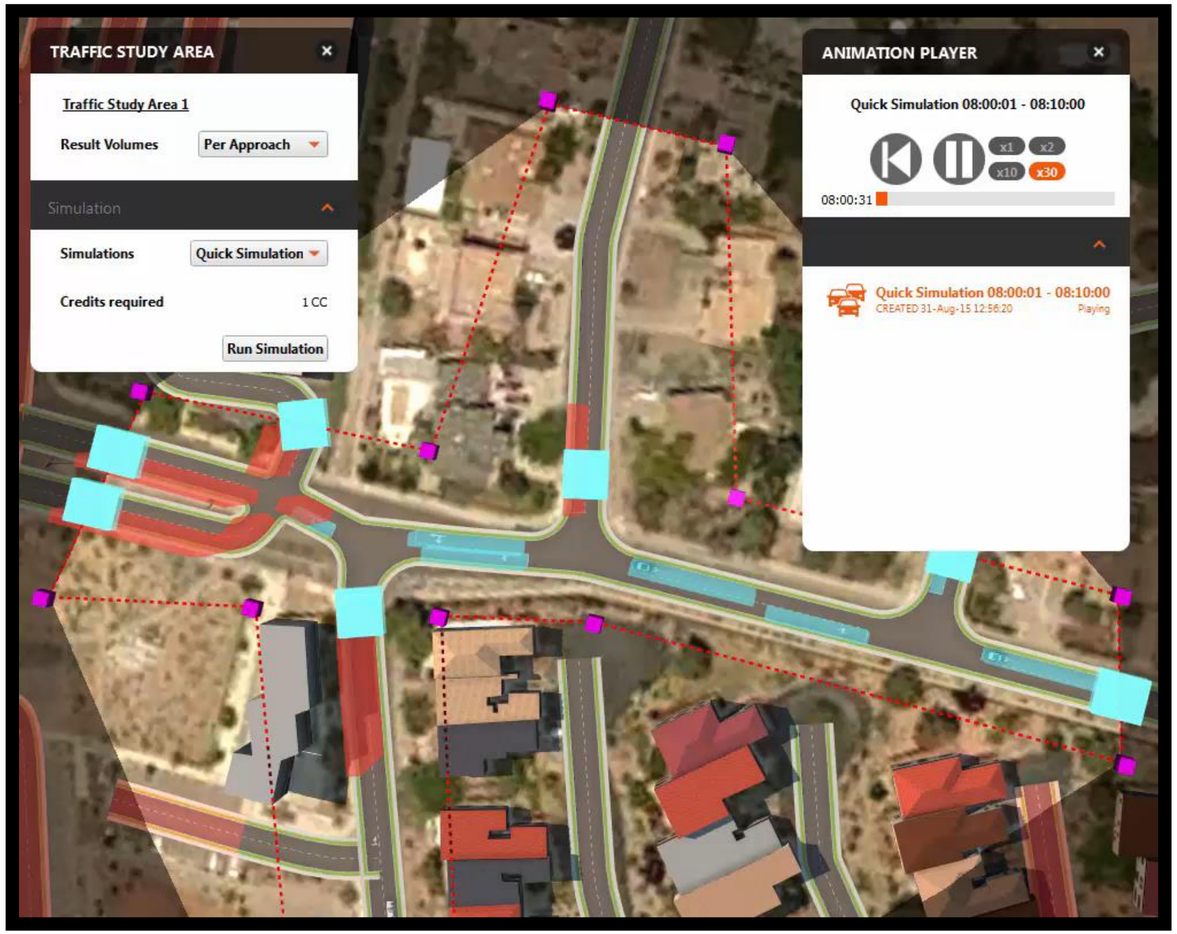


Traffic Simulation

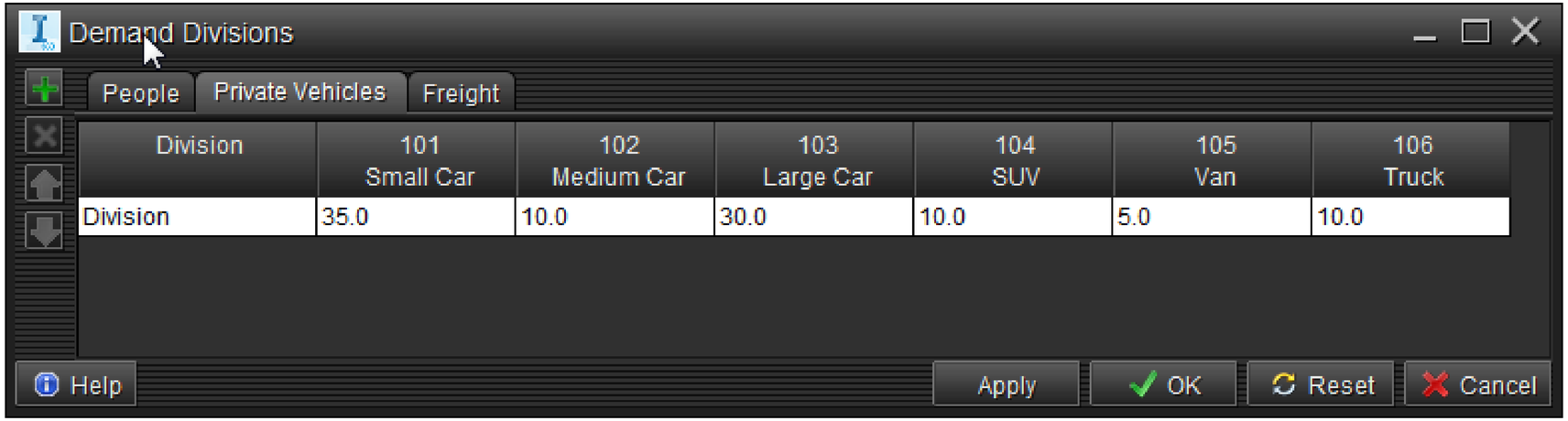
Traffic Simulation – Why?

Make Decissions based on Traffic analytics

- Analyze traffic flow for complex road systems
- Identify problem areas, redesign, and re-analyze
- Easy, visual approach yet robust and sophisticated
- Visual results are easy to understand and explain



Definition:
Demand Division



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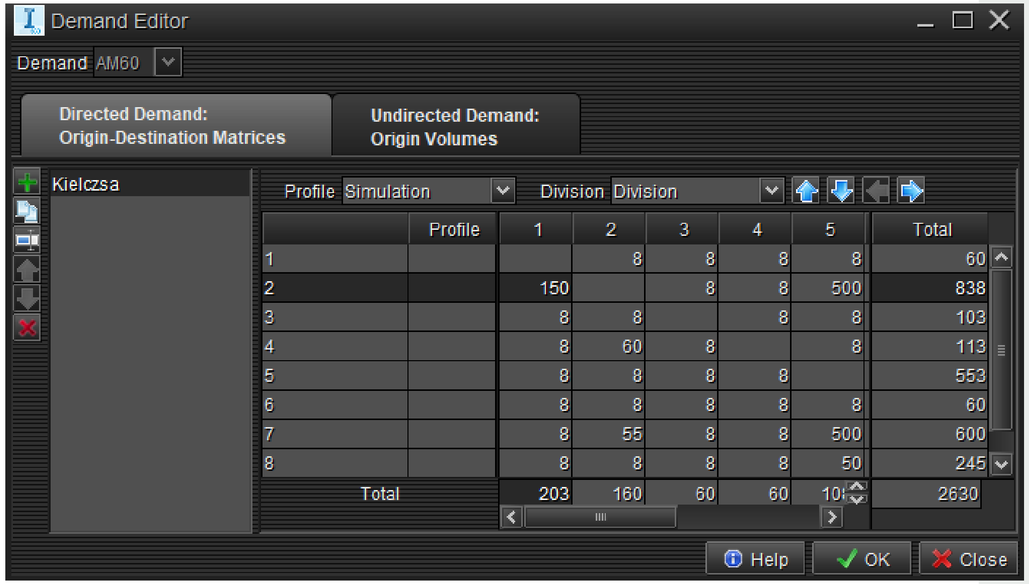

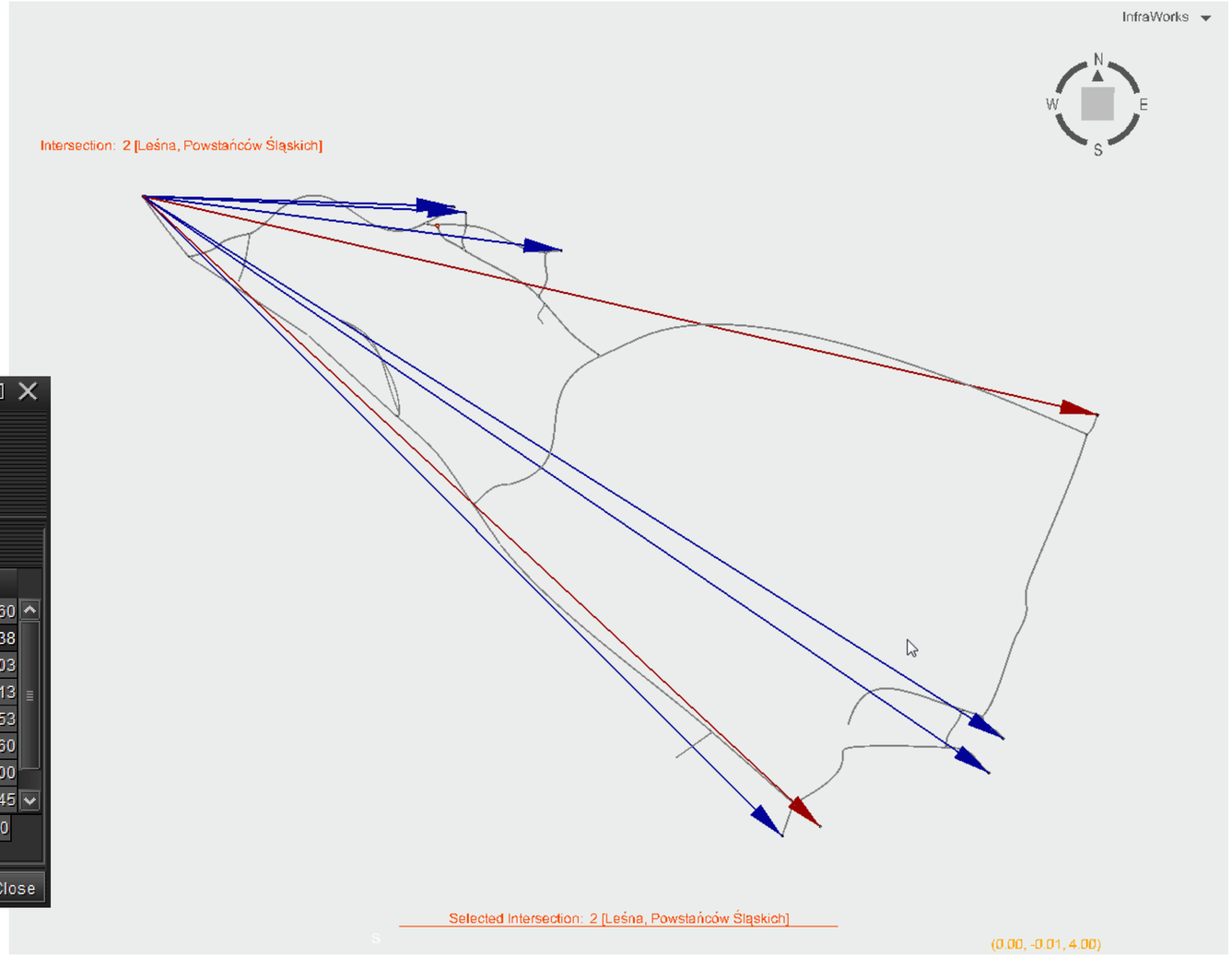

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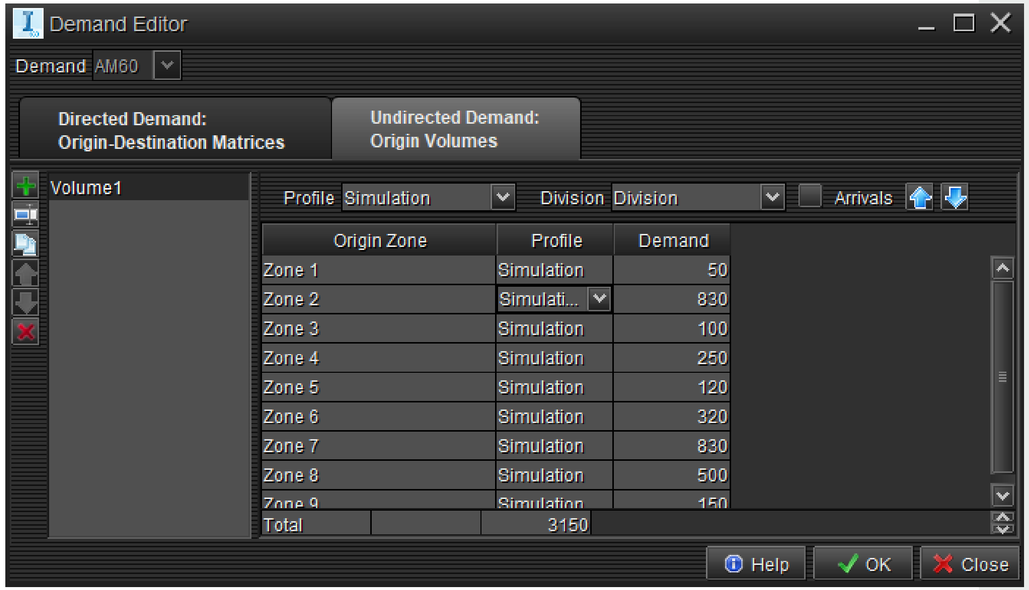
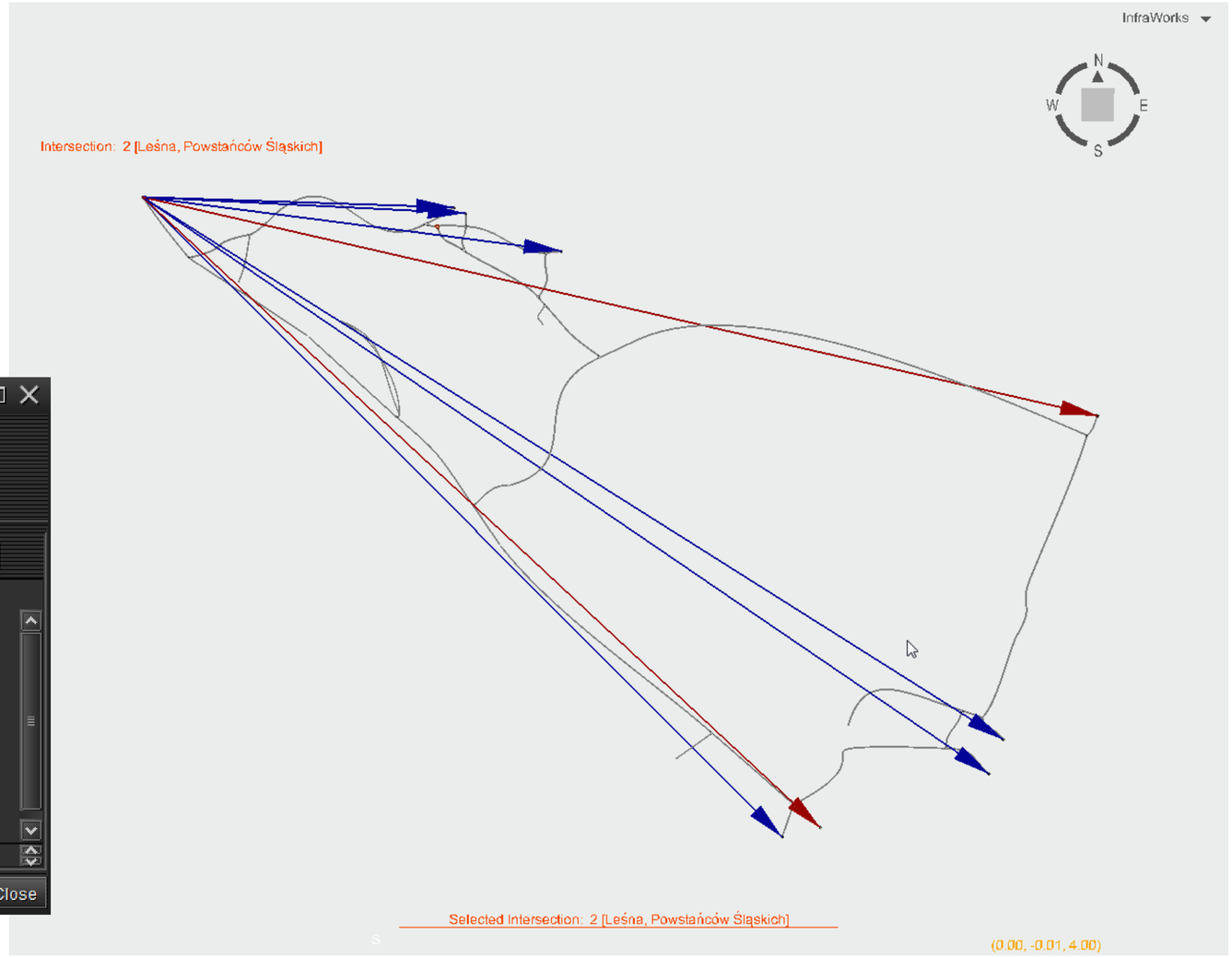
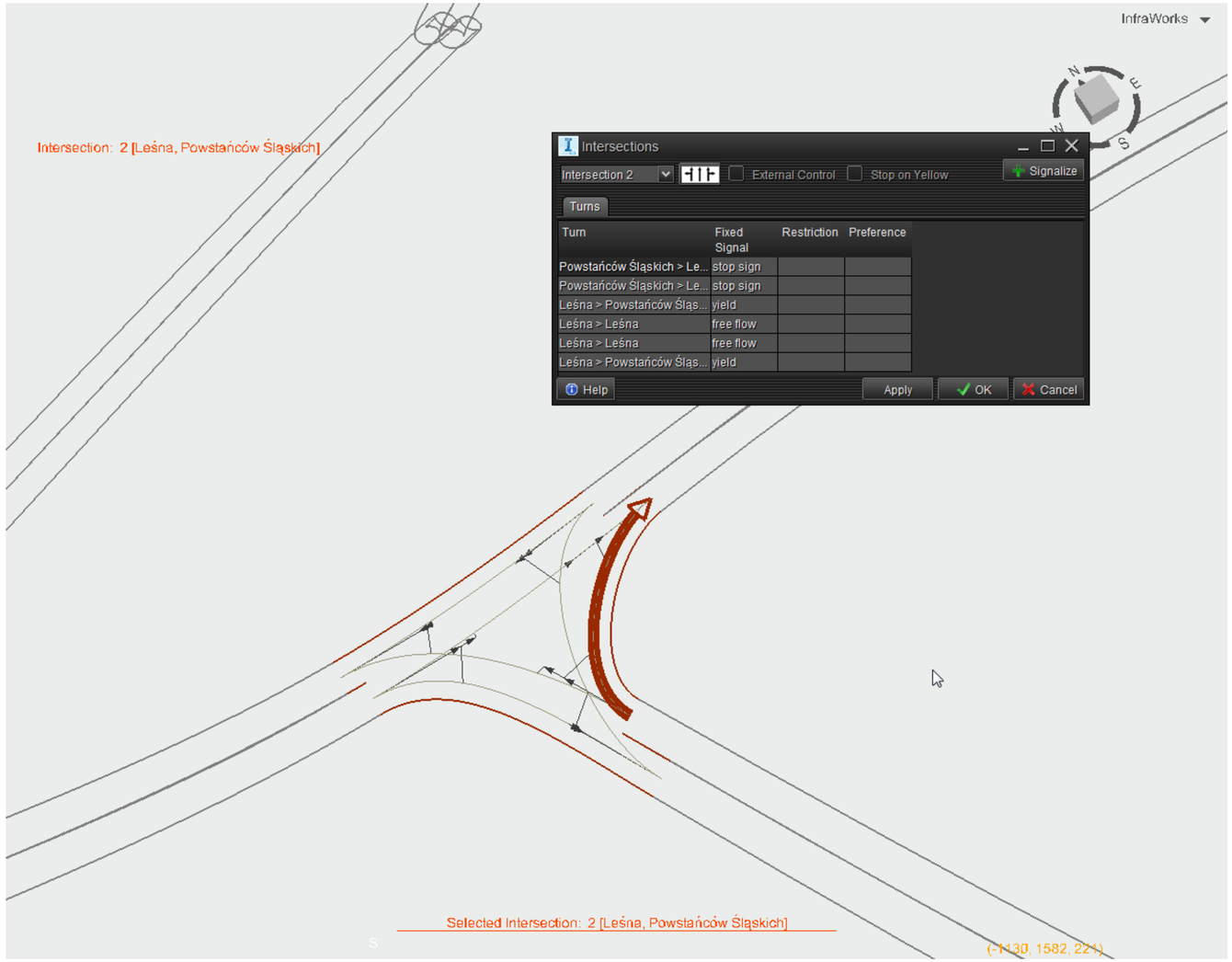
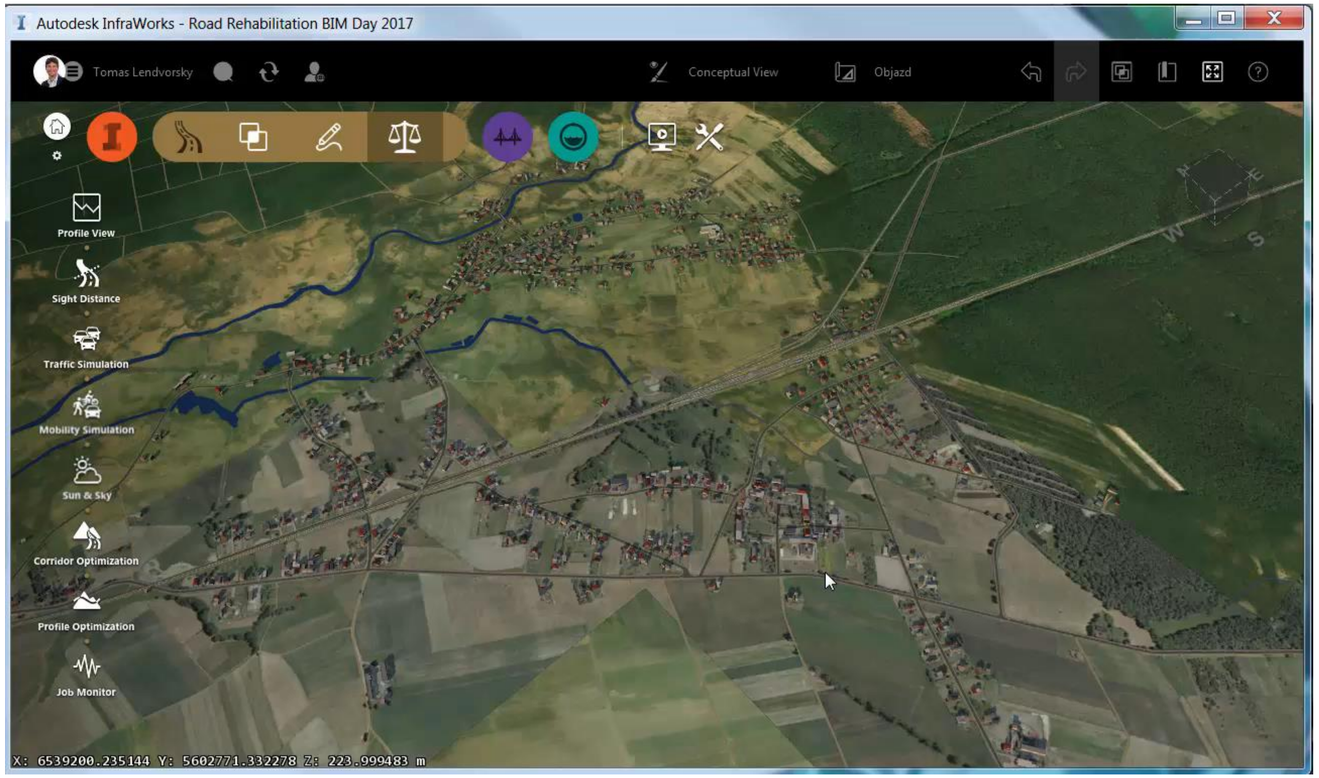




Definition:
Intersection Control



Traffic Simulation



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