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FEBRUARY 13, 2023



GEDO NovaTrack. Introduction

Trimble Geospatial Track Survey & Scanning



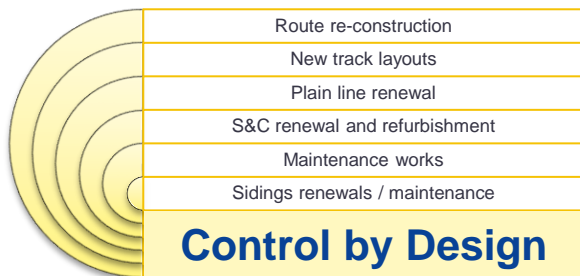
V.2.2.2

AGENDA

- Short intro into GEDO NovaTrack software
- Key features
- Standard workflows & special case
- Live demo
- Reference & Support information
- Questions



Goals within track maintenance and renewal



- Reduction of maintenance/renewal cycles
- Avoid issues with the clearances to the structures
- Increase in life of track infrastructure
- Track improvements by detecting geometry irregularities
- Always known the initial track position
- Increase construction asset utilization



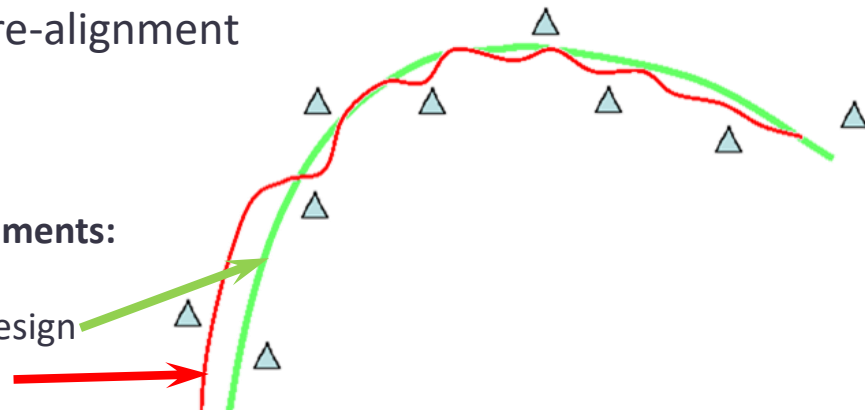
Typical issues with alignment data

Challenges with track design alignments:

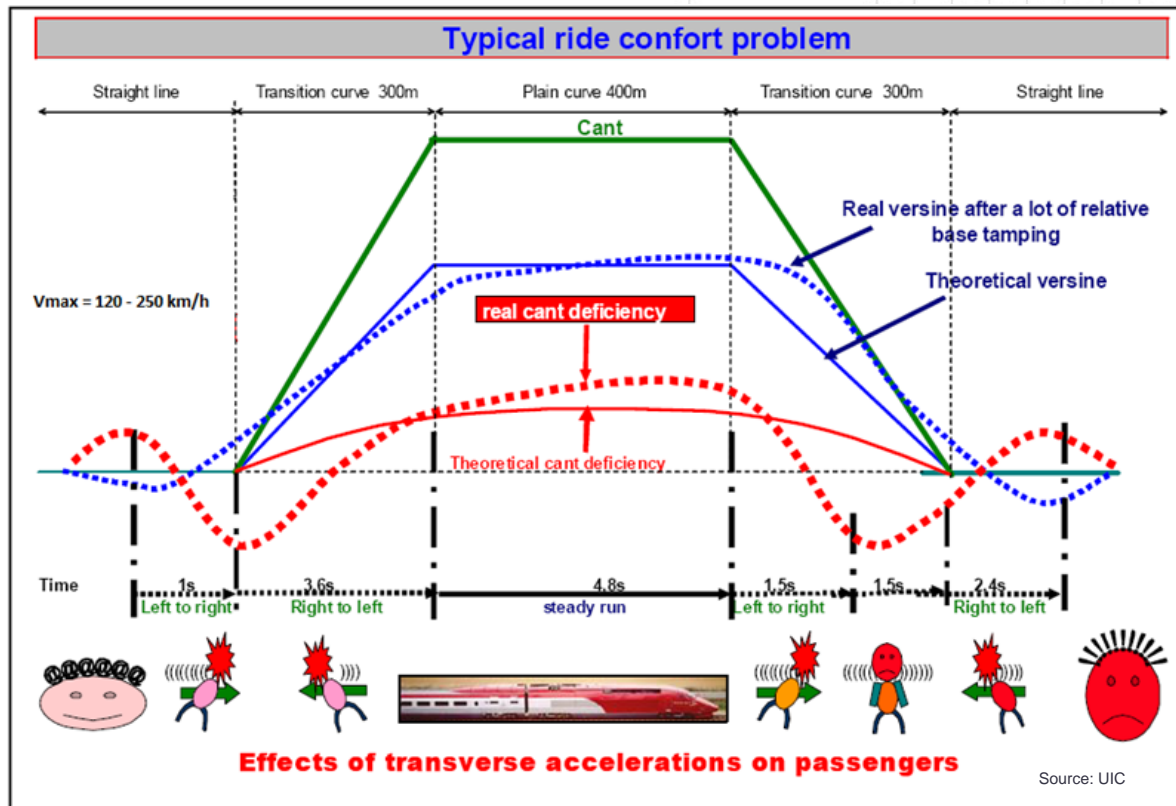
- Design alignment data is not available or partial
- Transition tangents are moved due to the relative tamping process
- Both vertical and horizontal radii are drifted from the original design
- Cant alignment is off from design
- No control of clearances before and after re-alignment

Track alignments:

- Initial design
- Existing



Consequences of bad* track maintenance



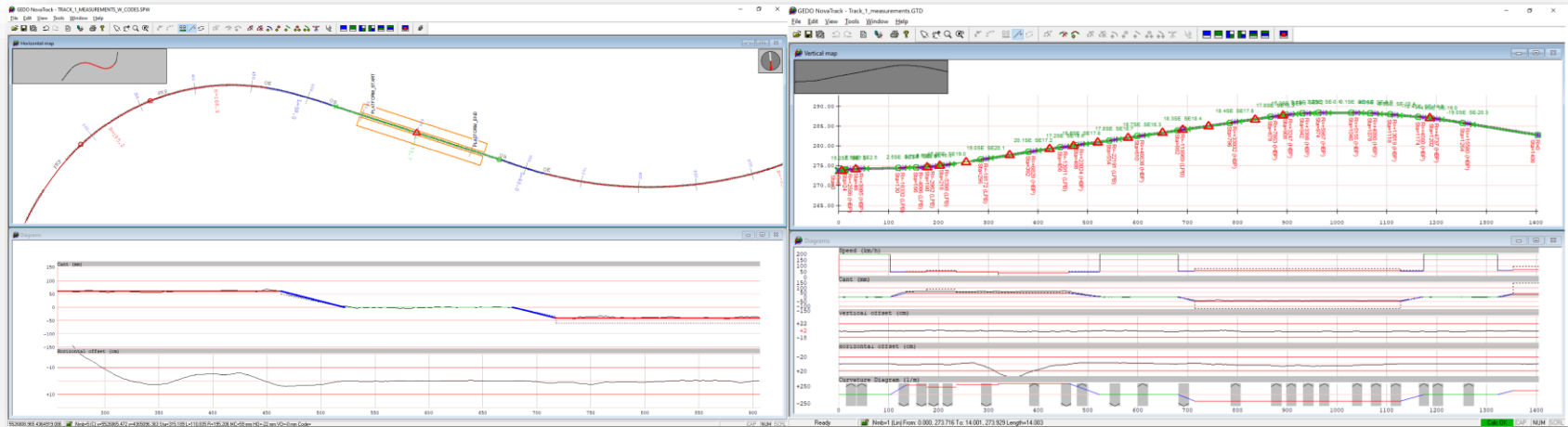
What is Trimble GEDO NovaTrack ?

- Trimble GEDO NovaTrack – software for analysis of existing track geometry and approximation with best fit design alignment geometry elements
- Primary applications
 - Create design alignment data for track maintenance (design tamping)
 - Evaluation of existing track geometry parameters
 - Checking historical alignment data against existing track position
 - Adjustment of old design alignment to match with existing track

GEDO NovaTrack - finding best-fit alignment solution

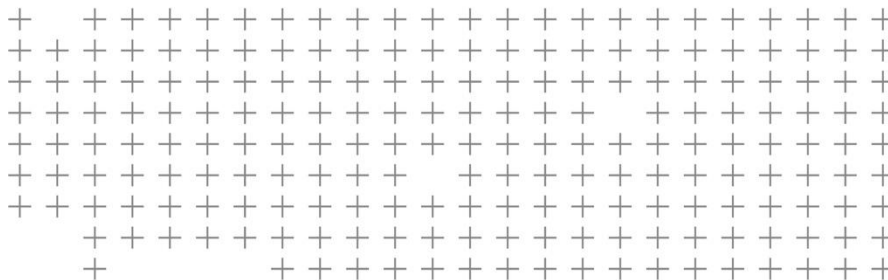
Key functionality and features:

- Automatic alignment fitting based on existing track measurement data
- Curvature prediction using 1/R curvature and Direction Analysis
- Clearance info during alignment adjustment process
- Calculation of design speed and cant
- Check alignment conformity against design regulations





02

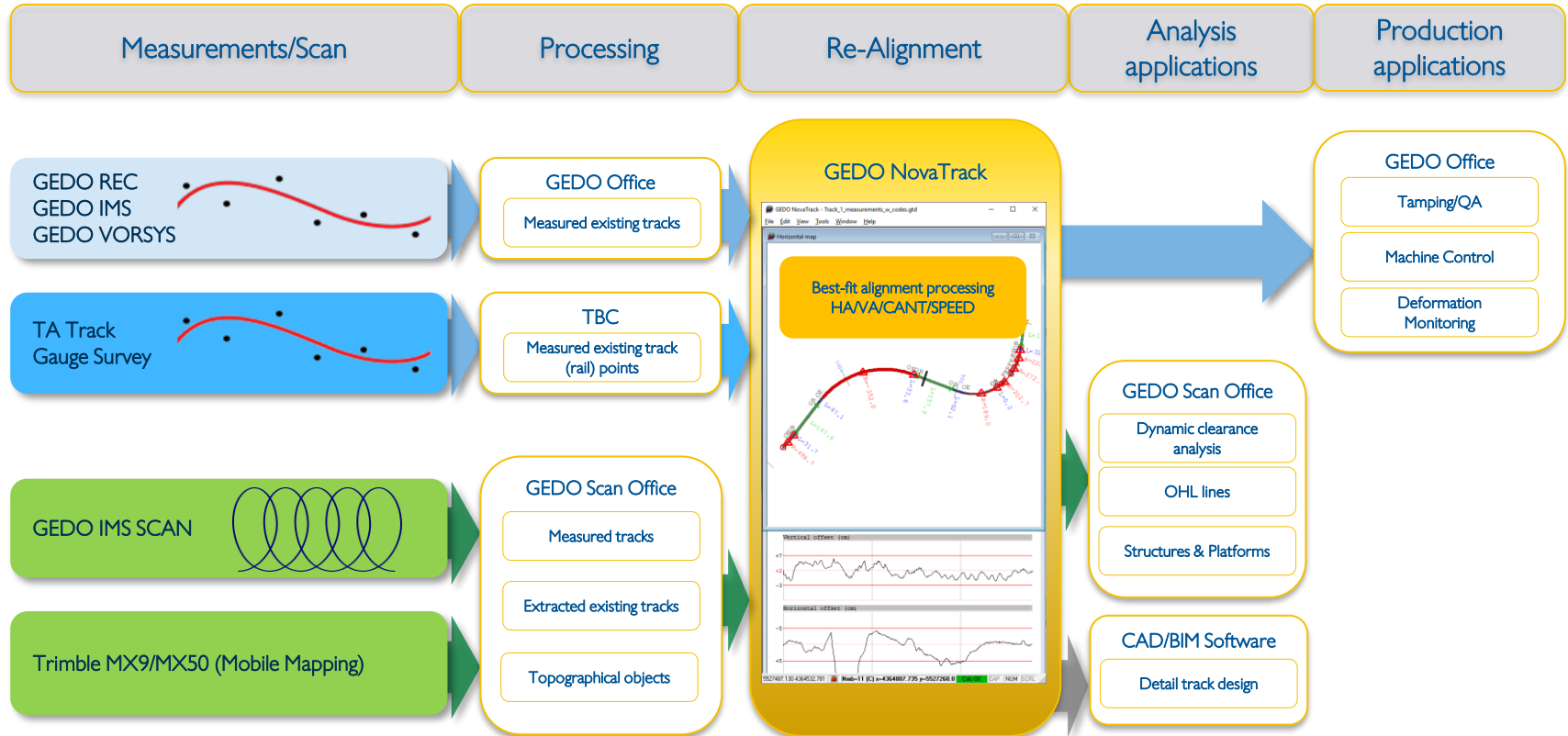


GEDO NovaTrack workflows - from measurement to a specific application

Trimble Geospatial Track Survey & Scanning

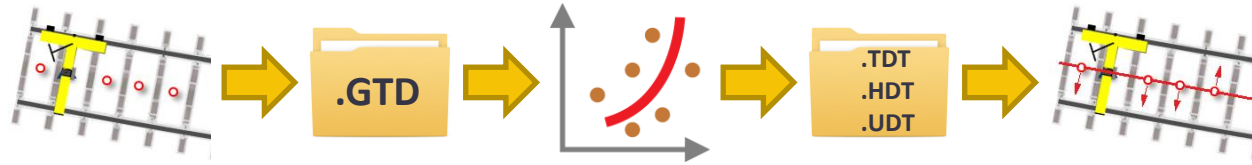
V.2.2.2

Data flow - from field to rail specific application



Alignment processing workflows

Recommended workflows for track re-alignment



A

Complete re-alignment

HAVA method

- 1 Import .GTD track data
- 2 Semi-automatic or automatic HA fitting
- 3 Adjustment HA elements. Reduction HA offsets
- 4 Automatic VA fitting, reduction of VA offsets
- 5 Cant and speed calculation (optional)
- 6 Design alignment export to .TDT/.HDT/.UDT files

B

Horizontal re-alignment

HA method

- 1 Import .GTD track data
- 2 Semi-automatic or automatic HA fitting
- 3 Adjustment HA elements. Reduction HA offsets
- 4 Design alignment output to .TDT file

C

Vertical re-alignment

VA method

- 1 Import .GTD track data
- 2 Automatic VA fitting
- 3 Design alignment output to .HDT file

D

Verification of alignment

Verification method

- 1 Import .GTD track data
- 2 Import design alignment
- 3 Check HA/VA offsets and compliance with rules

Track survey data input. Option #1

Input measurement data:

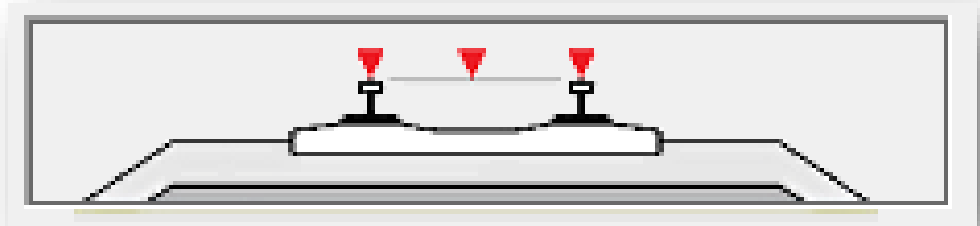
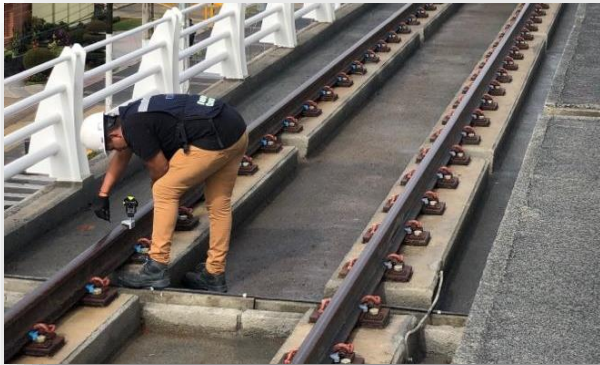
- Track measurements in the GEDO Track Data .GTD format:
 - Center line (X, Y)
 - Elevation (H, lower rail)
 - Measured Cant



Track survey data input. Option #2

Data input from other track survey sources:

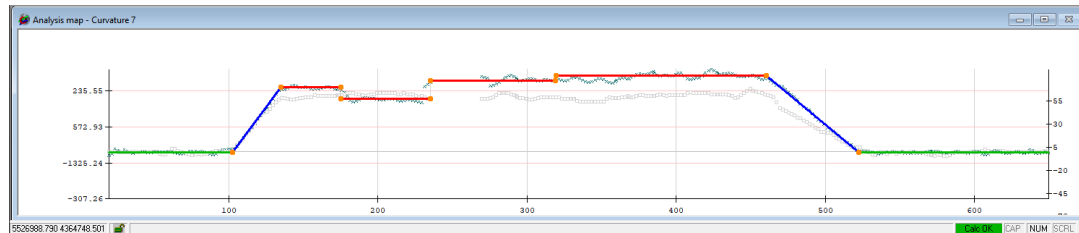
- Track points in .XML (.cgPoint) or .CSV format:
 - point name and code (code for left/right rail or axis)
 - point coordinates (left/right rail or axis)
 - coordinate precision 5 decimals or more



Requirements for track measurement data (input)

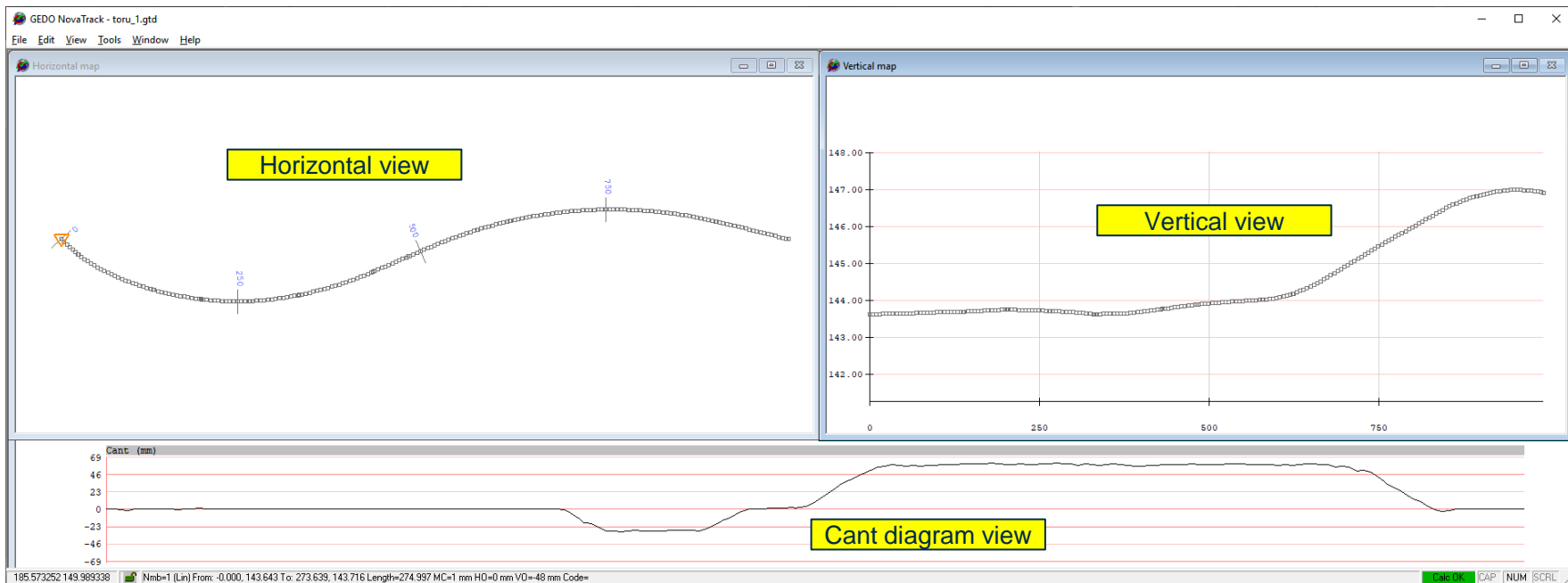
Input data specification:

- Interval between measured points
 - depending on track quality/complexity/application: 0.5 – 3 m
- Measured point coverage:
 - measurements **must** start/end in a straight or radii element (at least 50 m)
 - measurements **should not** start/end in the transition
 - the gaps are **allowed** in the measurement data



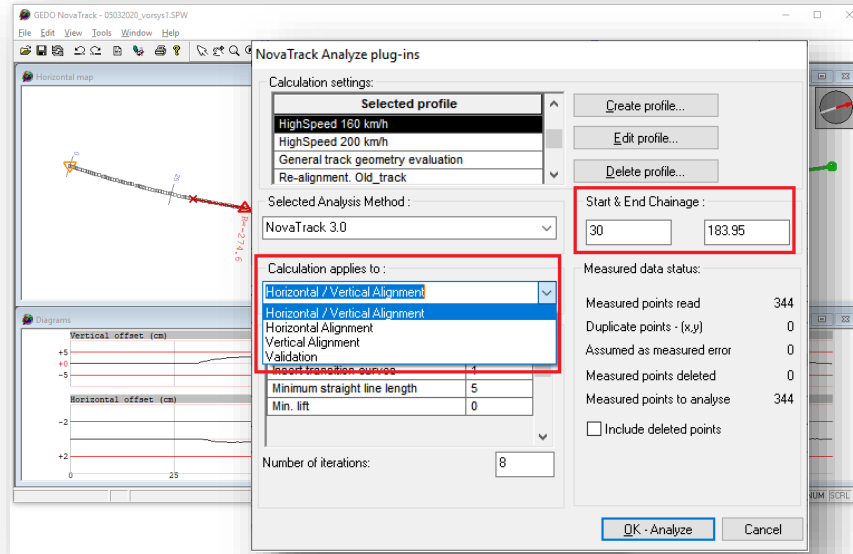
Workflow. Step 1. Data input.

- Import of measured track data (.GTD)



Workflow. Step 2. Selecting calculation settings

- Selecting chainage range: from – to chainage
- Selecting calculation profile (based on application or track type)
- Selecting alignment calc. scope: HA/VA, HA, VA or Validation



Workflow. Step 3. Automatic alignment fitting

- Point approximation with alignment elements

A

Novatrack 3.0

'Pre-design'

1

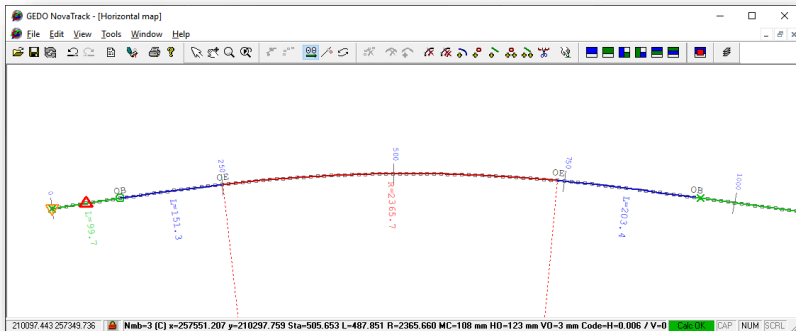
Better automatic prediction

2

Consistent geometry

3

Aimed for re-construction



B

Regression w/ Transitions

'Smoothing'

1

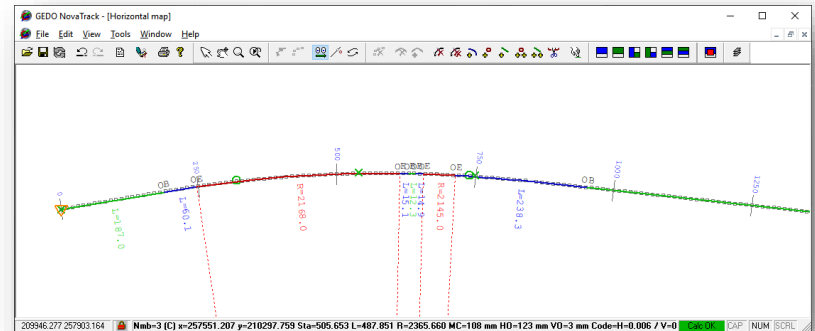
Follows existing track

2

Erratic combinations of elements

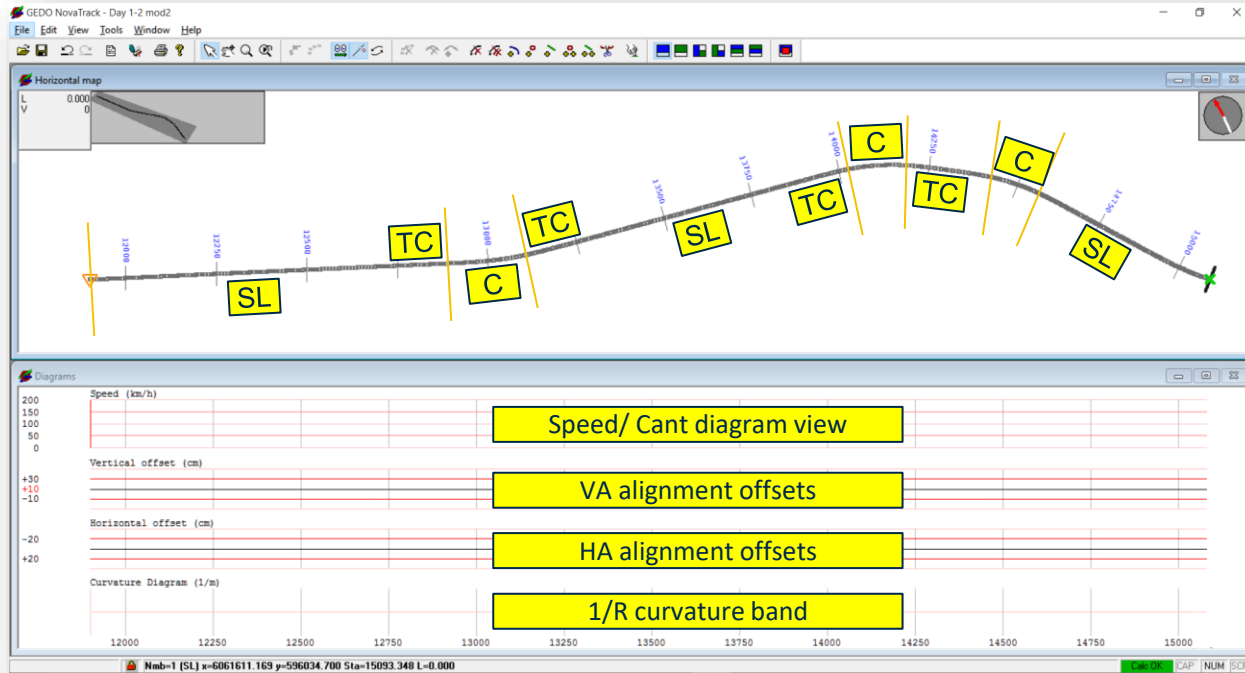
3

Suitable smoothing tamping



Workflow. Step 4. Automatic fitting result

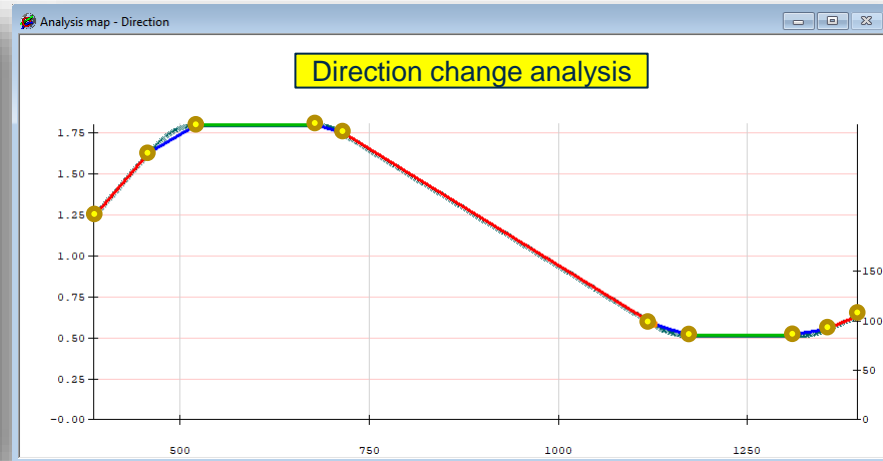
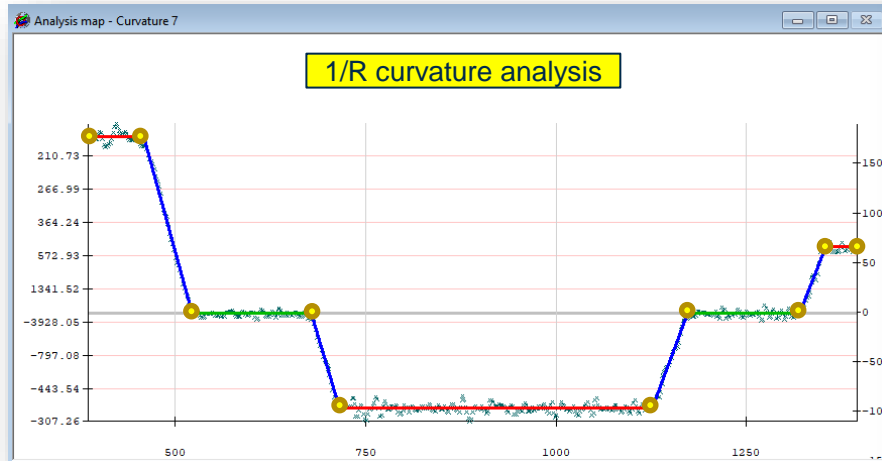
- Design alignment result after automatic alignment fitting



- Straight line
- Transition
- Radius/Arc
- Invalid fitting

Workflow. Step 5. Semi-automatic alignment fitting

- Using HA curvature/direction analysis diagram:
 - to adjust proposed HA alignment configuration
 - to set preliminar element configuration & tangent point positions



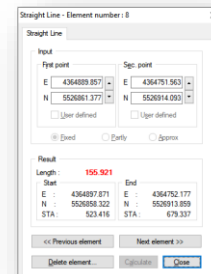
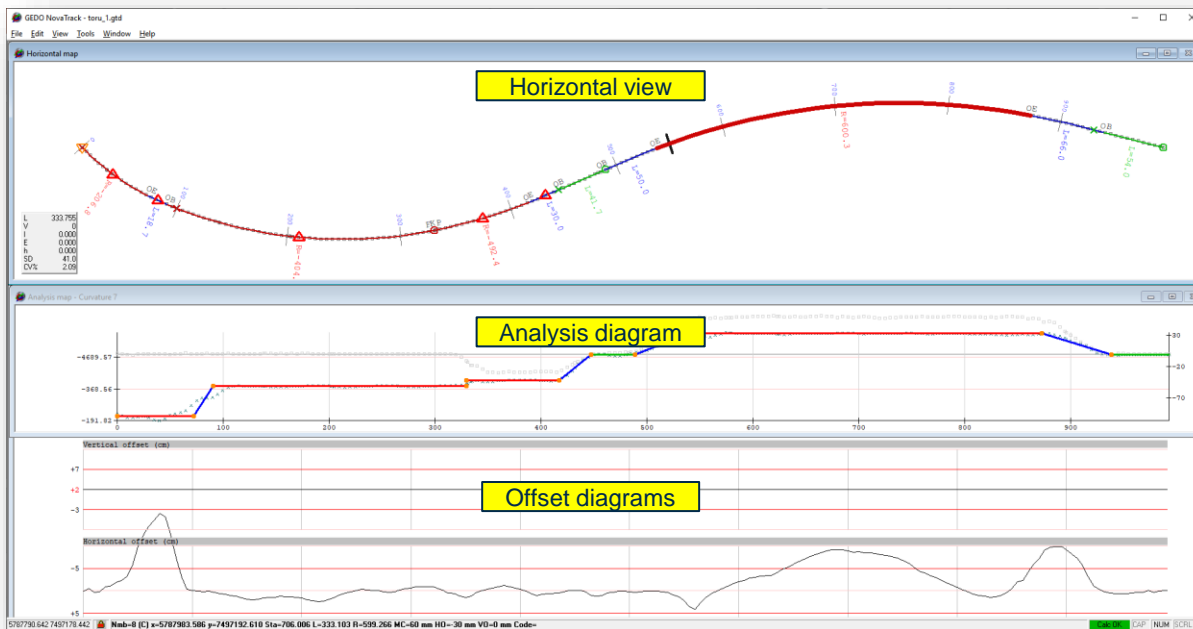
— Straight line (A)
— Transition

— Radius/Arc (A)
— Invalid fitting

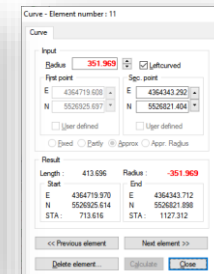
● Preliminary tangent location

Workflow. Step 6. HA alignment fine-tuning

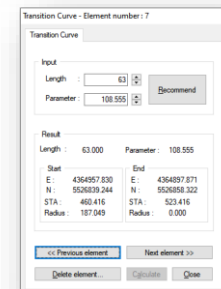
- Adjusting HA elements to minimize horizontal offsets:
 - direct element editing using parametric data



Straight line (A)



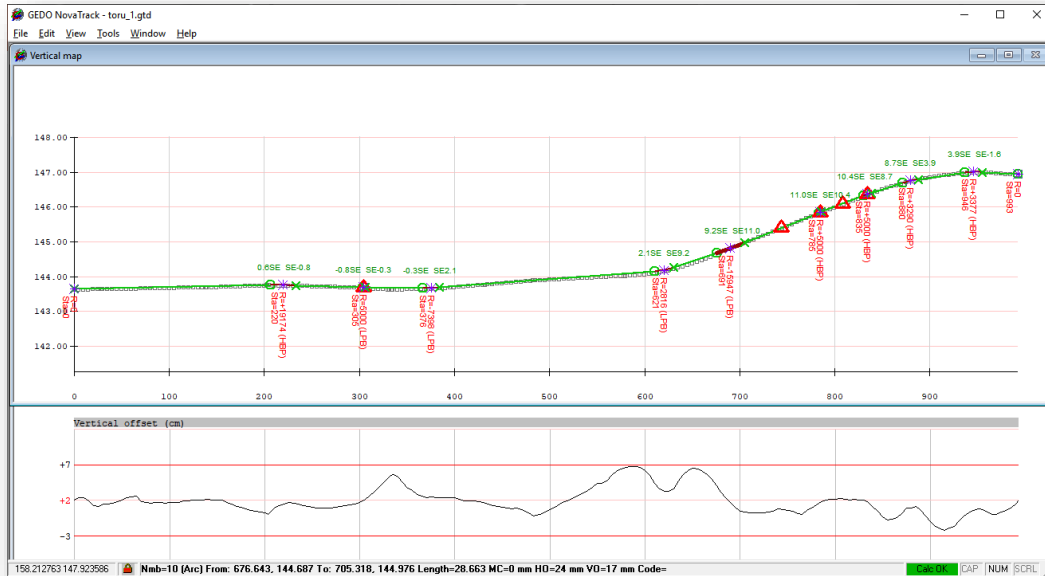
Radius/Arc



Transition

Workflow. Step 7. VA alignment establishment

- Establishment and adjust of VA elements :
 - draft VA alignment smoothing using calculation profile setting
 - VA element parametric editing to minimise vertical offsets



Vertical Alignment - Element number: 17

Input - Line

Start	End
STA 603.776	STA 861.788
Z 282.431	Z 287.149

Result

Start	End
STA: 603.776	STA: 861.788
Z: 282.431	Z: 287.149
Length: 258.046	Gradient 18.286

<< Previous element Next element >>

Calculate Close

Vertical Alignment - Element number: 16

Input - Arc

Radius	Angular point
71434.076	STA 593.777
Length 20	Z 282.240

Result

Start	End
STA: 583.779	STA: 603.776
Z: 282.068	Z: 282.431
Length: 20.000	

<< Previous element Next element >>

Delete element Calculate Close

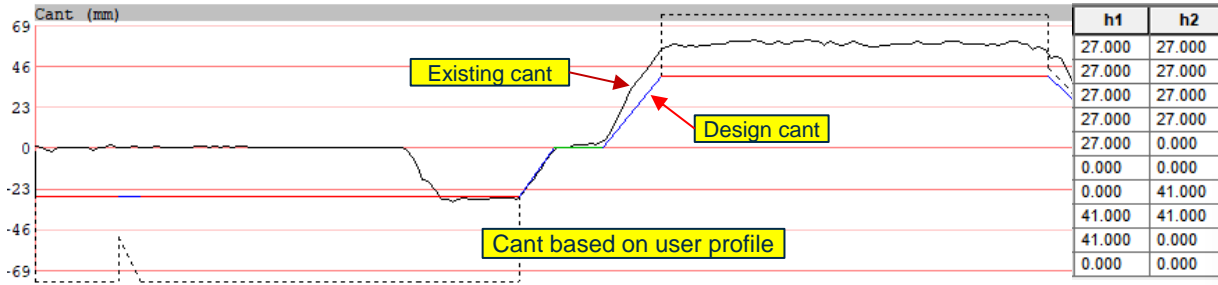
■ Straight line (A) ■ Radius/Arc (A)

Variable	Value	Description
analyse_method	1	Selected analyse method
error_tolerance	0.000	Error tolerance for horizontal geometry (m)
error_tolerance_vertical	0.03	Error tolerance for vertical geometry (m)
error_tolerance_on_rear_splts	02	Minimum % of measured points on rear side
nt3_remove_split	103	Initial percentage value for removing split points

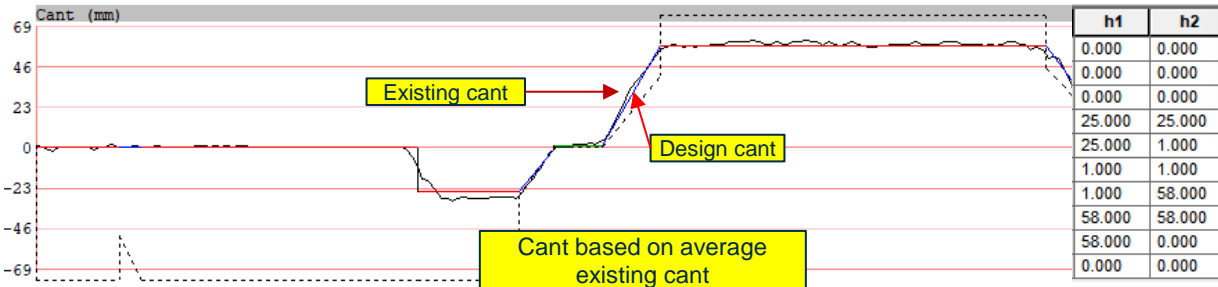
Calculation profile settings

Workflow. Step 8. Calculate design Cant

- Calculate design Cant using one of the available options:
 - Cant calculated based on user profile settings



- Cant calculated as an average of measured cant



Cant and speed calculation

Given speed Speed and Cant

No	From	To	R1	R2	L	H1	H2	V	h1	h2	v	U
1	-0.000	102.098	0.000	0.000	102.098	0.000	0.000	0	0.000	0.000	0	
2	102.098	136.098	0.000	223.350	34.000	0.000	0.000	0	0.000	59.000	0	
3	136.098	177.769	0.000	223.350	41.671	0.000	0.000	0	59.000	59.000	0	
4	177.769	226.577	274.636	274.636	58.905	0.000	0.000	0	61.000	61.000	0	
5	226.577	373.735	197.900	197.900	137.158	0.000	0.000	0	57.000	57.000	0	
6	373.735	460.416	187.049	187.049	86.681	0.000	0.000	0	61.000	61.000	0	
7	460.416	523.416	187.049	0.000	63.000	0.000	0.000	0	61.000	0.000	0	
8	523.416	679.337	0.000	0.000	155.921	0.000	0.000	0	0.000	0.000	0	
9	679.337	716.337	0.000	-351.680	37.000	0.000	0.000	0	0.000	38.000	0	
10	716.337	1126.665	-351.680	-351.680	410.328	0.000	0.000	0	38.000	38.000	0	
11	1126.665	1173.665	-351.680	0.000	47.000	0.000	0.000	0	38.000	1.000	0	

Design cant and speed Design element speed Design element cant **Cant averaging**

OK Cancel Help

Design speed & cant calculation options

- Cant averaging and based on measured cant
- Cant and speed based on the rule settings
- Speed/cant calculation for individual elements

The screenshot displays the GEDO NovaTrack software interface. On the left, three stacked line graphs show Speed (km/h), Cant (mm), and Horizontal offset (cm) over a distance of 0 to 1000 units. The top graph shows speed steps at 250 and 750 units. The middle graph shows cant values that increase from 0 to approximately 110 mm between 250 and 750 units. The bottom graph shows horizontal offset fluctuating around 0 cm. On the right, a 'Cant and speed calculation' dialog box is open, showing a table of calculated elements and several design options.

No	From	To	R1	R2	L	H1	H2	V	h1	h2	v	U
1	-0.000	104.726	0.000	0.000	104.726	0.000	0.000	200	0.000	0.000	200	<input type="checkbox"/>
2	104.726	239.019	0.000	2393.660	134.294	0.000	88.000	200	0.000	57.000	185	<input type="checkbox"/>
3	239.019	758.743	2393.660	2393.660	519.724	165.000	165.000	200	57.000	57.000	165	<input type="checkbox"/>
4	758.743	931.191	2393.660	0.000	172.448	57.000	0.000	200	57.000	0.000	200	<input type="checkbox"/>
5	931.191	2298.593	0.000	0.000	1367.40	0.000	0.000	200	0.000	0.000	200	<input type="checkbox"/>

Design options in the dialog box:

- Design cant and speed
- Design element speed
- Design element cant
- Cant averaging

Buttons: OK, Cancel, Help

Workflow. Step 9. Adding supportive map information

- Optionally import an external track or map data
 - supported format: .GTD, .DXF, .CSV and .LandXML
 - available tooltip information: offsets, chainage, layer code

Options

Project General Grid & Map Diagrams

Grid:

Horizontal Size : 50

Vertical Size : 50

Hor. Color : [Color Picker]

Vert. Color : [Color Picker]

Line Width : 1

Line Type : Solid

Map:

Name	O	Color	Type	Width
_OTHER_TRACKS	<input checked="" type="checkbox"/>	[Green]	Solid	2
MAIN_TRACK	<input type="checkbox"/>	[Red]	Solid	2
_PLATFORMS	<input checked="" type="checkbox"/>	[Brown]	Solid	2
0	<input checked="" type="checkbox"/>	[Black]	Solid	1
_SIGNALS	<input checked="" type="checkbox"/>	[Green]	Solid	2
_TRACK4_POINTS	<input type="checkbox"/>	[Black]	Solid	1
_TRACK3_POINTS	<input type="checkbox"/>	[Black]	Solid	1
_TRACK2_POINTS	<input type="checkbox"/>	[Black]	Solid	1
_SWITCH	<input checked="" type="checkbox"/>	[Black]	Solid	1
_MAIN_TRACK_POINTS	<input type="checkbox"/>	[Black]	Solid	1

OK Cancel Apply

Data exchange

- Supported file formats

Format	Read	Write	Map read	Description
SPW (.spw)	+	+		Native GEDO NovaTrack project file format
GEDO Track data (.gtd)	+		+	GEDO track data (ASCII)
GEDO Office TDT (.tdt)	+	+		Horizontal alignment (tabular, ASCII)
GEDO Office HDT (.hdt)	+	+		Vertical alignment (tabular, ASCII)
GEDO Office UDT (.udt)	+	+		Cant alignment (tabular, ASCII)
NovaPoint (.tit)	+	+		Horizontal alignment (ASCII)
NovaPoint (.nyl)	+	+		Vertical alignment (tabular, ASCII)
LandXML (.xml)	+	+		Horizontal, vertical and cant alignment
LandXML lines (.xml)			+	Line elements
LandXML cgPoints (.xml)	+		+	Point elements
Data exchange format (.dxf)			+	Point and line elements
Slew-lift report (.alc)		+		Design/as-build slew-lift offset report (space separated)
Design geometry report (.csv)		+		Complete alignment geometry report (semi-column, ASCII)

GEDO NovaTrack Live

- Live software demonstration

03



Questions?





Thank you!

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