LandXML-related works at TUM - CMS

- 3D Geometric Representation and Applications –

Yang Ji, André Borrmann

Chair of Computational Modeling and Simulation (CMS)

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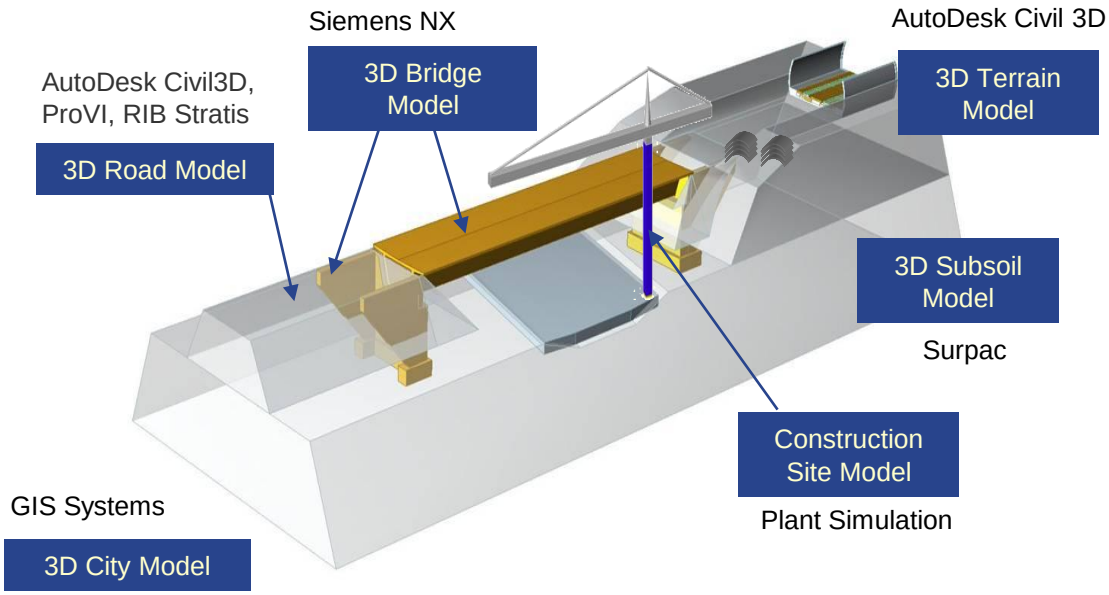
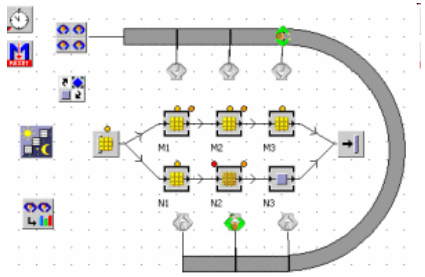
Integrated 3D Infrastructure Modeling



Bayerische Forschungsstiftung

ForBAU Project - The Virtual Construction Site (2008-2010)

ForBAU Integrator



Simulation of Earthwork Processes

volume and position of cut and fill areas

3D Terrain Model

2D Road Alignment

3D Subsoil Model

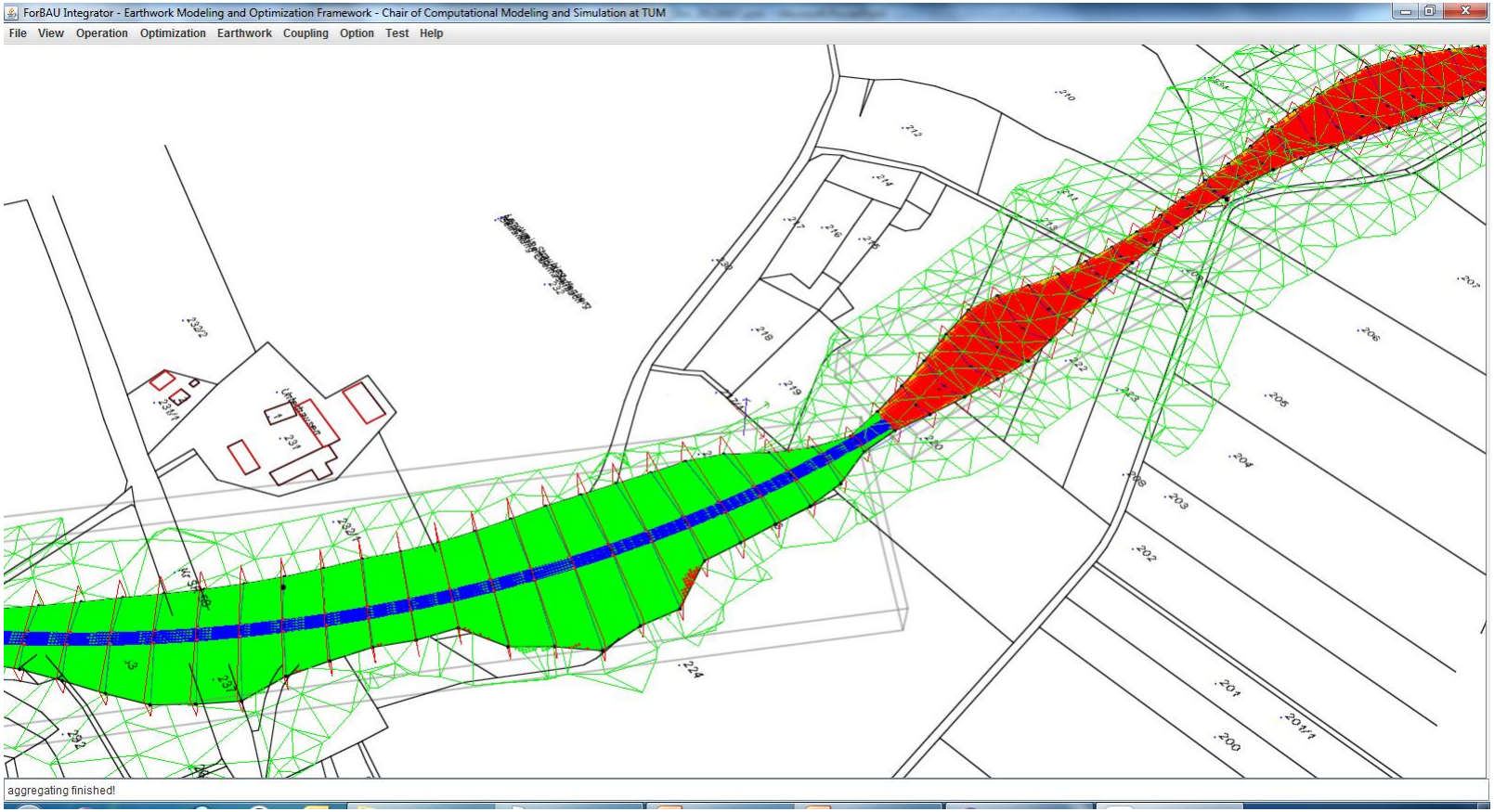
LandXML

3D Infrastructure Model

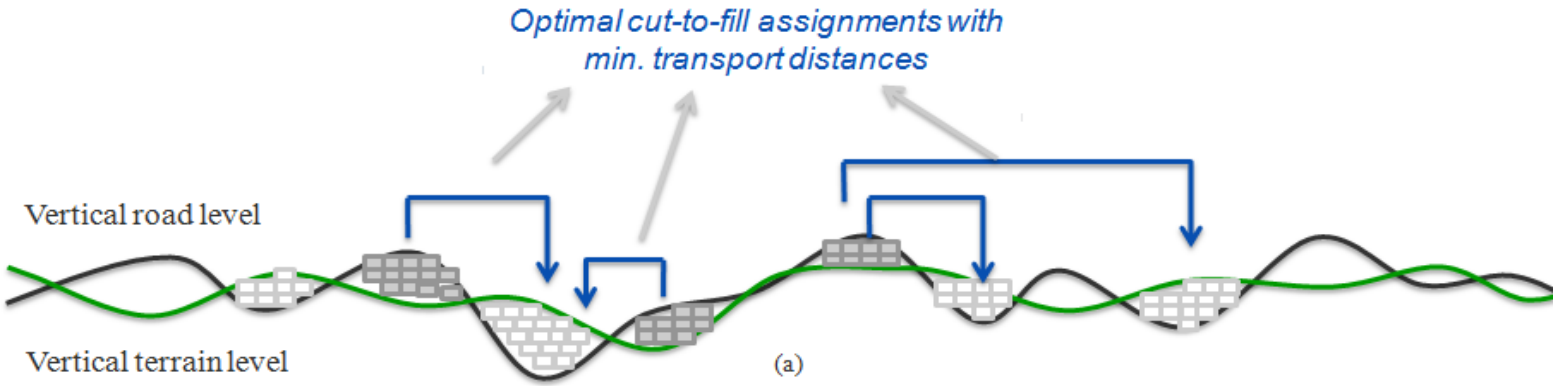
3D road alignment

3D Parametric Bridge Modeling

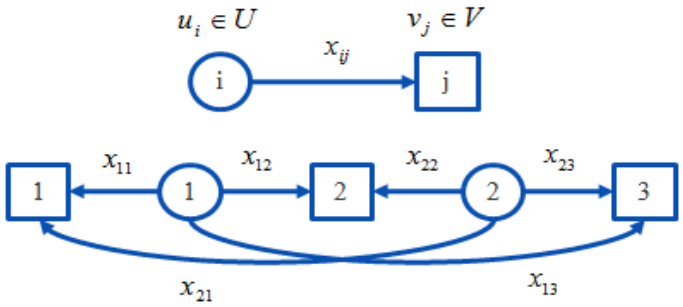
ForBAU Integrator - Demonstration



Earthwork Optimization



(a)



(b)

$$\min \sum_{(i,j)\in E} c_{ij} x_{ij} \qquad (1)$$

$$\sum_{(i,j)\in E} x_{ij} = X_i \quad \text{for all } i \in U \qquad (2)$$

$$\sum_{(i,j)\in E} x_{ij} = X_j \quad \text{for all } j \in V \qquad (3)$$

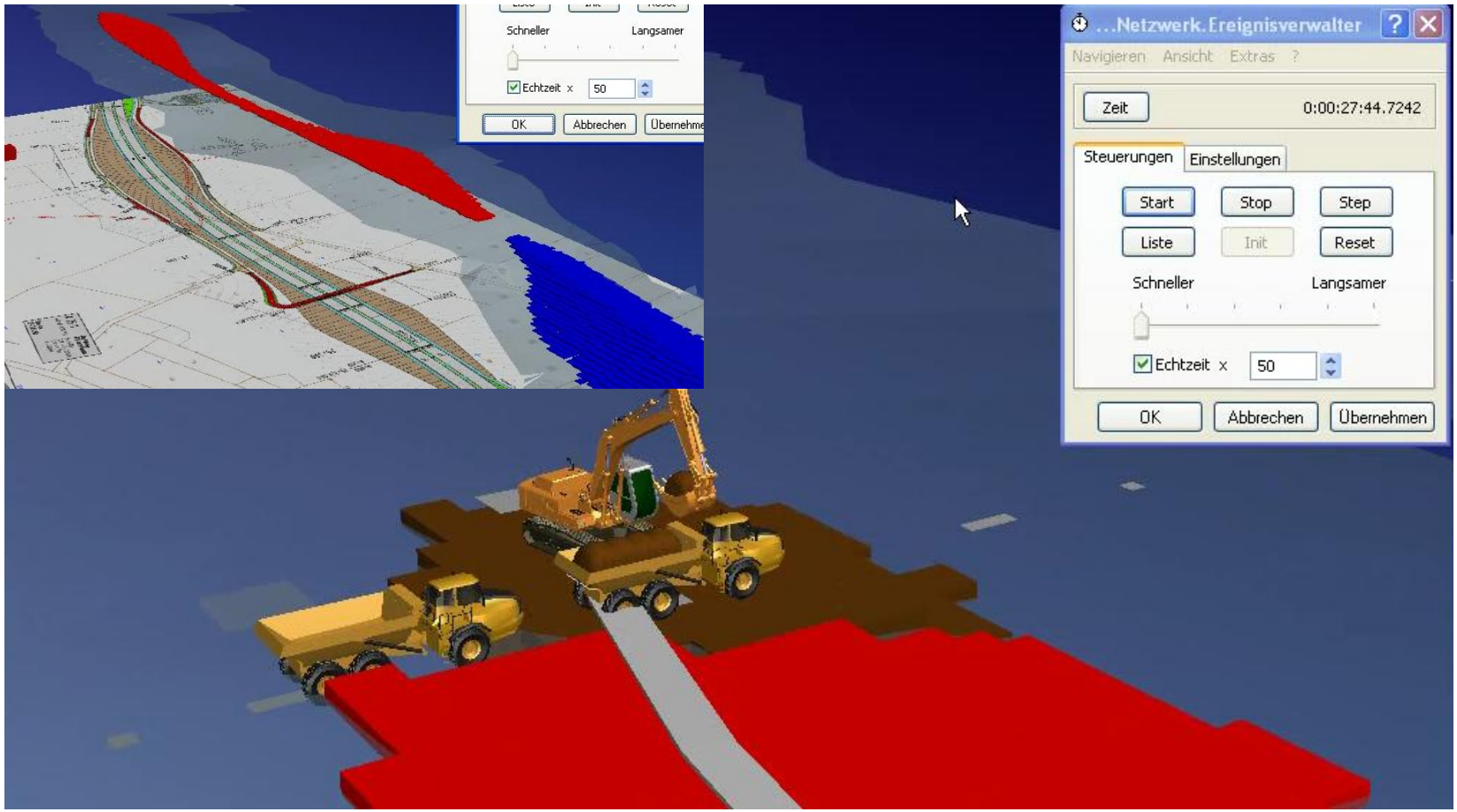
$$x_{ij} \geq 0 \qquad (4)$$

(c)

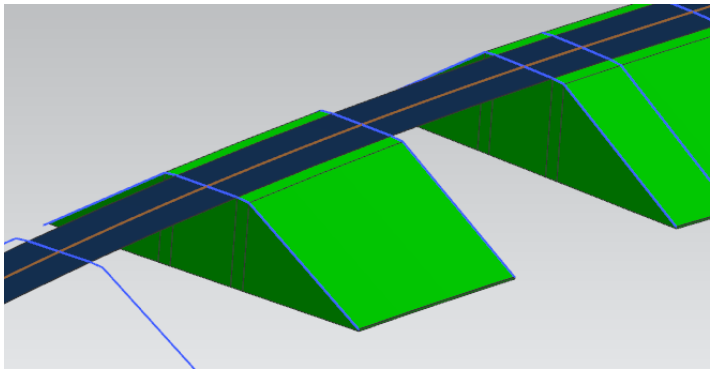
j \ i	1	2	3	4
1	x_{11}	0	0	0
2	x_{12}	x_{22}	0	0
3	0	0	x_{33}	0
4	0	0	x_{34}	0
5	0	0	x_{35}	x_{45}

(d)

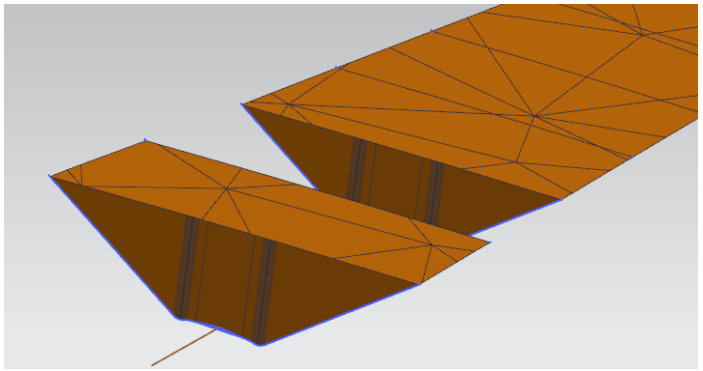
Earthwork Simulation mit Siemens Plant Simulation



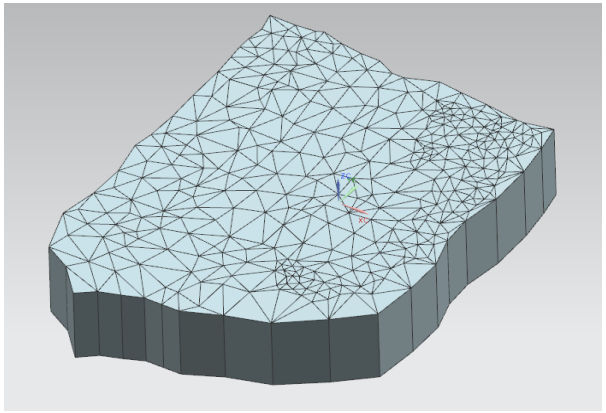
Earthwork Quantity Take-off



Fill



Cut



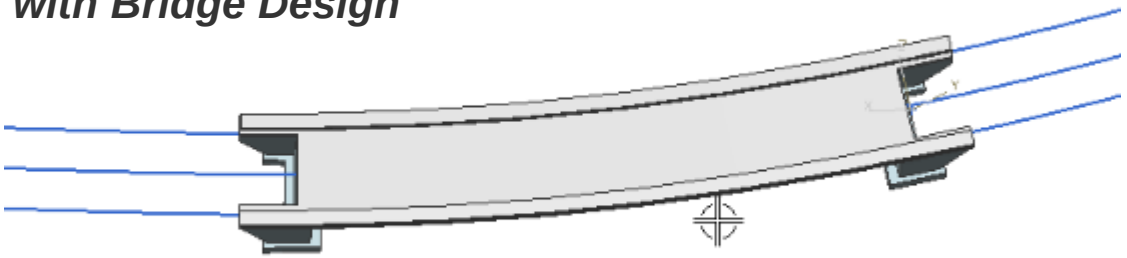
Solid DGM

Parametric Bridge Design

Movie

Road Design is coupled with Bridge Design

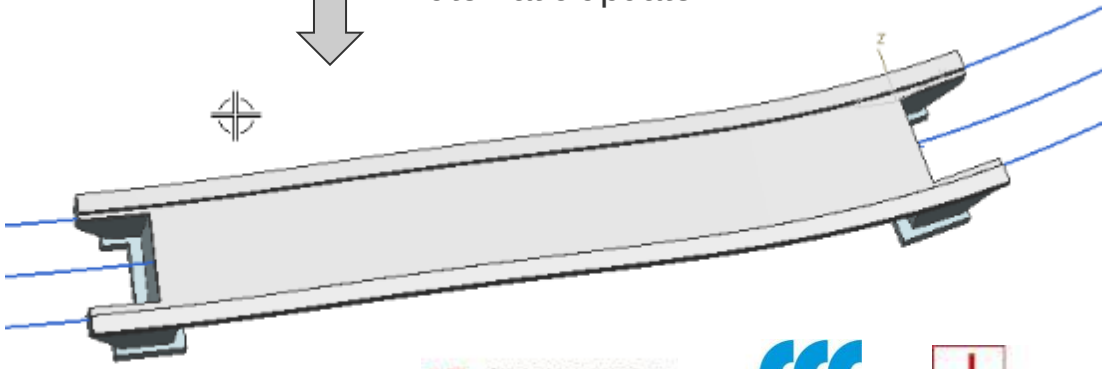
3D Road Alignment
Version 1



Design changes

Automatic update

3D Road Alignment
Version 2

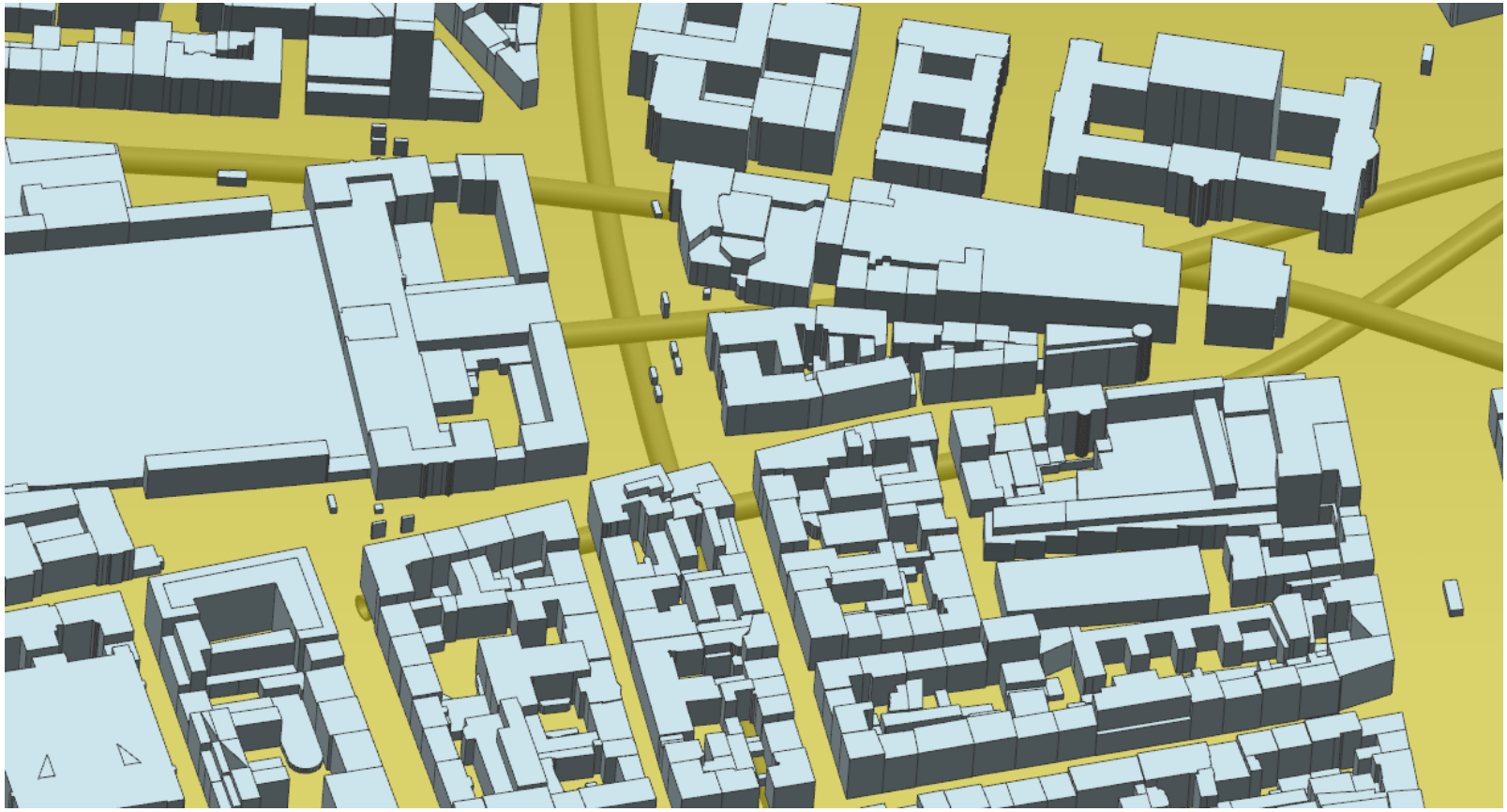


OBERMEYER PLANEN + BERATEN GmbH

SSF Ingenieure

MAX BÖGL
Fortschritt baut man aus Ideen.

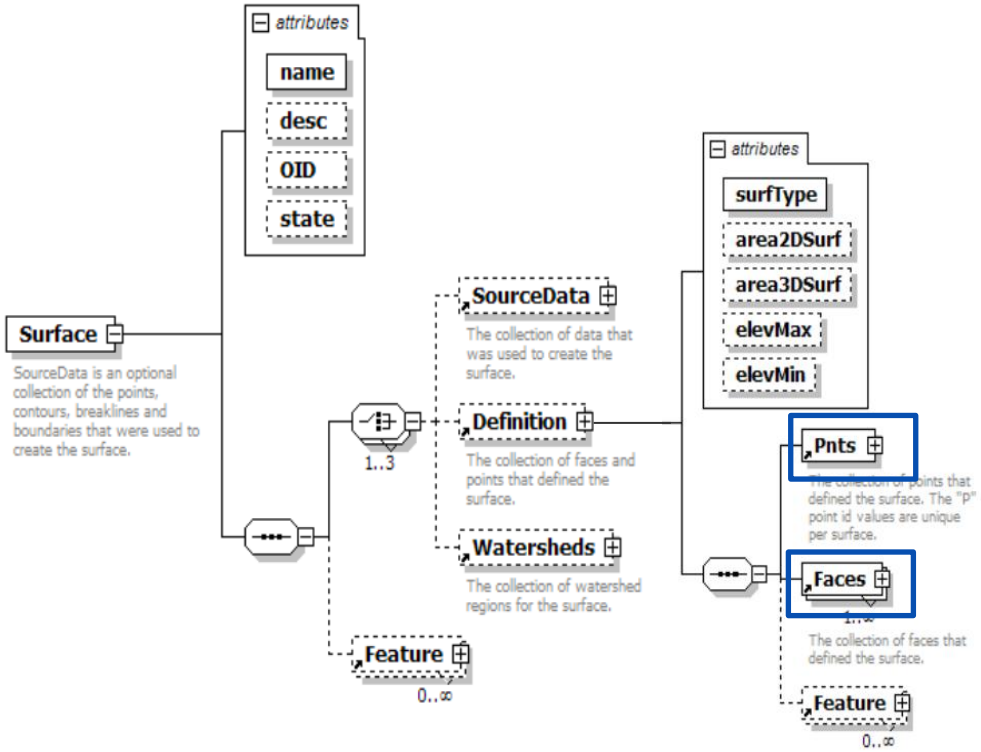
Multi-scale Integrated Infrastructural Planning

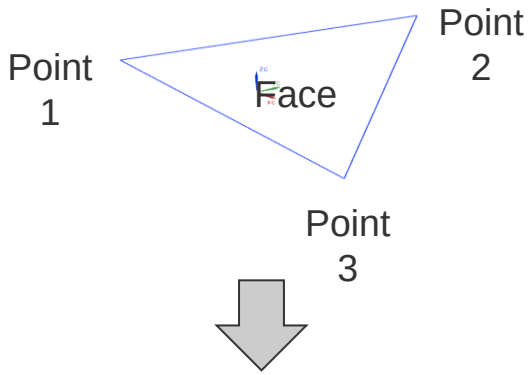


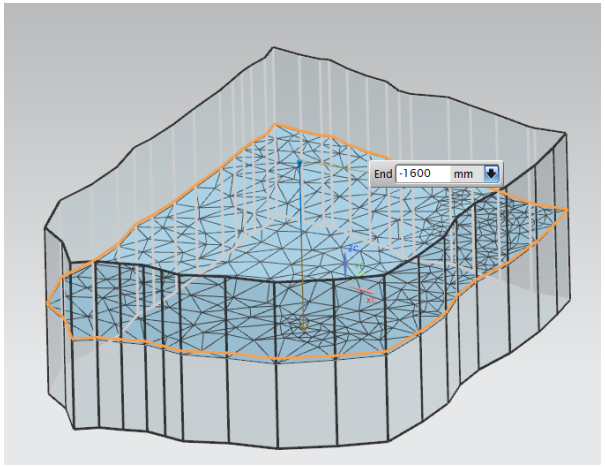
Experience with LandXML – 3D Geometric Representation

3D Terrain Model

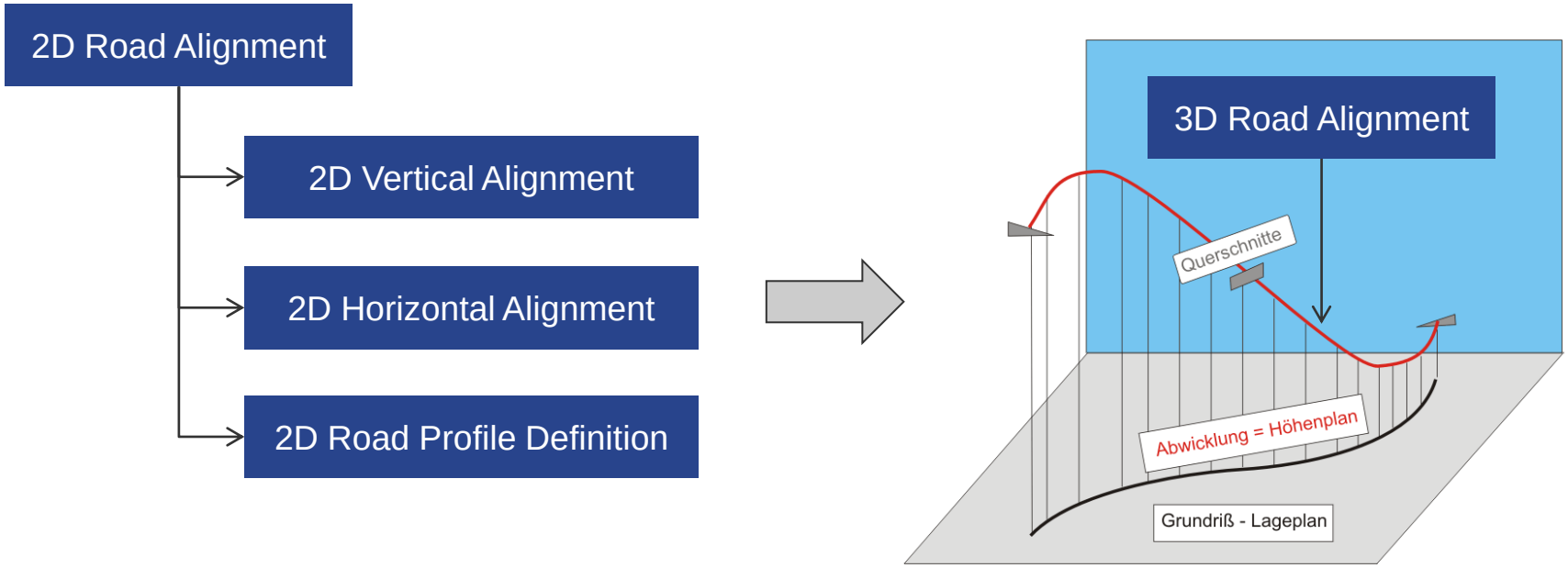
3D Subsoil Model





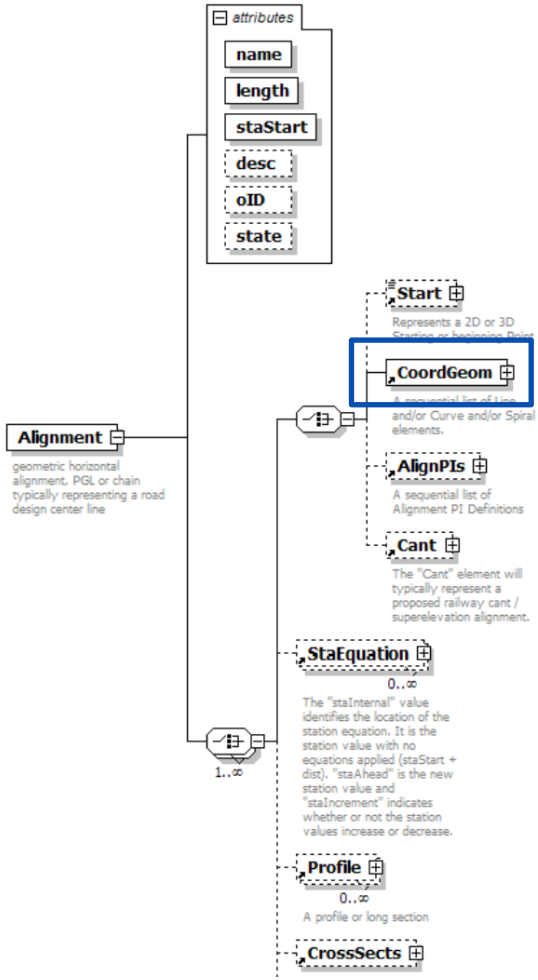


Experience with LandXML – 3D Geometric Representation

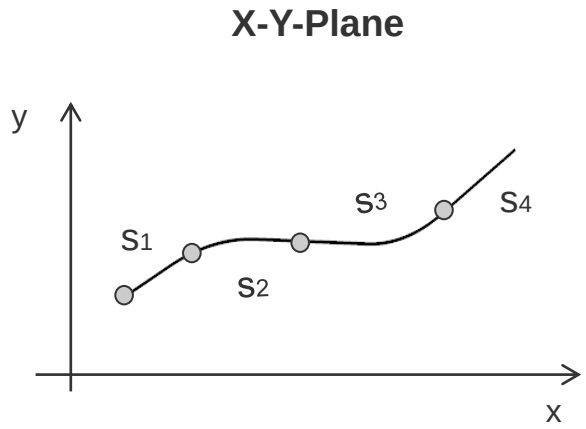


3D road alignment geometry **implicitly** represented
by 2D alignment designs

2D Horizontal Alignment



Horizontal Alignment



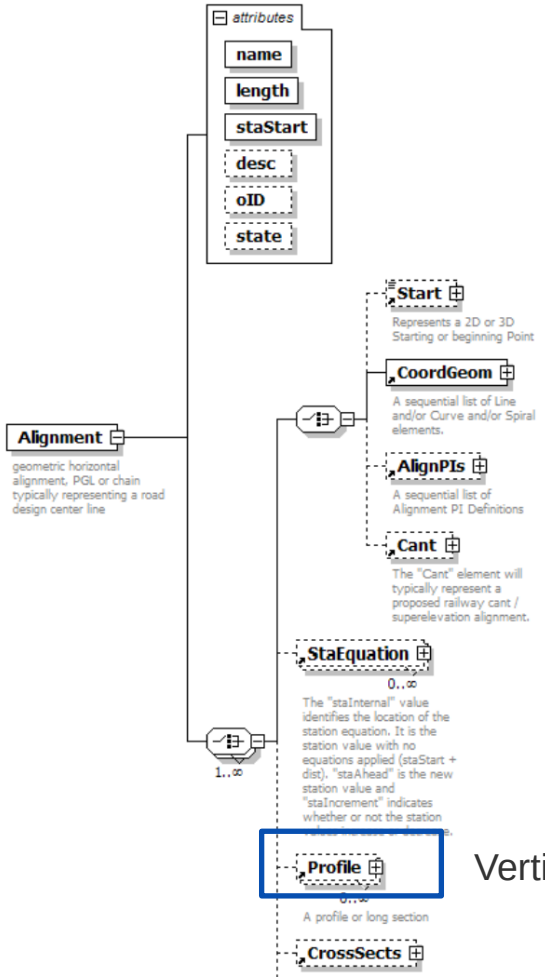
Sn : length of curve

Circle
- *length*
- *rotation*
- *start- and end point*
- *center*
- *radius*

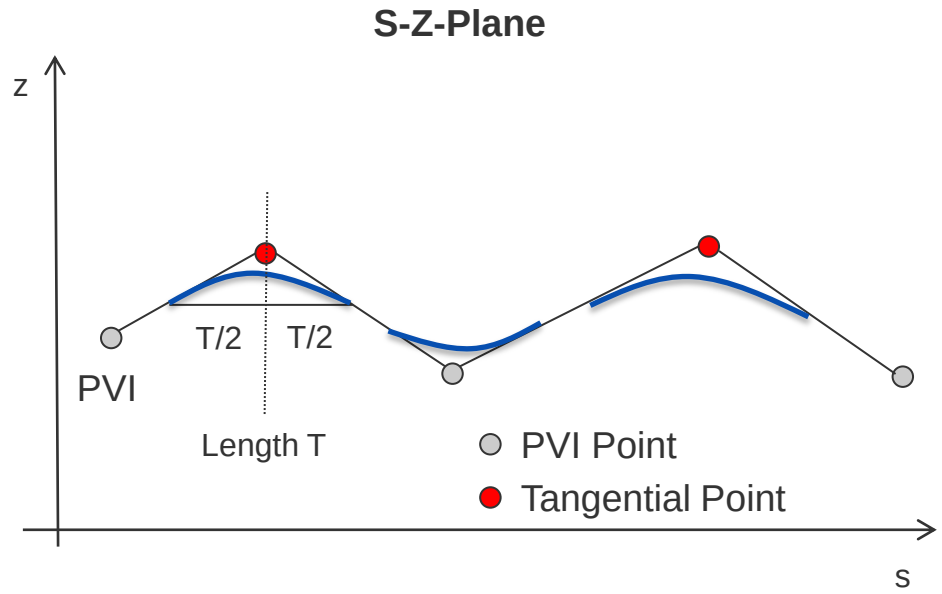
Transition curve (Clothoide)
- *length*
- *start- and end point*
- *rotation*
- *start radius and end radius*

Line
- *start point*
- *end point*
- *length*

2D Vertical Alignment



Vertical Alignment

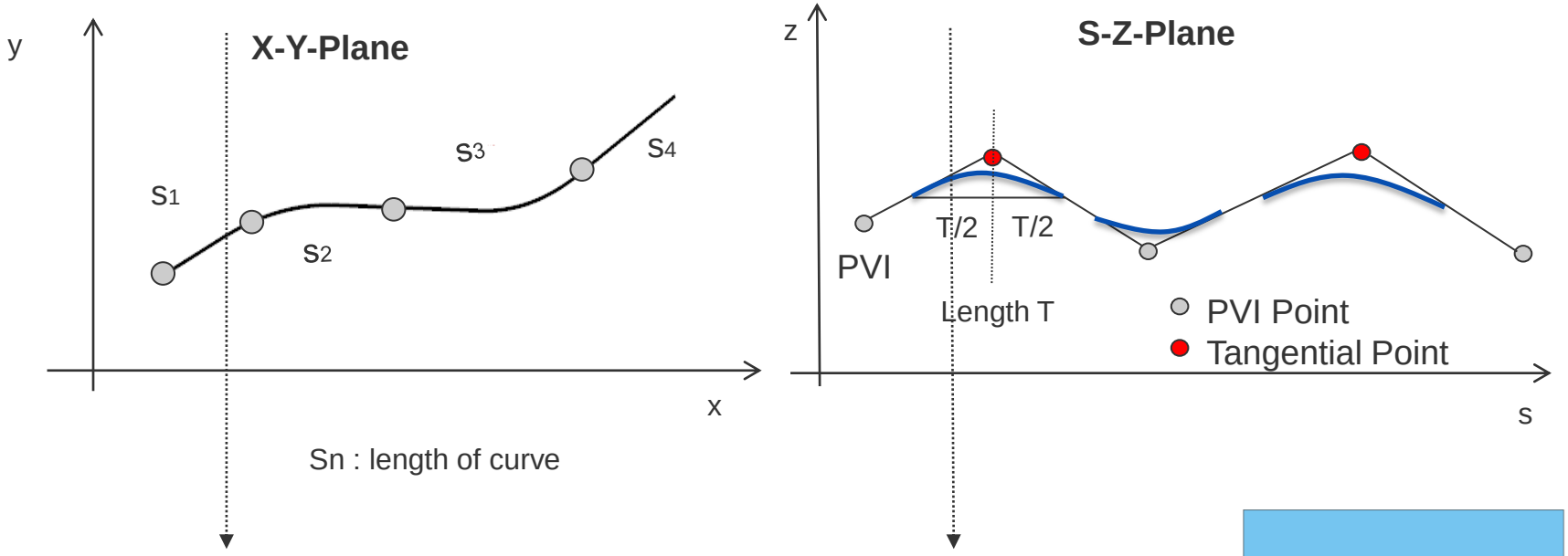


S : abscissa of horizontal alignment

PVI point
- *Abscissa s*
- Superelevation

Parabolic curve
- *Tangential point*
- *Length*

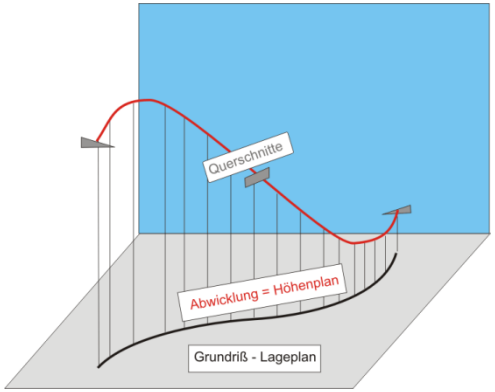
3D Road Alignment



s = 3 → (x, y)

s = 3 → z = 10

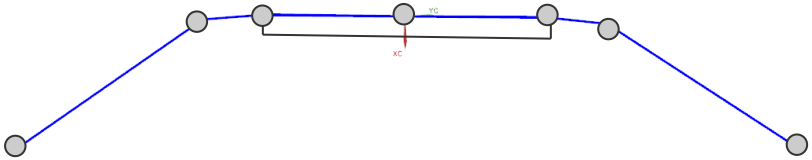
3D coordinate of road alignment points



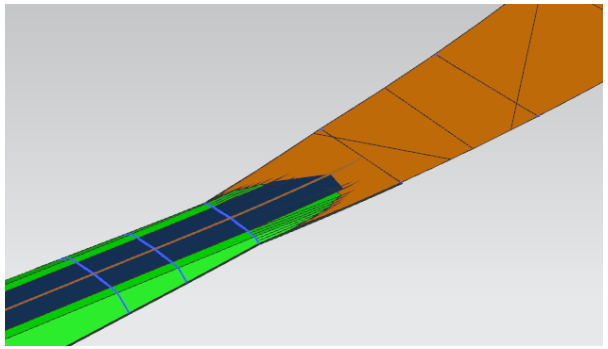
3D Road Solid Model

2D Road Profile Definition

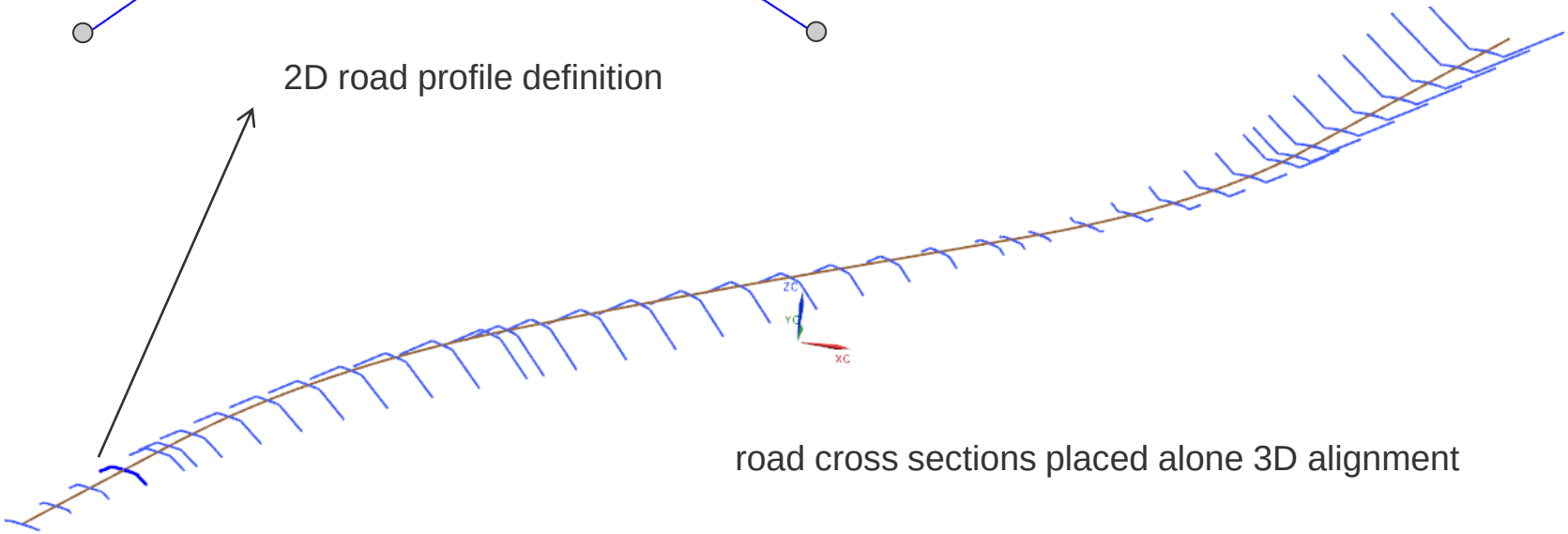
- No standardized profile definition available
- different implementations by software provider



2D road profile definition

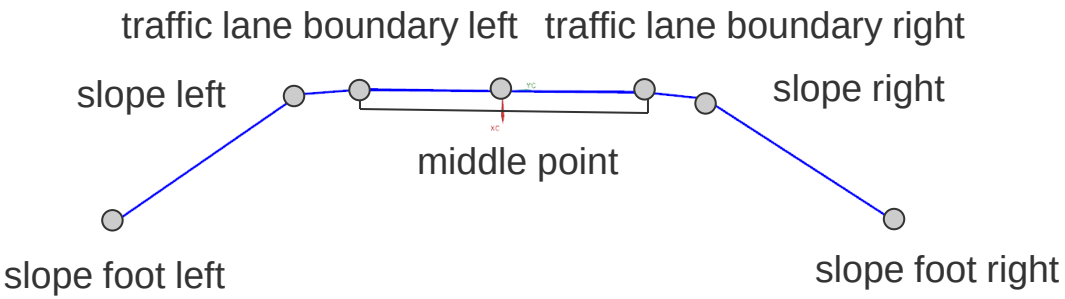


road solid model

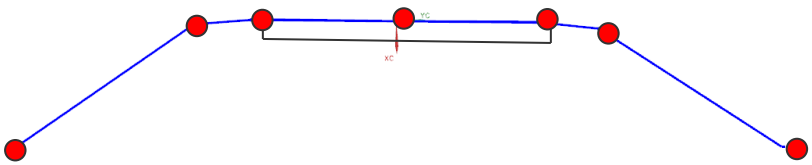


road cross sections placed alone 3D alignment

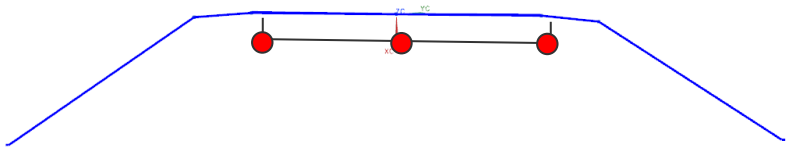
Examples of different cross section definitions



AutoCAD Civil3D



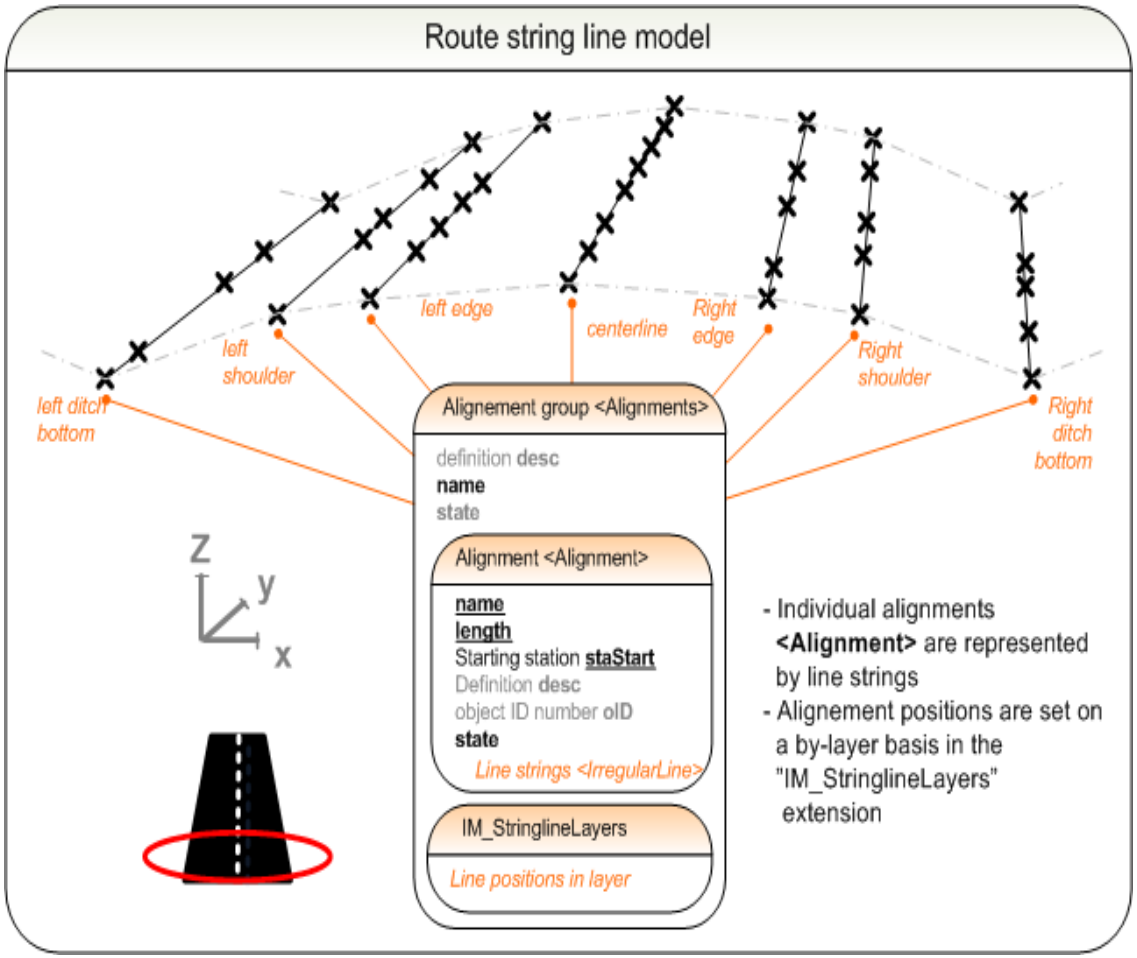
No. 20 → e.g. outer curve



No. 30 → layer cover

RIB STRATIS / AKG VESTRA

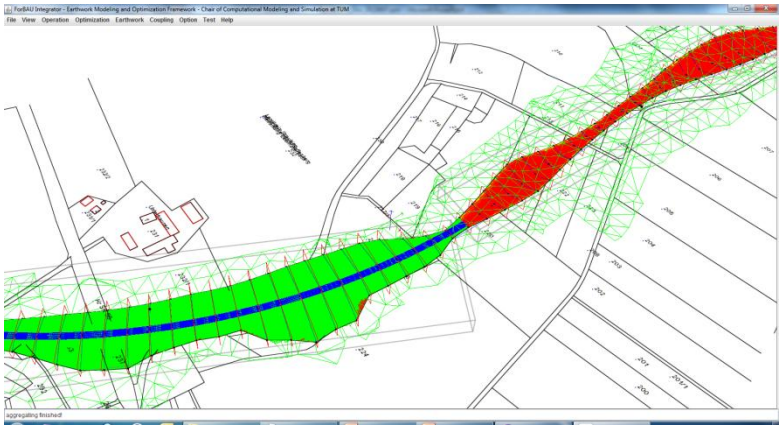
Extension of VTT Finland

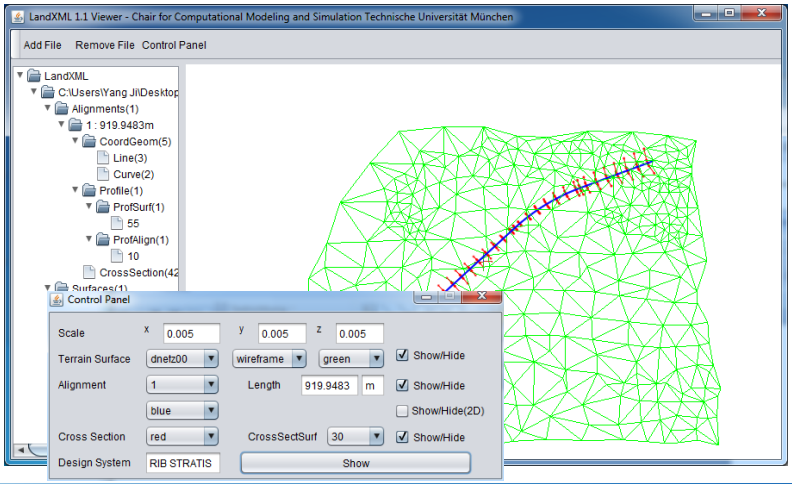


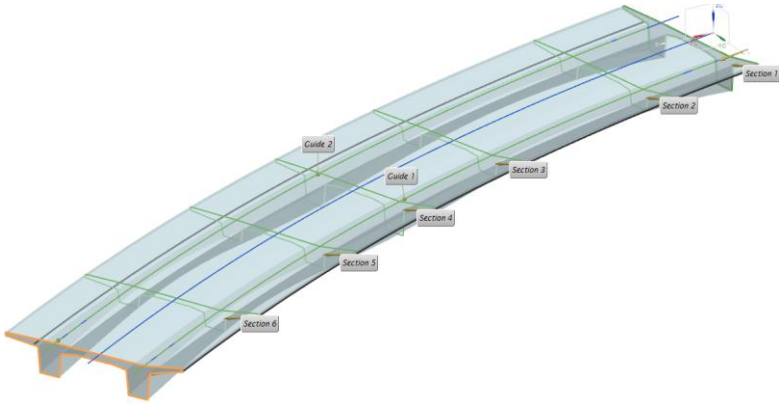
Quelle: http://cic.vtt.fi/projects/inframodel2010/eng/index_IM.html

LandXML software tools developed CMS

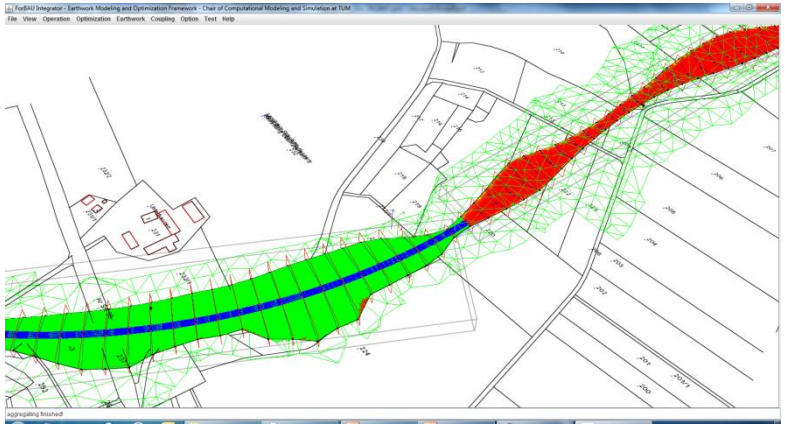
- ForBAU Integrator for Earthwork Optimization and Simulation
- LandXML Interface for Siemens NX for 3D Bridge Design (in commercializing)
- TUM LandXML Viewer



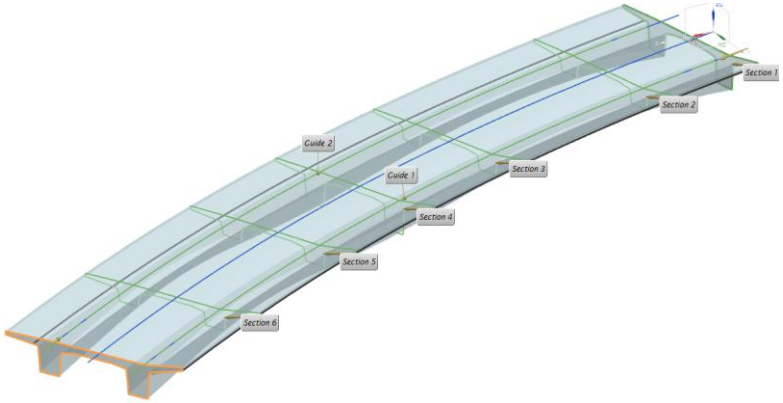




Summary and Outlook



- Knowhow of LandXML development
- Implementation of LandXML tools in Java, C# with Java3D, Siemens NX
- Cooperation with VTT Finland with Juha Hyvärinen for testing and visualizing extension of LandXML
- Research partner in openINFRA particularly for IFC-Bridge extension



Welcome to IFC-Bridge Workshop in Paris on 13th July!

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