

MODELLERING OG ANVENDELSE AF DRAINAGE & UTILITIES

AGENDA

- Presentation
- What is 3D / BIM
- Level of Development (LOD)
- DanDasGraf vs. D&U
- Examples of 3D projects
- What is Drainage & Utilities?
- Collaboration with road/rail
- Hydraulic calculation
- The future – next step
- Questions?

PRESENTATION

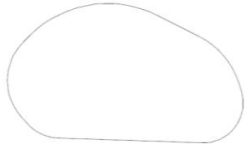
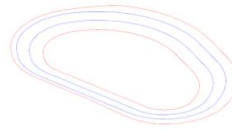
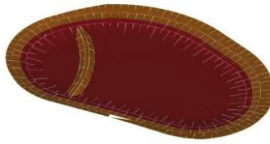
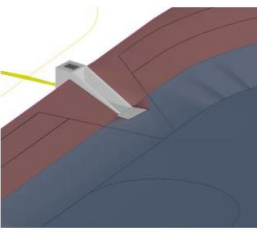
- Andreas Bangsø Stockholm
- Rambøll since 2009 (RHO and Vejle) – teacher
- Department: Utility & Climate Adaptation
- Disciplin Lead, 3D CAD/BIM Rambøll Water DK
- SUE Sub SIG Bentleyuser.dk

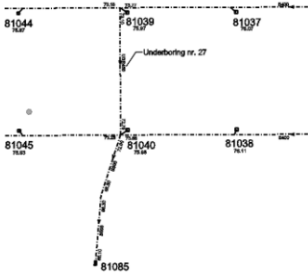
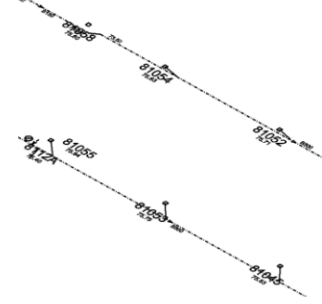
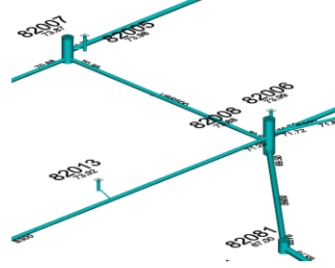
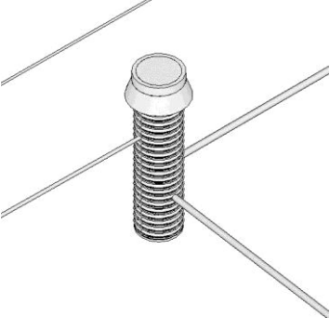


LEVEL OF DEVELOPMENT

[BDK CAD manual](#)

VD Modelstandard

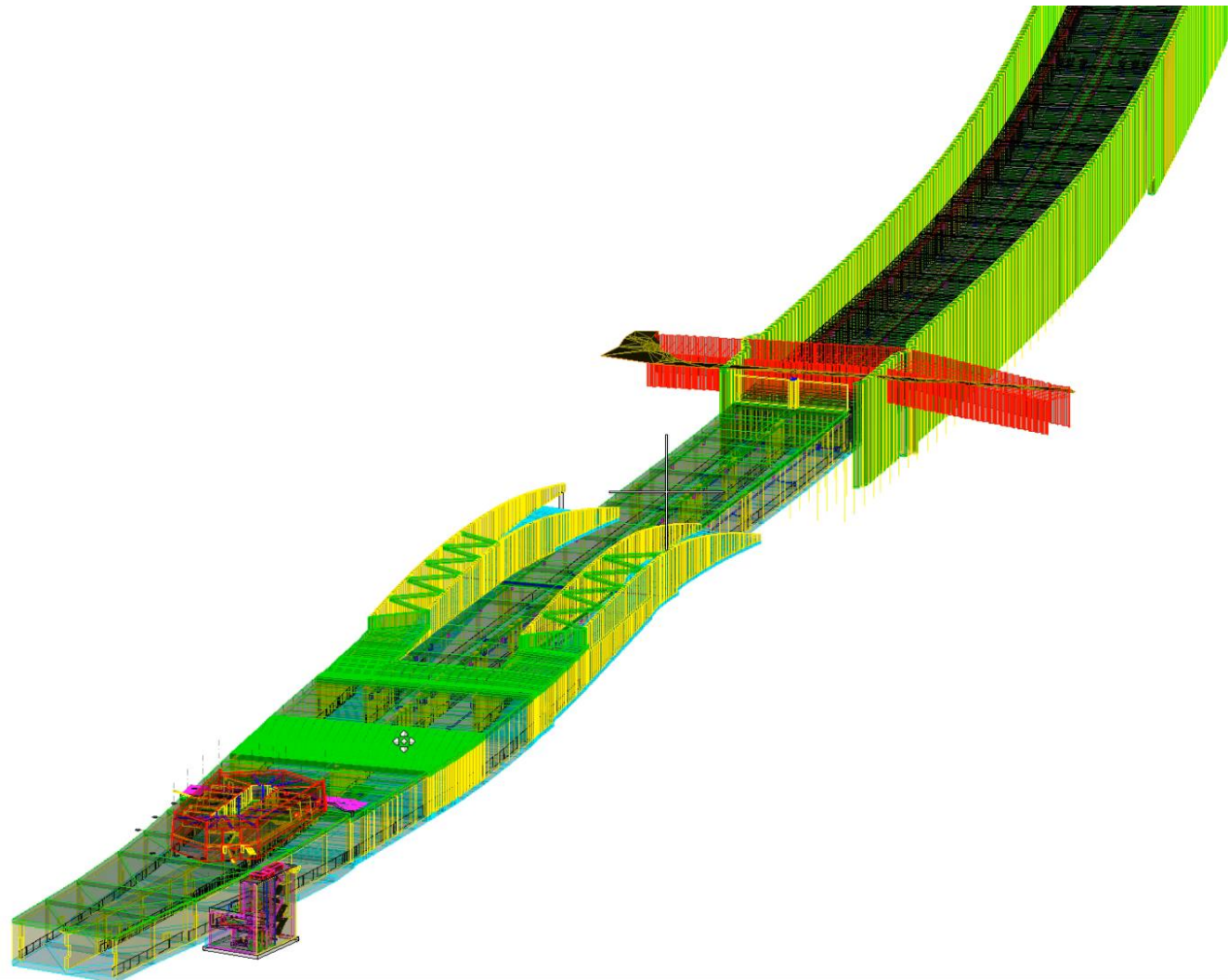
LOD 100	LOD 200	LOD 300	LOD 325	LOD 400
LOG 100	LOG 200	LOG 300	LOG 325	LOG 400
 <p>Basins appear as 2D shapes.</p>	 <p>Basins appear as 3D lines indicating the top and bottom of the basin, permanent water level and maximum stowing level.</p>	 <p>Basins appear as 3D with correct outer geometry including slopes and surfaces. The basins must follow the requirements for stowing capacity.</p> <p>All 3D lines necessary to construct the basins, permanent water level and maximum stowing level is included.</p>	 <p>Basins appear as 3D with correct shape including slopes, surfaces and drain constructions. The basins must follow the requirements for stowing capacity.</p> <p>All 3D lines necessary to construct the basins, permanent water level and maximum stowing level is included.</p>	Pending

LOD 100	LOD 200	LOD 300	LOD 325	LOD 400
LOG 100	LOG 200	LOG 300	LOG 325	LOG 400
 <p>Drainage appears as 2D lines. Manholes appear as 2D signatures.</p>	 <p>Drainage appears as 3D reference lines according to DS 475. Manholes is indicated by a point and appears as 3D signatures for top of manhole.</p>	 <p>Drainage appears as 3D solids including 3D reference lines according to DS 475. Manholes appear as 3D solids and points indicating the center.</p>	 <p>Drainage appears as 3D solid pipes and manholes with gradients, dimension and the reference lines and points according to DS 475. The model includes joints.</p>	Pending

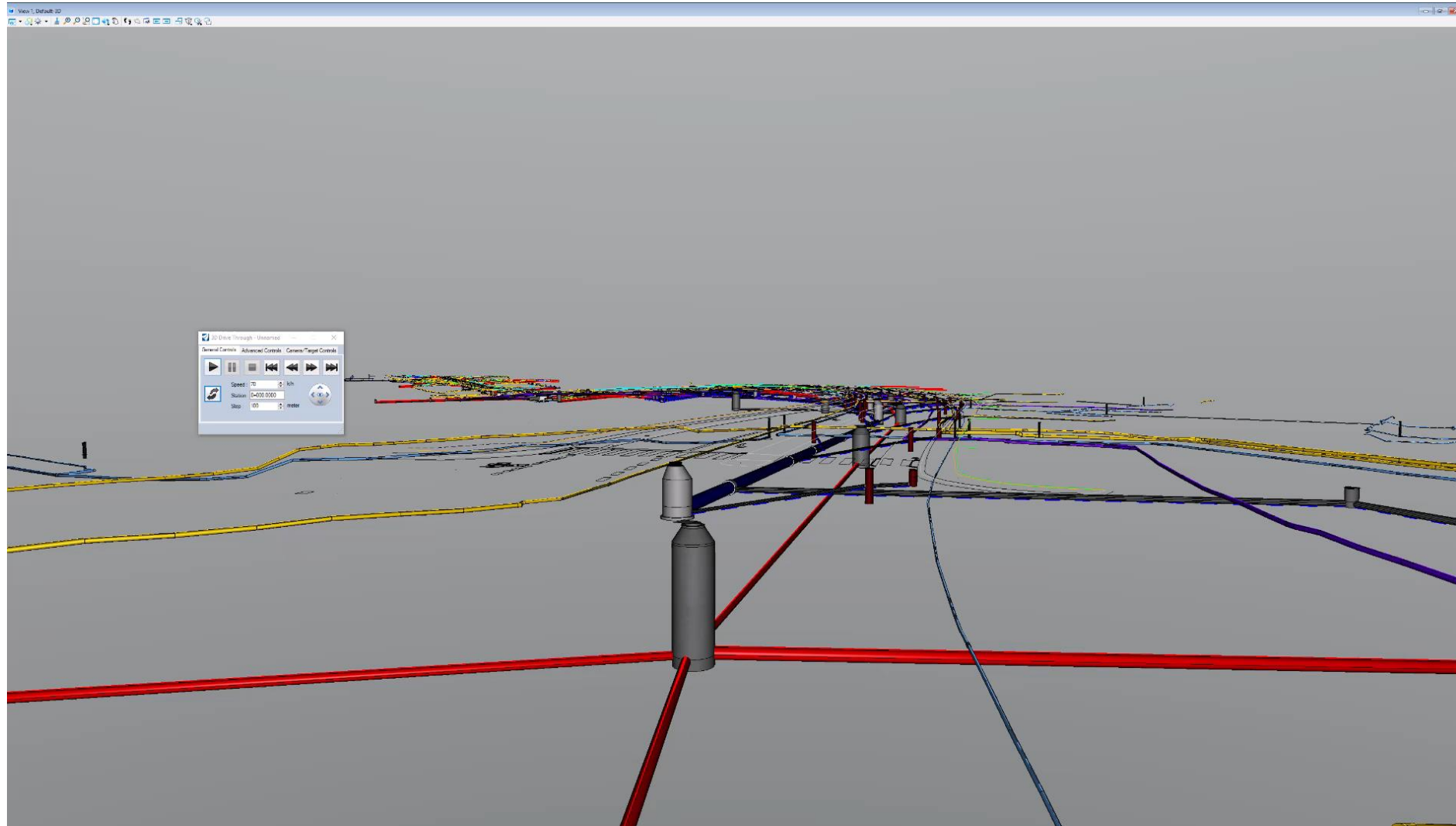
DANDASGRAF VS D&U (2021)

Description	Dandasgraf/Multigraf	D&U (ORD)
2D	+	+
TV-inspection	+	-
Quantity Extraction	+	+
Annotation	Good	Work in progres
3D	(+) LOD300	+ LOD325
Hydraulic calculation	(+)	+
Flow calculation	-	+

DANDASGRAF/MULTIGRAF – NORDHAVNSTUNNEL



DRAINAGE & UTILITIES (CE) - SMAKKEGÅRDSVEJ

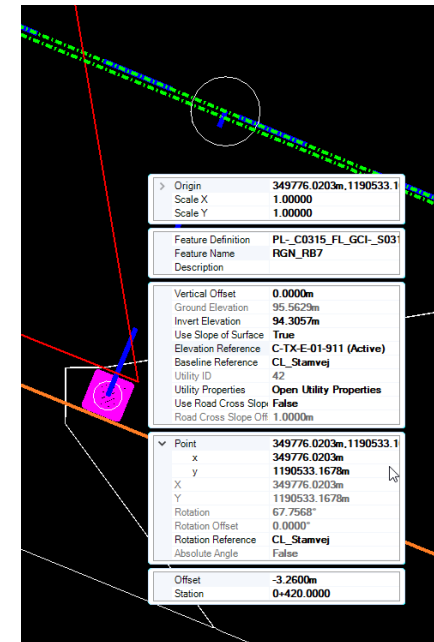
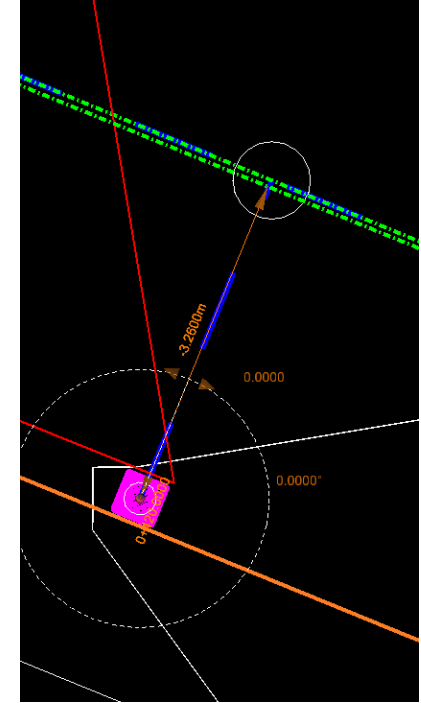
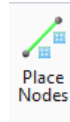


WHAT IS DRAINAGE & UTILITIES

- Dynamic 3D design tool
- Utilities (Communication, Heat, Water, Storm Water, Electricity, etc.)
- LOD - no boundaries (3D details, item types, UDX)
- Uses terrain models existing and designed
- Hydraulic calculations

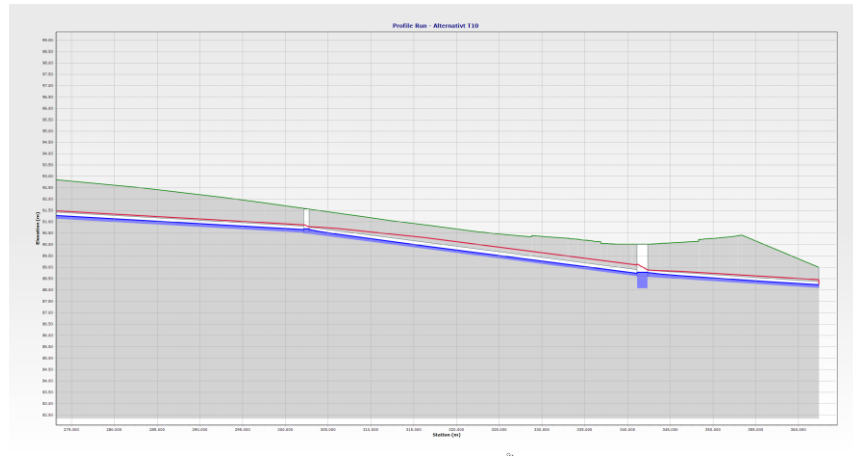
COLLABORATION WITH ROAD/RAIL

- Snap to terrain model
- Placement of node along alignment
- Placement of gully in relation to alignment (rotation, distance, station)
- Use of road surface to calculate catchment area
- Dynamic when changes occur



HYDRAULIC CALCULATION

- Use of regionalregnrækker 4.1.xls
- Defining catchment areas and runoff coef.
- Analyse or design the drainage system

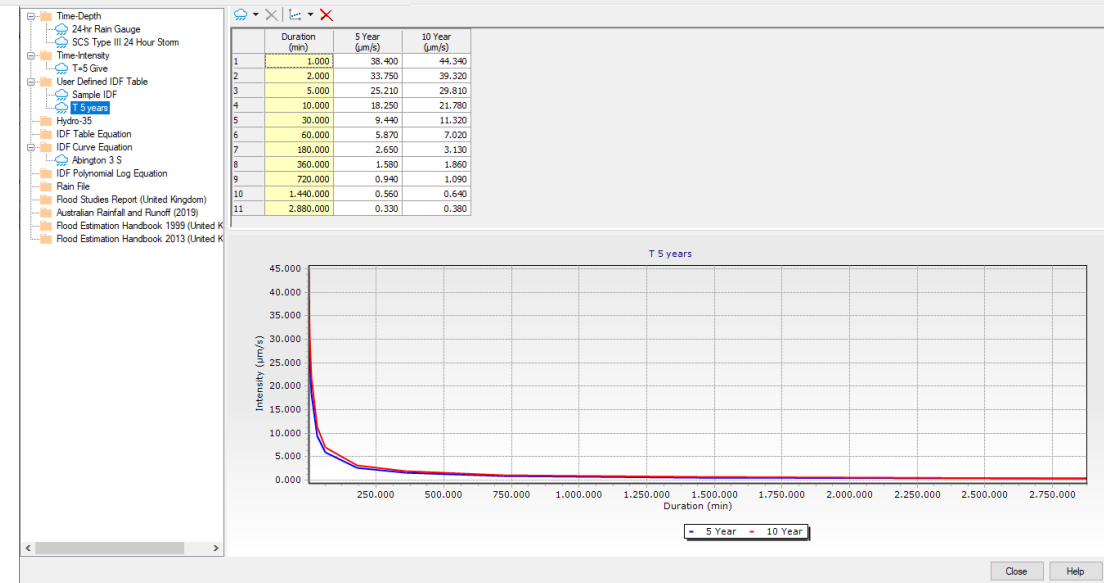


Flow (L/s)	Velocity (m/s)	Depth (Out) (m)	Capacity (Full Flow) (L/s)	Flow / Capacity (Design) (%)	Depth (Normal) / Rise (%)
0.00	0.00	0.05	1.231.99	0.0	0.0
0.00	0.00	0.17	3.83	0.0	(N/A)
71.05	2.00	0.15	130.67	54.4	52.6
71.05	2.70	0.12	195.68	36.3	41.7
71.05	2.08	0.15	137.90	51.5	50.9
67.45	2.30	0.15	87.33	77.2	66.0
70.68	2.16	0.17	80.40	87.9	72.7
0.37	0.75	0.17	14.23	2.6	11.1

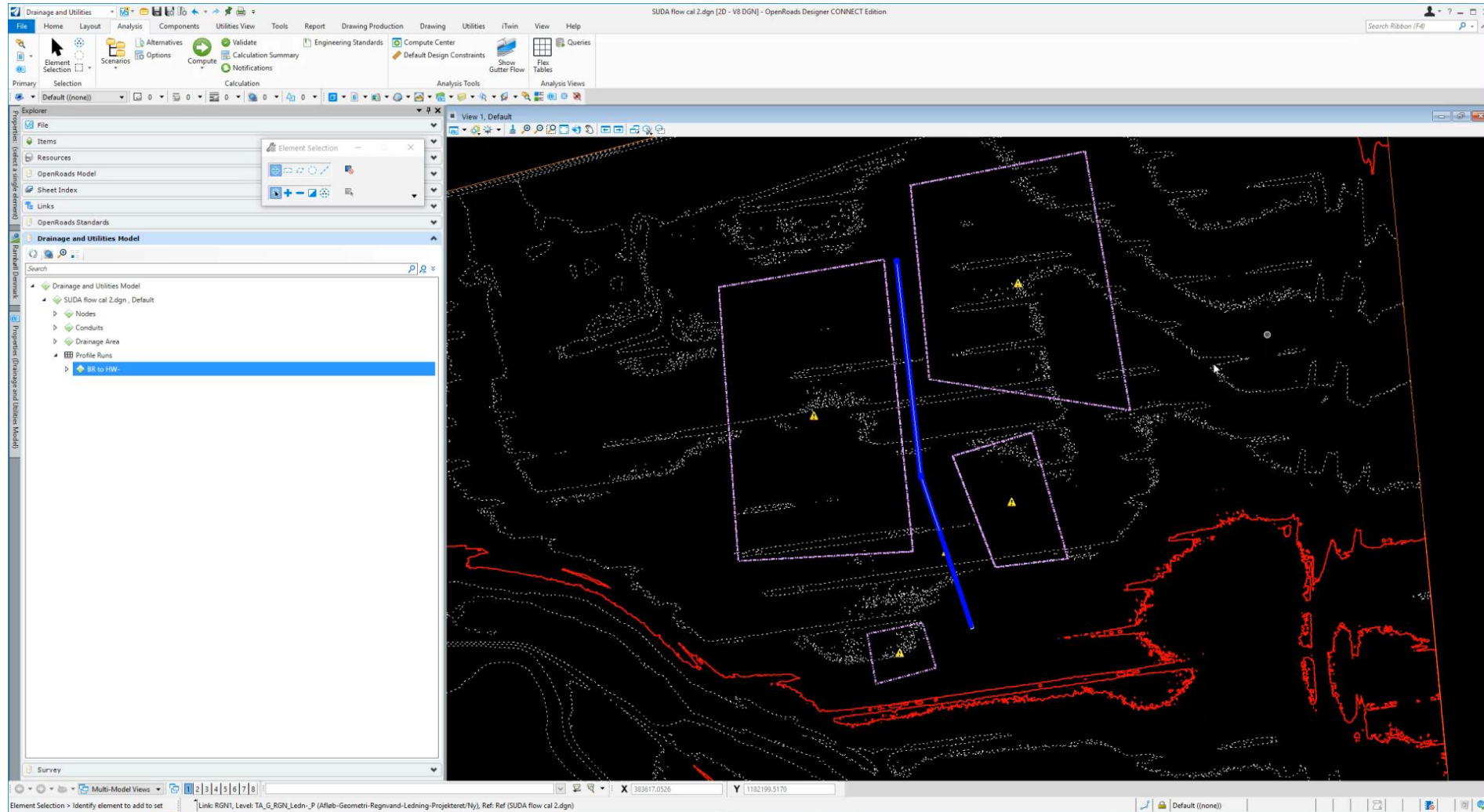
Regnkurve karakteristika		Ledningsdimensionering	
Northing (WGS84 ZONE 32)	6189713	CDS-regn varighed (min)	240
Easting (WGS84 ZONE 32)	514848	Tidsskridt (min)	1
Arsmiddeldnedbør (mm)	827	Asymmetri koefficient	0.5
Middelværdi ekstrem døgnedbør DMK Klimagrid (mm/døg)	25.4		
Gentagelsesperiode (år)	5		
Sikkerhedsfaktor (Fra Skrift 27)	1	Defineret i Skrift 27, Faktor til beskrivelse af usikkerhed, klima, mv. Typisk 1.0 - 1.8	
Varighed (min)	Intensitet givet ovenstående input (µm/s)		
10	18.24		

Varighed (min)	z ₁ (µm/s)	S(z ₁) (µm/s)	F _{z₁} (µm/s)	Regression (µm/s)
1	38.13	3.68	38.13	38.39
2	33.57	2.95	33.57	33.74
5	25.27	1.67	25.27	25.20
10	18.64	1.41	18.64	18.24
30	9.61	0.91	9.61	9.44
60	5.96	0.67	5.96	5.87
180	2.58	0.25	2.58	2.65
360	1.56	0.11	1.56	1.58
720	0.93	0.07	0.93	0.94
1440	0.56	0.04	0.56	0.56
2880	0.34	0.03	0.34	0.33

Tid (min)	Intensitet (µm/s)
0	0.551612257
1	0.555290403
2	0.559025775
3	0.562819777
4	0.566673861
5	0.570589528
6	0.574568329
7	0.578611871
8	0.582721816
9	0.586899884
10	0.591147856
11	0.595467578
12	0.599860951
13	0.604329987
14	0.608876712
15	0.613503266
16	0.618211962
17	0.623004796
18	0.627884448
19	0.632853298



HYDRAULIC CALCULATION



FUTURE

- More demand for 3D models
- 3D models as design tool
- Higher LOD demand
- Multidisciplinary collaboration/ Clash detection
- 3D models at meetings
- 3D models to contractor (currently primarily basins and 3D bottom line)
- Collaboration with DanDasGraf import/export
- Hydraulic calculation (regional + CDS)

QUESTIONS

- ???