

F5 - Multidisciplinary use of InRoads and Storm & Sanitary in the biggest infrastructure project in Sweden, Norra länken

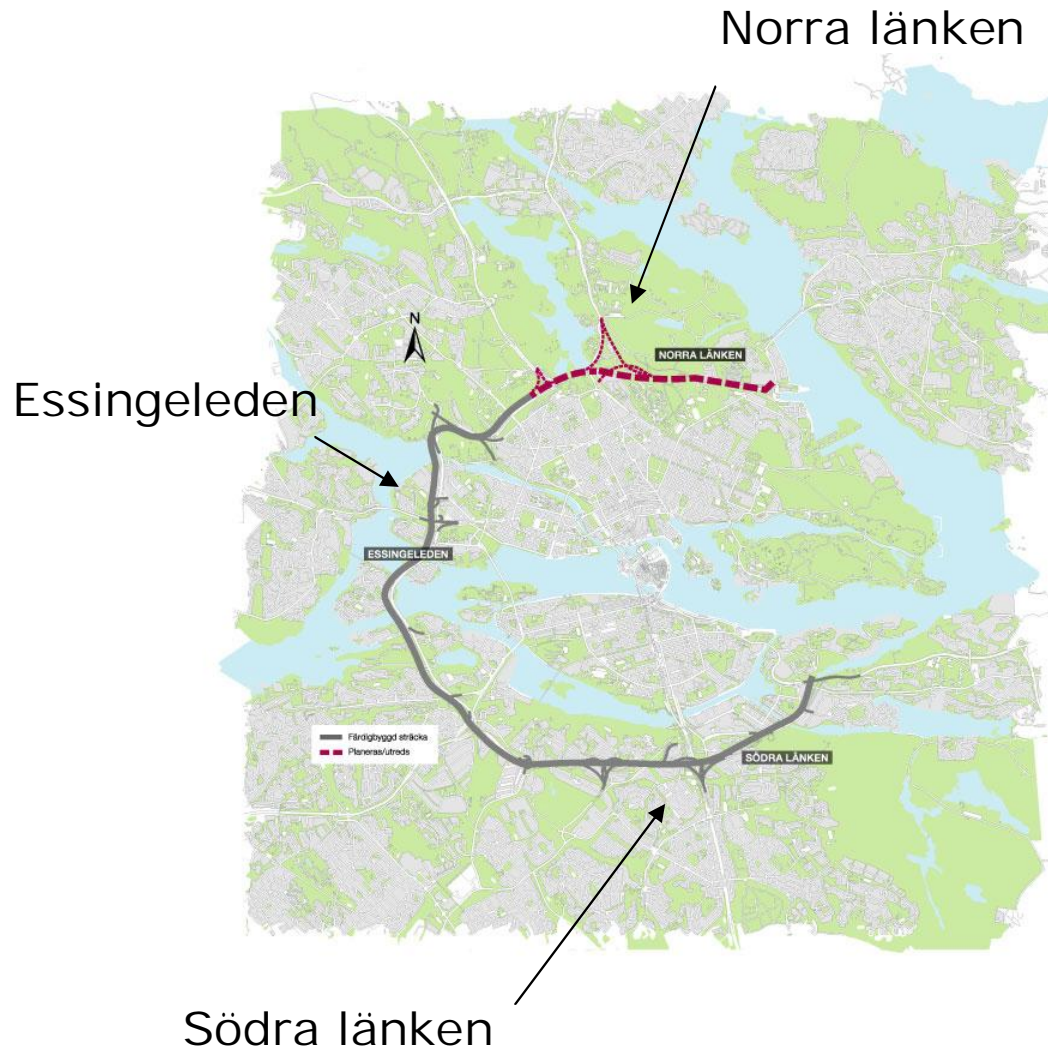


*Natallia Azaronak, Rambøll Sverige, Geotechnics
Therese Sandgren, Rambøll Sverige, Storm water*

Presentation for bentleyuser.dk
Vejle, 2008

NORRA LÄNKEN

Together with Södra länken and Essingeleden, Norra länken builds a centrally located, inter-linking traffic system in Stockholm



- 9 km rock tunnels, 2 km concrete tunnels, 2 km new and upgraded roads, new and temporary railway bridge, railway station track
- Connection to the ports at Värtahamnen and Frihamnen
- Norra länken will provide safer inner city streets through directing heavy transport vehicles into underground tunnels
- The Swedish Road Administration (SRA) is responsible for the construction as Norra länken is classified as a national road
- The cost is about 11.6 billion SEK, the national government finances 75% and the rest is financed by the City of Stockholm
- 800 jobs
- Opens to traffic in 2015

Ramböll's parts in Norra länken: Frescati and Värtan

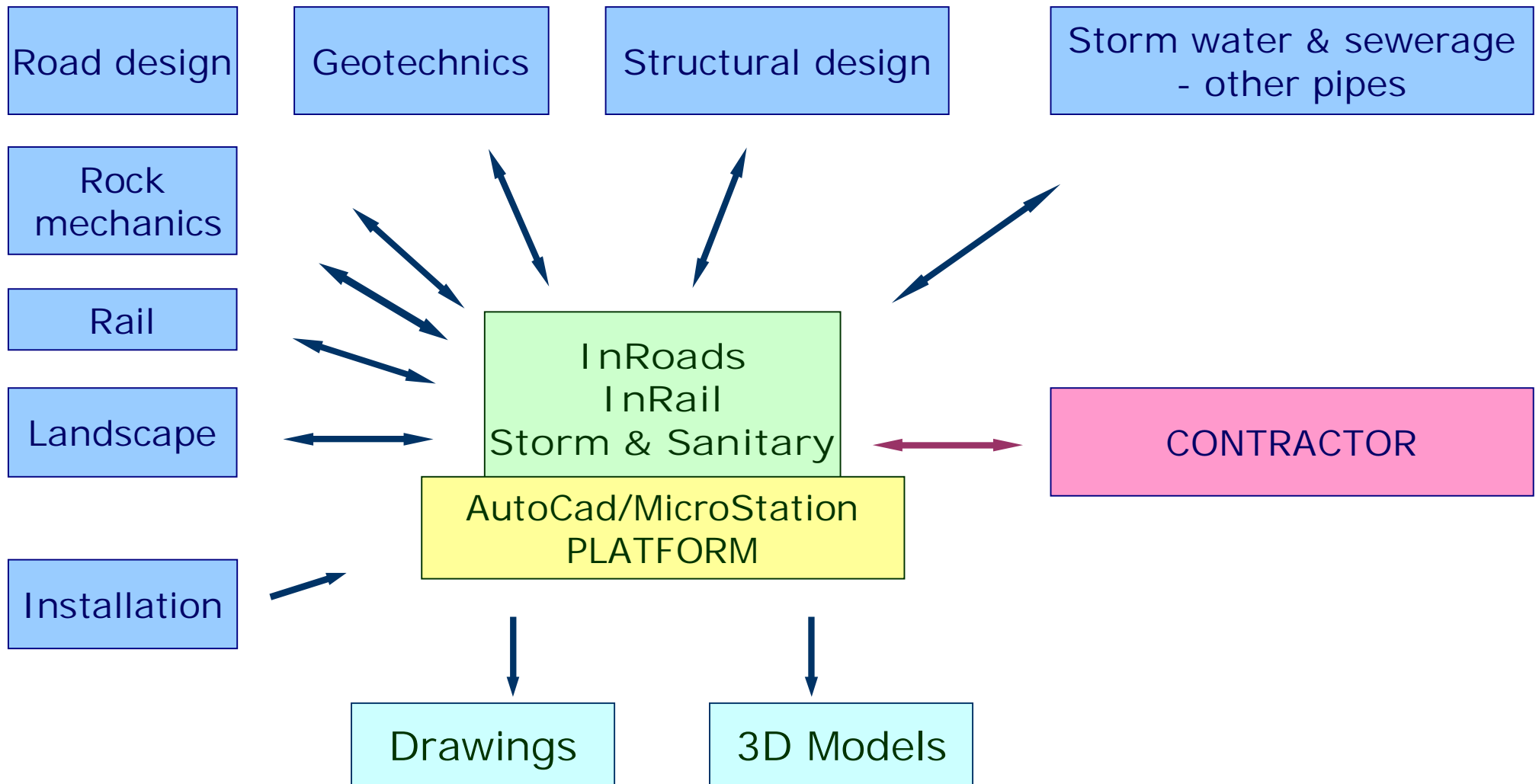


- Exit parts
- Rock tunnel
- Earth tunnel
- Concrete tunnel

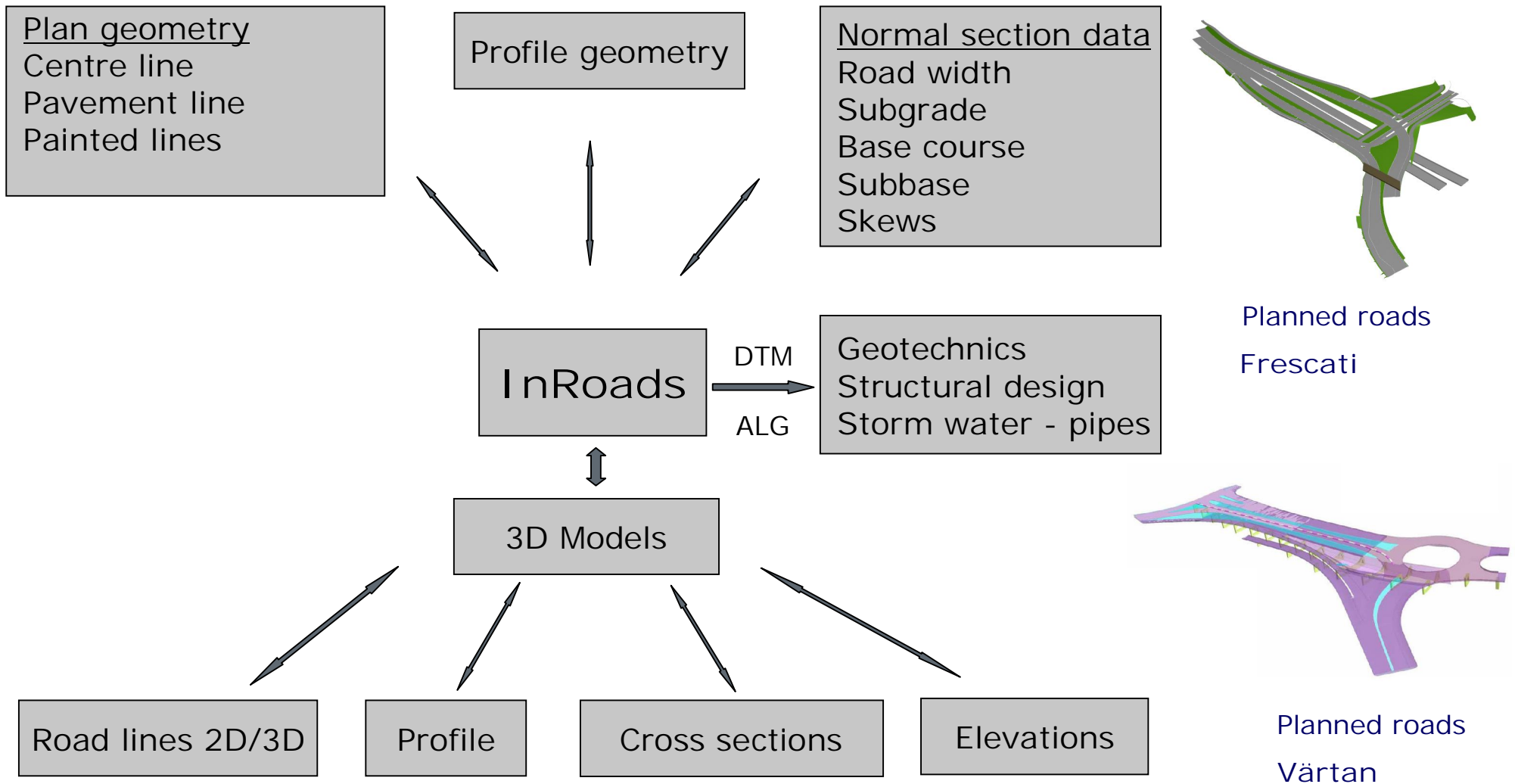
Challenges & problems

- National City Park
- Metro
- Rail lines, transport to the port
- Busy traffic areas (traffic re-routing)
- Pipe networks (preparatory works)
- Geology
- Soil reinforcement
- Existing geotechnical & structural constructions

Technical disciplines involved in the design

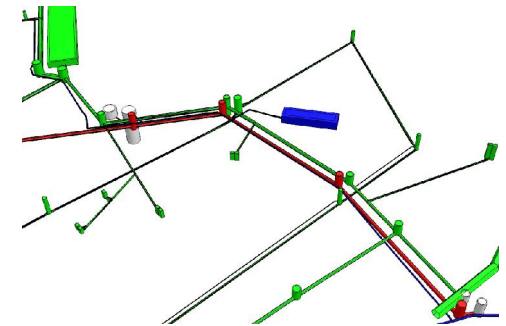
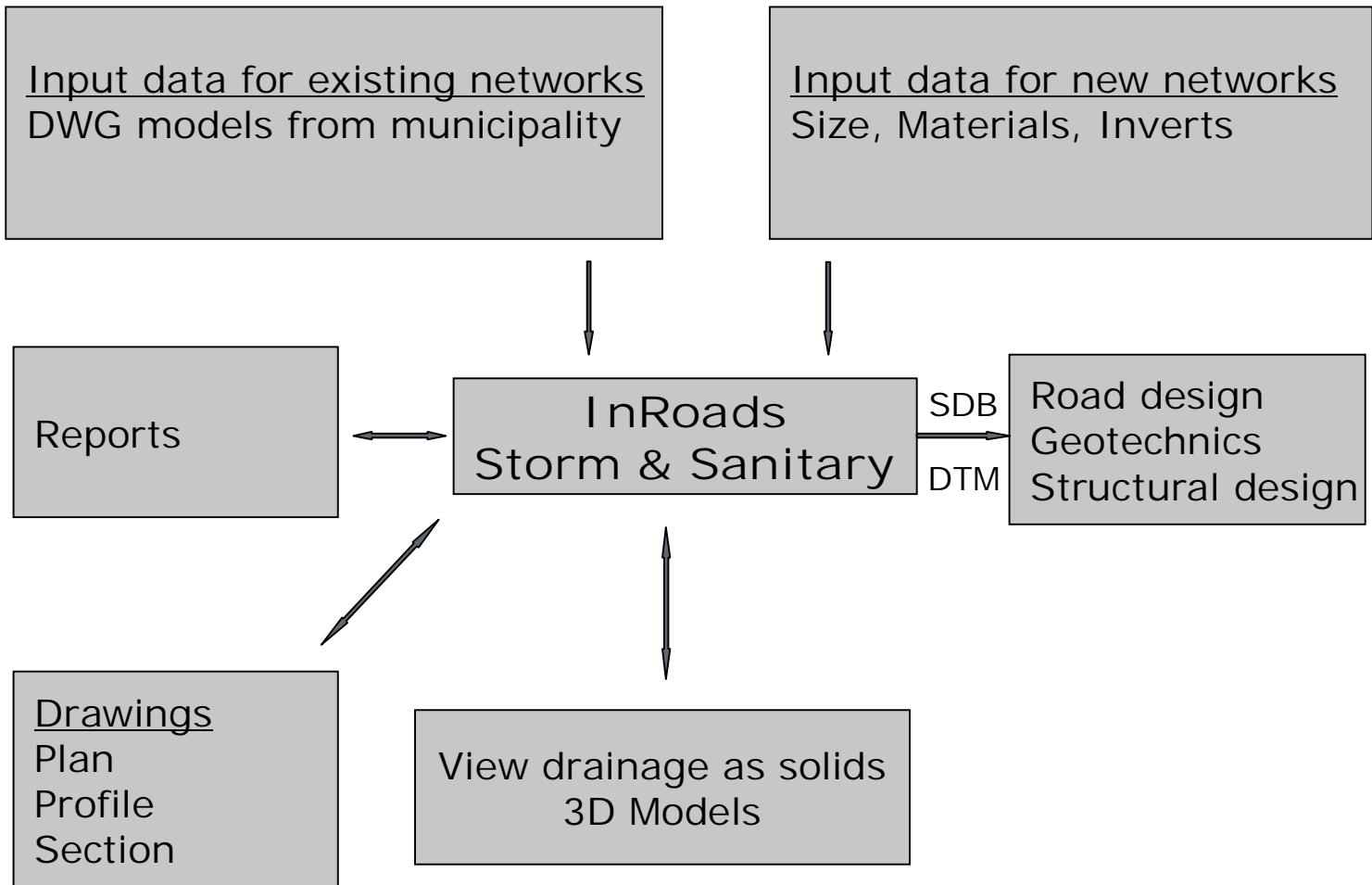
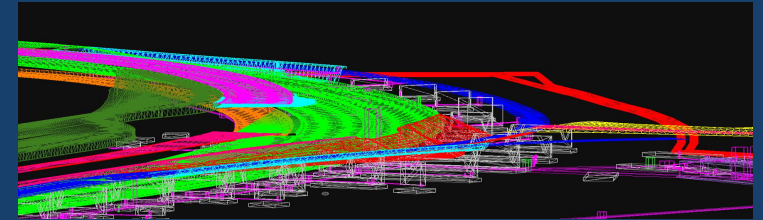


Road design

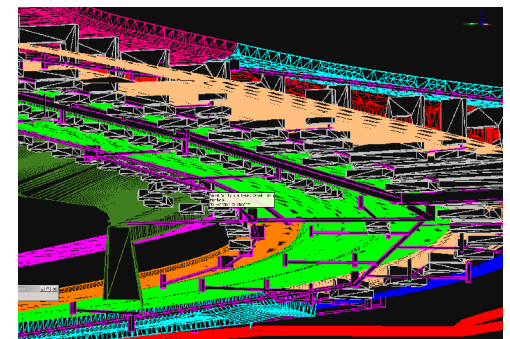


Storm water and sewerage – other pipes

part 1



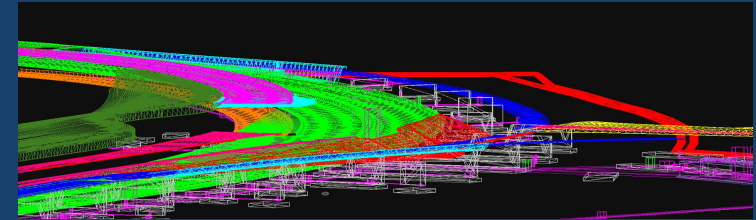
Planned pipes
Frescati



Planned pipes
Värtan

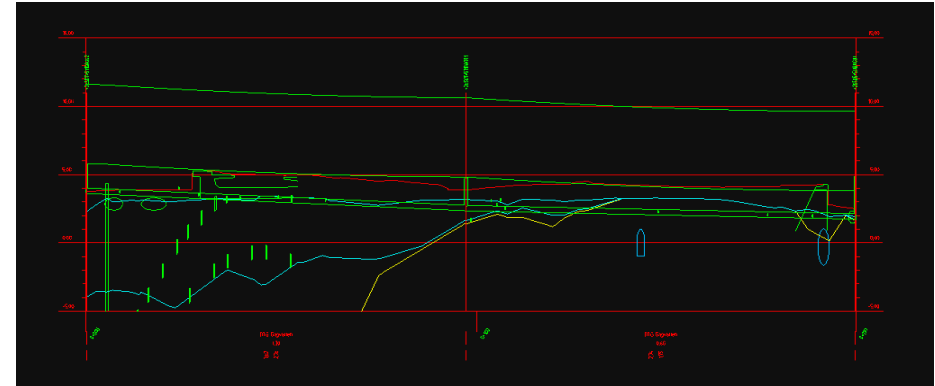
Storm water and sewerage – other pipes

part 2



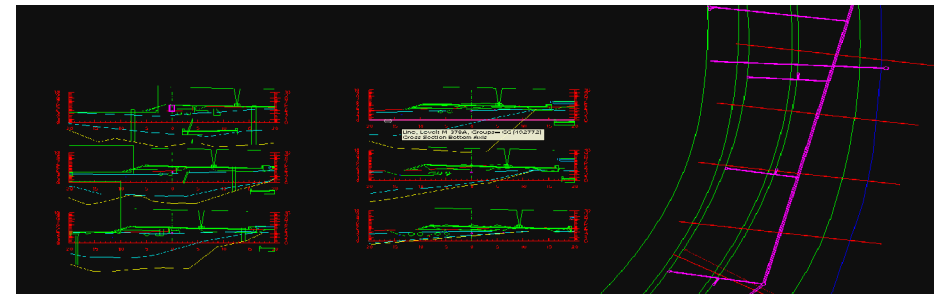
Profiles

- requires manual work in AutoCAD
- SRA accepts only DWG
- along pipe network or projected



Cross sections

- good for discussions
- used for mass calculations
- along the pipe network/along an ALG



Reports

- calculation of mass, meter pipes
- coordinate lists
- invert in &out

Results

Drainage Reports

Element Type: Pipe

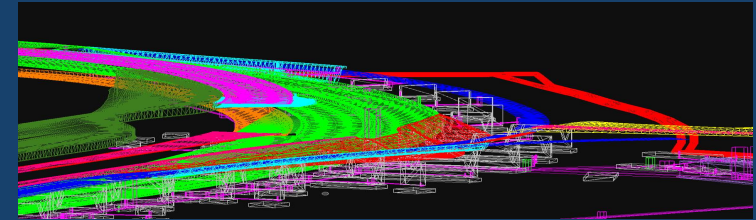
Date: den 20 maj 2008 20:28:41

Drainage Data File: VA_undreplan_NL52

Material	Diameter (mm)	Pipe ID	Längd (m)
PP	200	PP1000000000	1.000000000
PP	200	PP1000000001	1.000000000
PP	200	PP1000000002	1.000000000
PP	200	PP1000000003	1.000000000
PP	200	PP1000000004	1.000000000
PP	200	PP1000000005	1.000000000
PP	200	PP1000000006	1.000000000
PP	200	PP1000000007	1.000000000
PP	200	PP1000000008	1.000000000
PP	200	PP1000000009	1.000000000
PP	200	PP1000000010	1.000000000
PP	200	PP1000000011	1.000000000
PP	200	PP1000000012	1.000000000
PP	200	PP1000000013	1.000000000
PP	200	PP1000000014	1.000000000
PP	200	PP1000000015	1.000000000
PP	200	PP1000000016	1.000000000
PP	200	PP1000000017	1.000000000
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PP	200	PP1000000019	1.000000000
PP	200	PP1000000020	1.000000000
PP	200	PP1000000021	1.000000000
PP	200	PP1000000022	1.000000000
PP	200	PP1000000023	1.000000000
PP	200	PP1000000024	1.000000000
PP	200	PP1000000025	1.000000000
PP	200	PP1000000026	1.000000000
PP	200	PP1000000027	1.000000000
PP	200	PP1000000028	1.000000000
PP	200	PP1000000029	1.000000000
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PP	200	PP1000000041	1.000000000
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PP	200	PP1000000099	1.000000000
PP	200	PP1000000100	1.000000000

Storm water and sewerage – other pipes

part 3

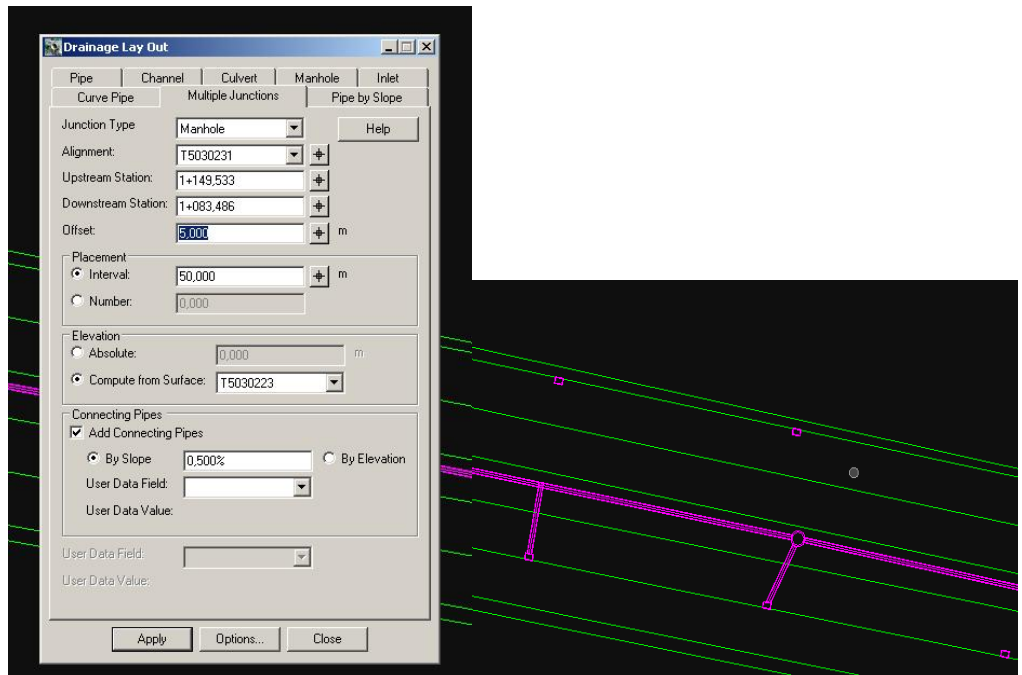
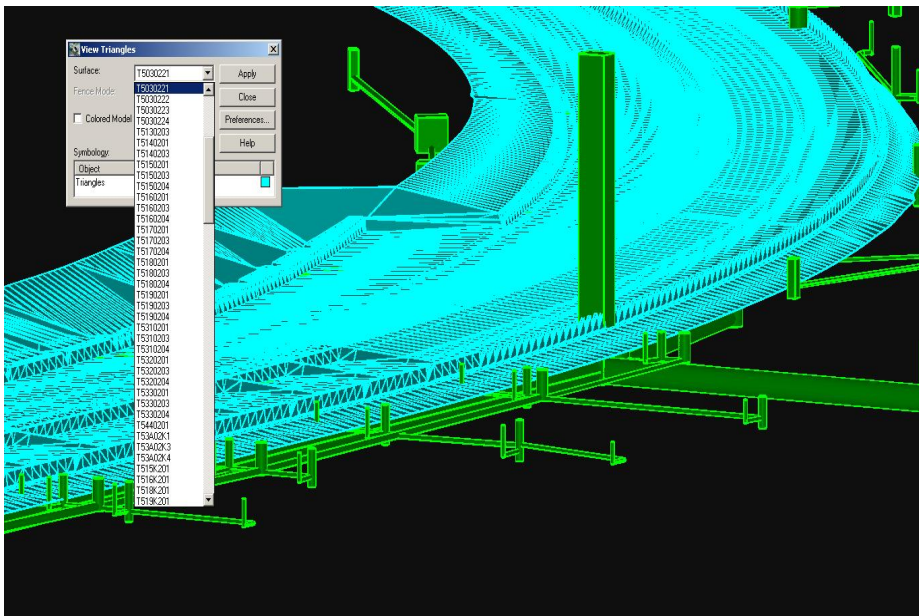


View drainage as solids - 3D Models

- quick illustration
- visual collision control
- visualize design mistakes
- view DTM as triangles

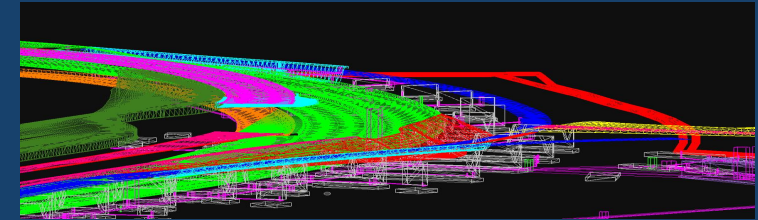
Drainage lay out

- multiple junctions, manhole or inlet
- road alignment and offset
- placement interval or number
- elevation absolute or from surface
- connecting pipes by slope or by elevation



Storm water and sewerage – other pipes

part 4



Contours - choose any DTM

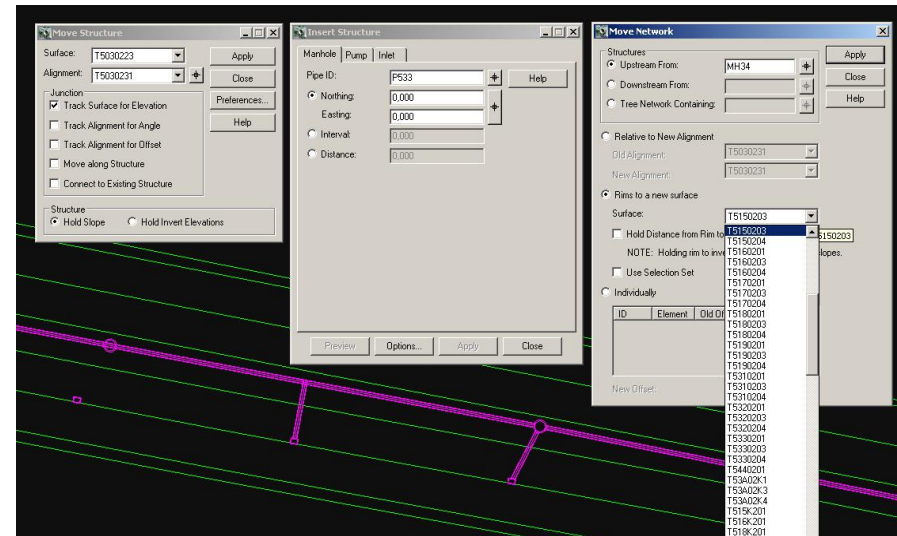
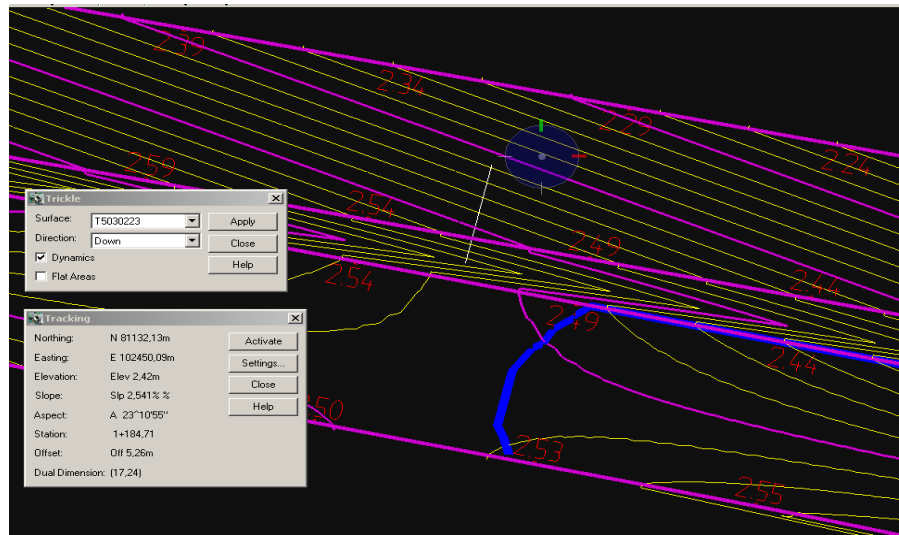
Trickle - helps to place inlets

Tracking - lets us know the elevation and station offset

Move Structure – adjust manhole/inlet to road surface, connect two structures

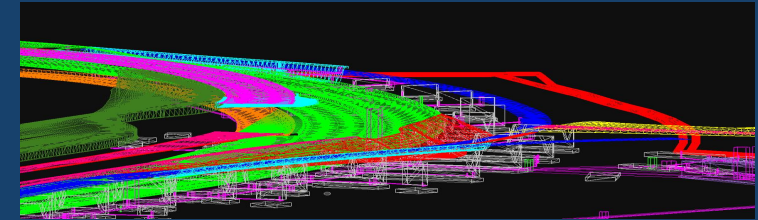
Move Network – adjust network to an updated road surface or alignment

Insert Structure – insert new structure in plan or profile



Storm water and sewerage – other pipes

part 5



Edit/Review Pipe

Pipe ID: P534 Help

Upstream ID: MH34

Downstream ID: MH35

Shape: Circular Circular

Material: BTG Dagvatten BTG Dagvatten

Material Description:

Roughness: 0,130000 0,130000

Size (W x T): 300,000 x 45,00000 mm
300,000 x 45,00000 mm

Plan Length: 50,207 m

Pipe Length: 49,207 m

Invert In: -0,181 m

Invert Out: -2,642 m

Slope: 5,000%

Split Flow: 0,000 % Change...

Structure Status:
 Fixed Resize

Apply Close Edit Up... Edit Down...

Edit/Review Pipe is a quick way:

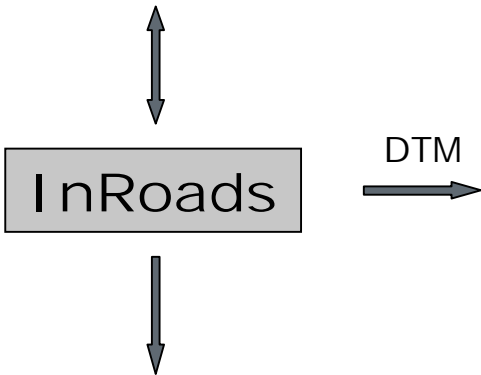
- to go through the system
- control slopes and invert in & out
- test changes
- change material or size

The tabs Pipe and Styles were used in the Norra länken project

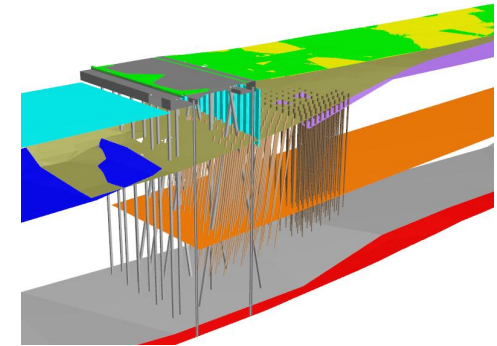
Other tabs belong to the design process except User Data

Structural design

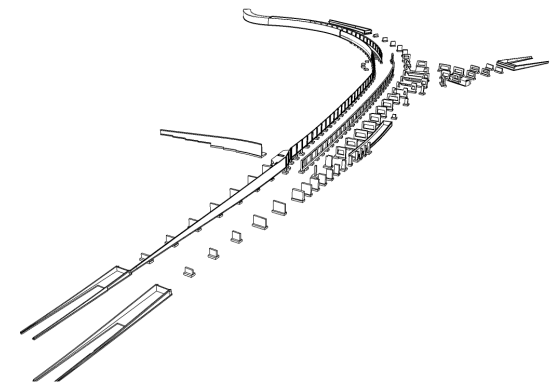
2D data (paper/digital formats):
Plan
Profile/Elevation
Section



Road design
Geotechnics
Storm water - pipes



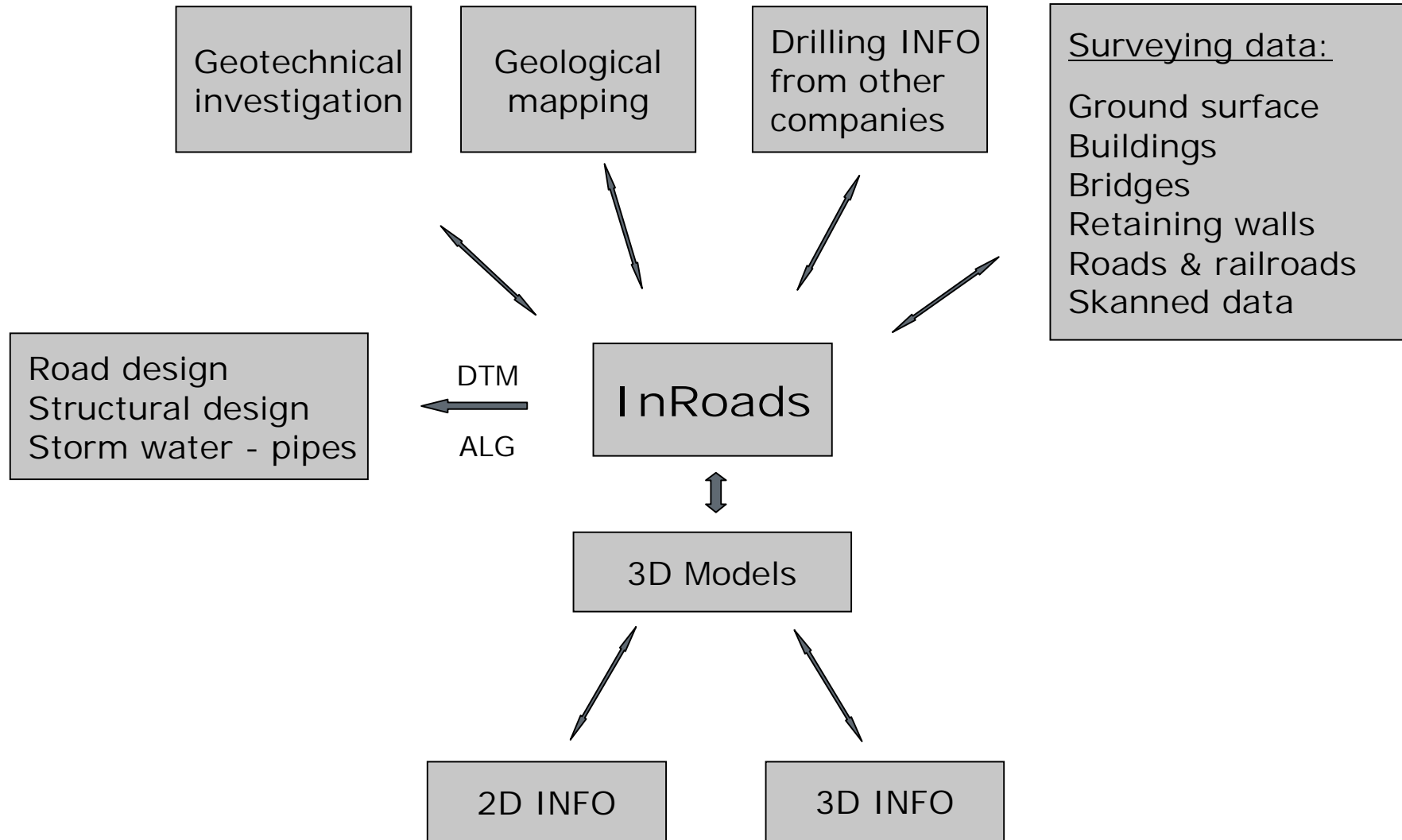
Planned constructions Frescati



Planned constructions Värtan

Geotechnics

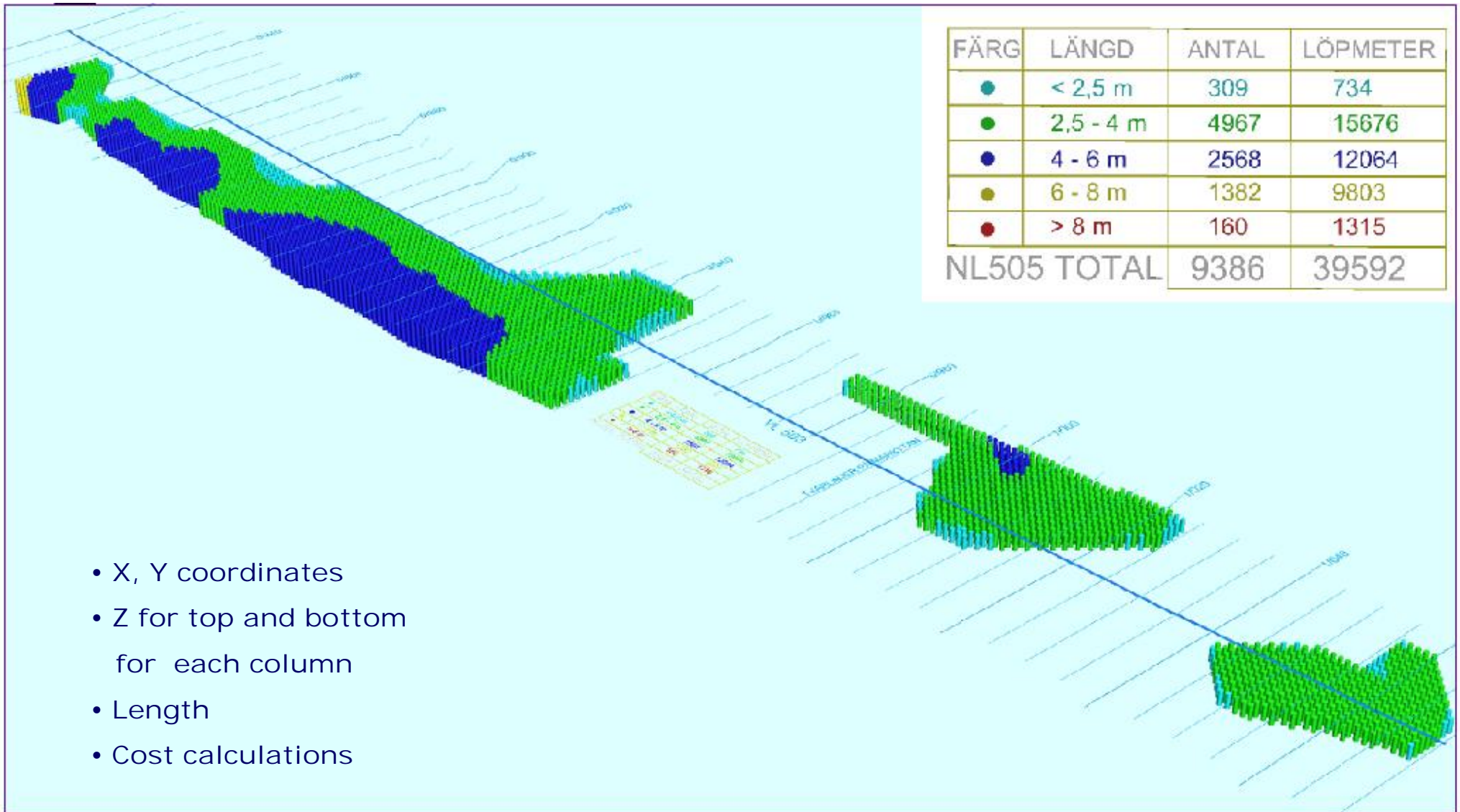
part 1



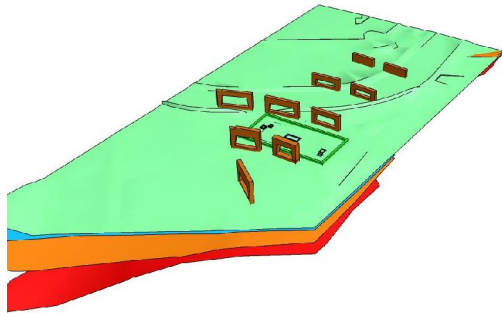
Geotechnics

part 3

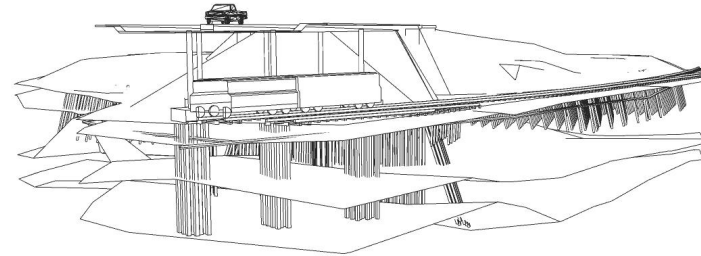
Lime-cement columns



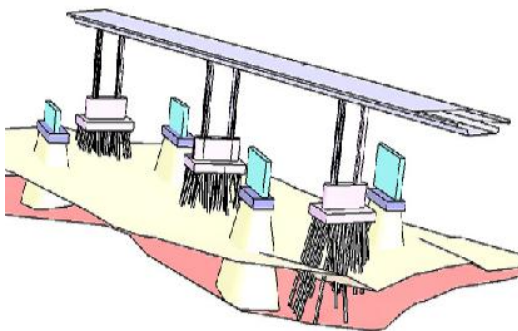
Storm water detention basins



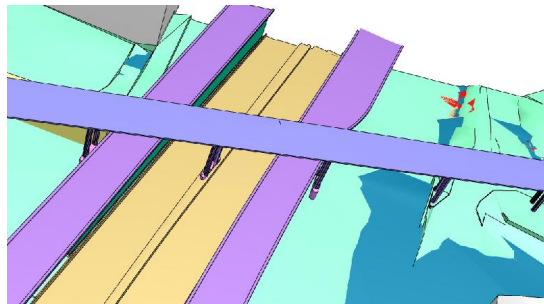
Existing wood piles



Existing piles for the metro



Existing piles for the metro



District cooling pipes



What settings need to be done?

§ XIN – the control file
Decides how objects are displayed in the dgn or dwg file, e.g. the profiles and the cross sections, the plan view, the reports.

Everyone involved in the project should work on a common XIN

§ DTM – Digital Terrain Model
Surface models, tunnels, culverts, district cooling pipes, etc

§ ALG –Alignments
Road lines, geometry lines

§ SDB – Structure Drainage Database
Consists of all pipes, manholes, inlets

§ DAT – Pipe network library, each object has to be defined with a style. Possibility to display any type of pipe, tele, gas, electricity.

§ IDF – Intensity Duration Frequency

The screenshot displays the MicroStation V8i 2014 Edition interface. At the top, a Notepad window shows the XIN control file content, including XML tags for `<PreferredPreferenceCollection>` and `<SystemPreferencesCollection>`. Below this, the Style Manager dialog is open, showing a table of styles and their properties. The table has columns for Name, Description, Surface Named Symbology, Numeric Code, and Alpha Code. The bottom part of the screenshot shows a 3D model of a drainage structure with various pipes and manholes, and a Drainage Structures File dialog with a table of structure types and materials.

Name	Description	Surface Named Symbology	Numeric Code	Alpha Code
Avringsgator	Avringsgator	Avringsgator	0	
Bef dagvatten	Bef dagvatten	Default	0	
Bef el	Bef el	Bef el	0	
Bef farname	Bef farname	Bef farname	0	
Bef spkvatten	Bef spkvatten	Bef spkvatten	0	
Bef tele	Bef tele	Bef tele	0	
Bef vatten	Bef vatten	Bef vatten	0	
Dagp	Dagvatledning	Dagp	0	
Dagp osvrig	Dagp osvrig	Dagp osvrig	0	
Dagkanalst	Dagkanalst	Dagkanalst	0	
Dagbunna	Dagvatbunna	Dagvatbunna	0	
Default	Default	Default	0	
Dranledning	Dranledning	Dranledning	0	
El	Elspoltråd	Elspoltråd	0	
Ivar18-tunnel	Dagvatbunna	Ivar18-tunnel	0	

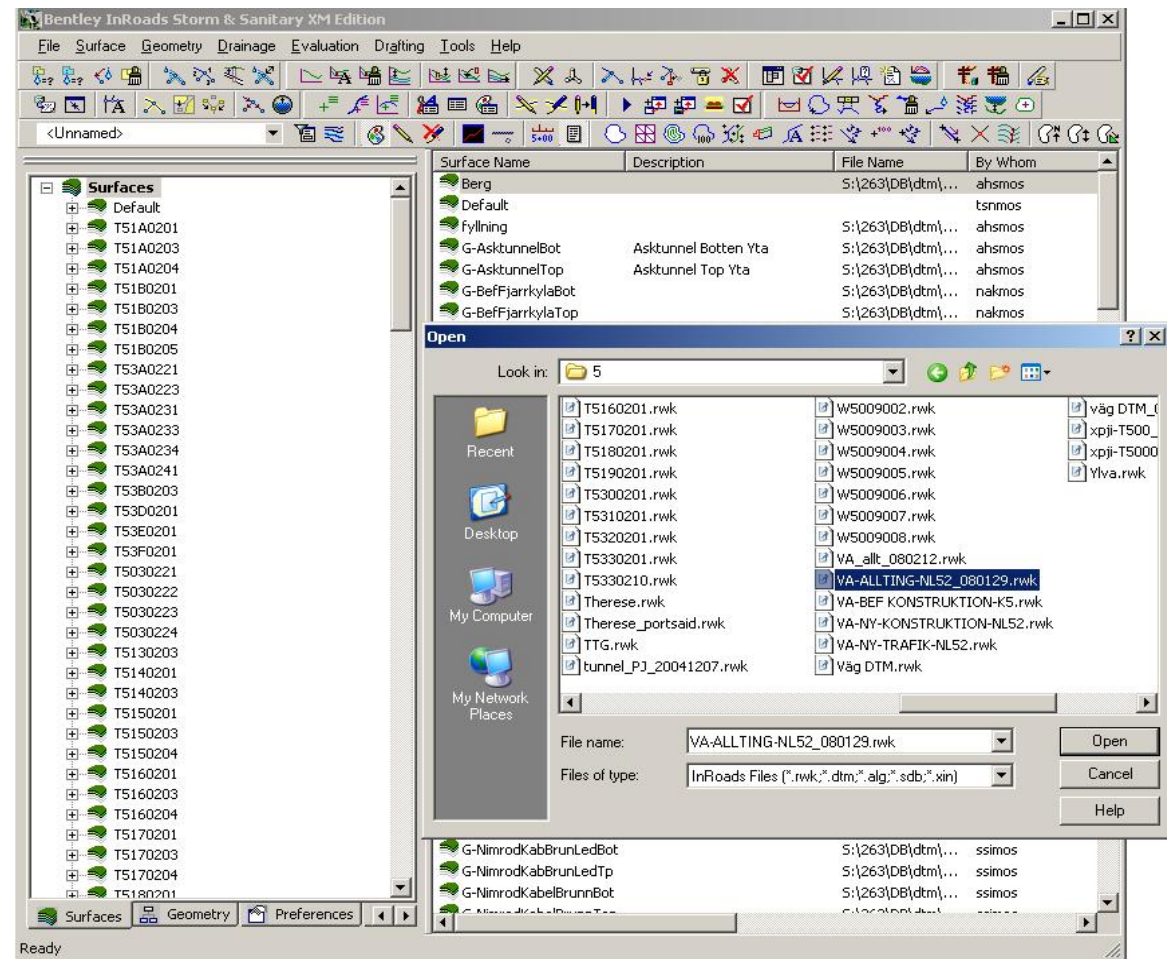
Material	Description	Rough.
AV	AV	0.000000
BTG Dagvatten	BTG Dagvatten	0.130000
BTG Spkvatten	BTG Spkvatten	0.130000
PE GRANULÄRE	PE GRANULÄRE	0.000000
PP	PP	0.000000
PE	PE	0.000000
GAS	GAS	0.000000
TEL	TEL	0.000000
TELE	TELE	0.000000
PEBISDR17	PEBISDR17	0.000000
PEBISDR11	PEBISDR11	0.000000
BTG DagvArmedad	BTG DagvArmedad	0.130000
BTG SpkvArmedad	BTG SpkvArmedad	0.130000
PE SÄVARME	PE SÄVARME	0.000000
OPTOKABEL	OPTOKABEL	0.000000
SÄVARME	SÄVARME	0.000000
SÄL	SÄL	0.000000
BTG Samledning	BTG Samledning	0.130000
PE VÄNSTER	PE VÄNSTER	0.000000
PE Höger	PE Höger	0.000000
REF LÄGV	REF LÄGV	0.130000
REF SPRLLV	REF SPRLLV	0.130000
REF FALLV	REF FALLV	0.130000
SEG	SEG	0.000000
Reviderat	Reviderat	0.000000

How does the RWK simplify your work?

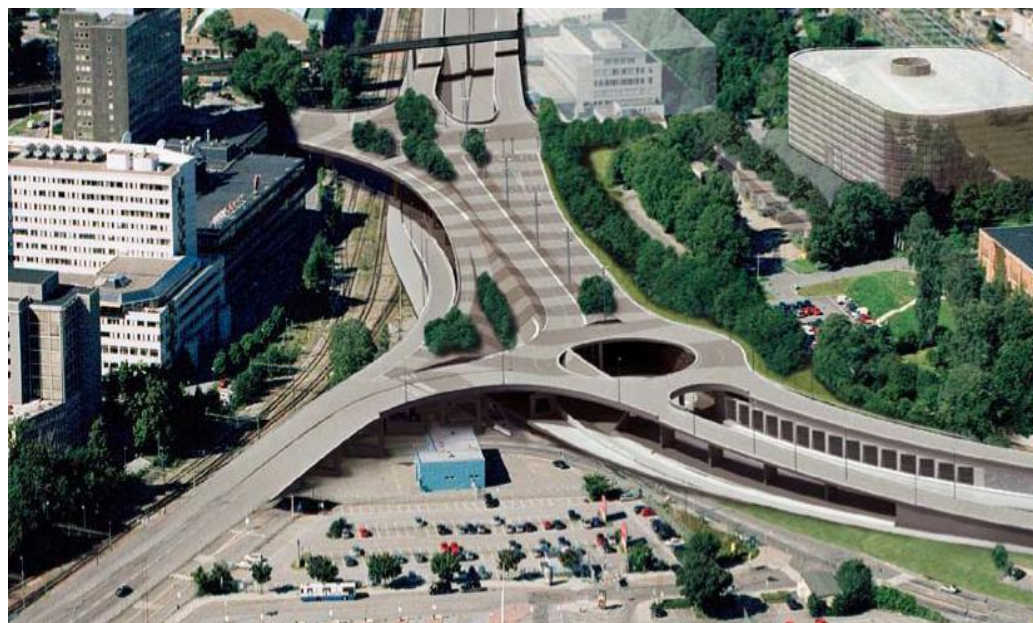
RWK is a project file

- DTM
new and existing surfaces
- ALG
all geometry lines
- SDB
only one SDB at a time
- XIN
controlled by Project Defaults

Important to have "InRoads meetings" to inform all designers on the new data available!



*If you have any questions about the presentation,
feel free to contact us!*



Geotechnics

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Storm water

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