Presentation BROL - Grontmij I&M Rail

Aarhus, 09 September 2009

Grontmij

planning connecting
respecting
the future

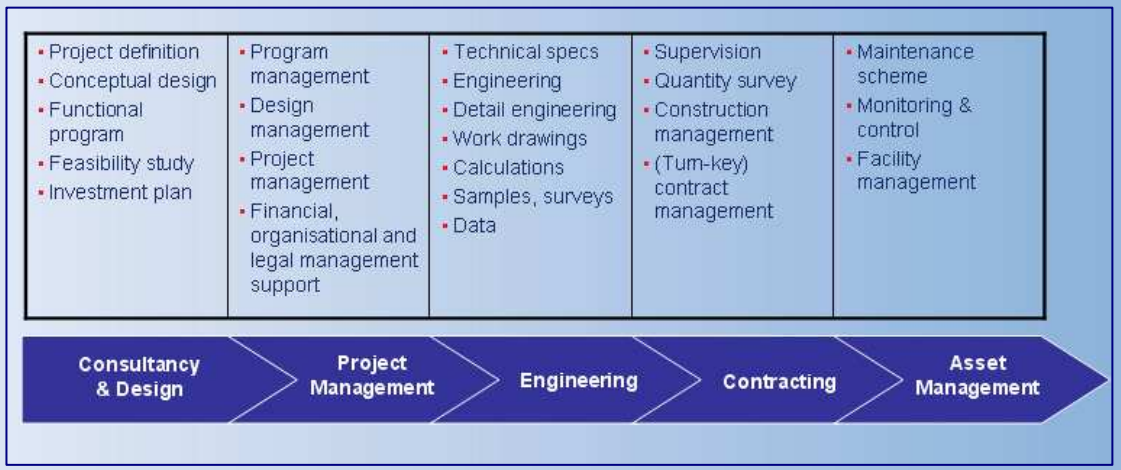
Summary presentation

- Grontmij
- I&M Rail
- BROL
- What has been done so far
- What still has to be done
- Questions…and conclusion

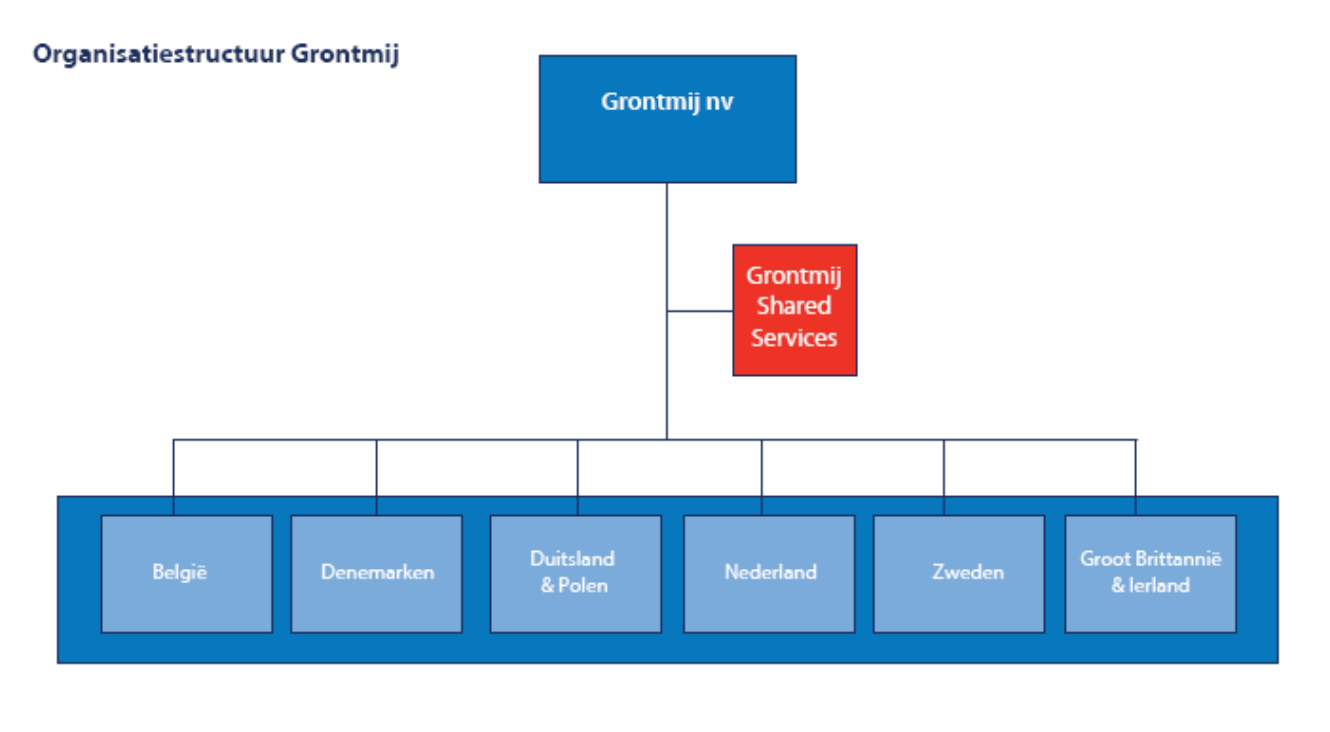
Grontmij

Grontmij is a multidisciplinary design, consultancy and engineering firm employing more than 8,000 professionals active in the environmental, water, energy, building, industrial and transportation sectors.

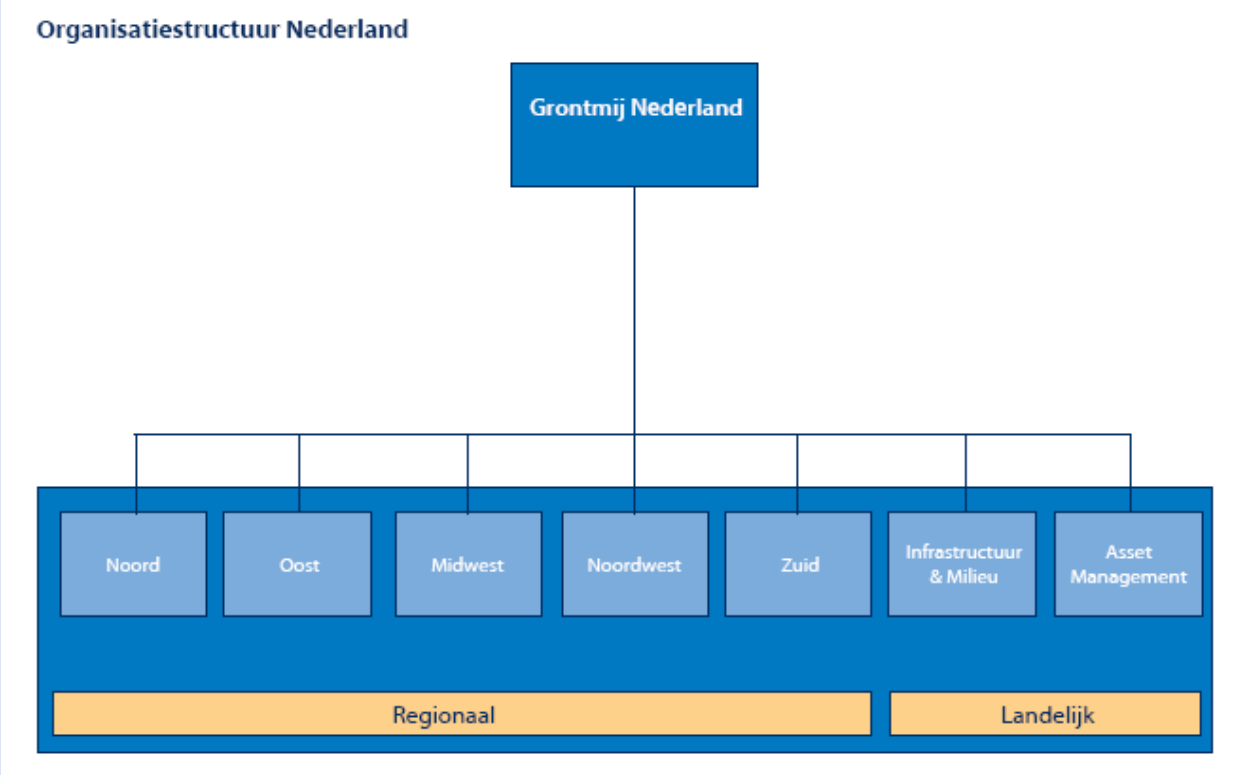
We aim to be the best local service provider in North-West Europe and provide added value throughout the entire process of design, consulting, engineering, contracting and managing multidisciplinary projects.



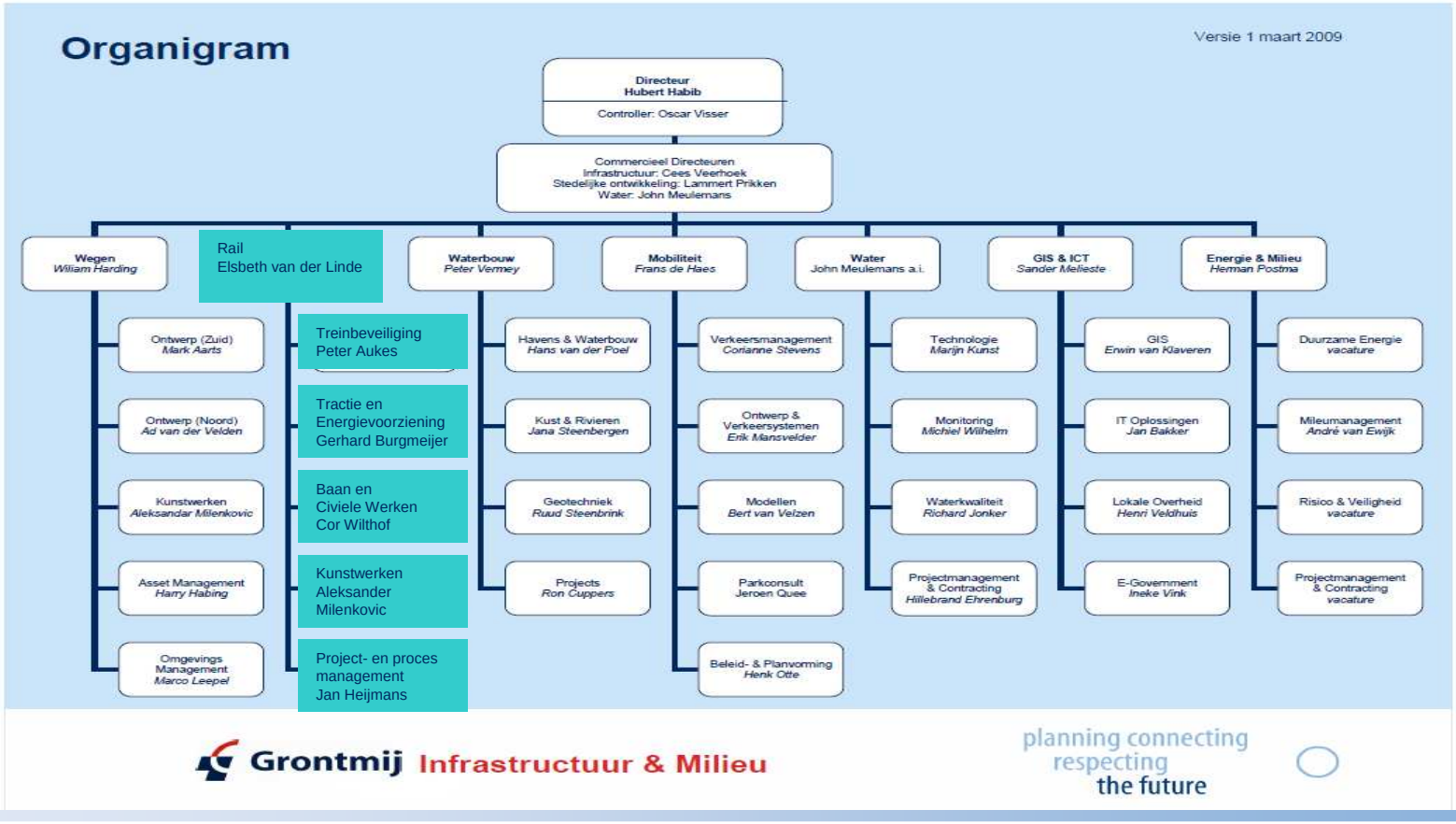
Organization structure Grontmij



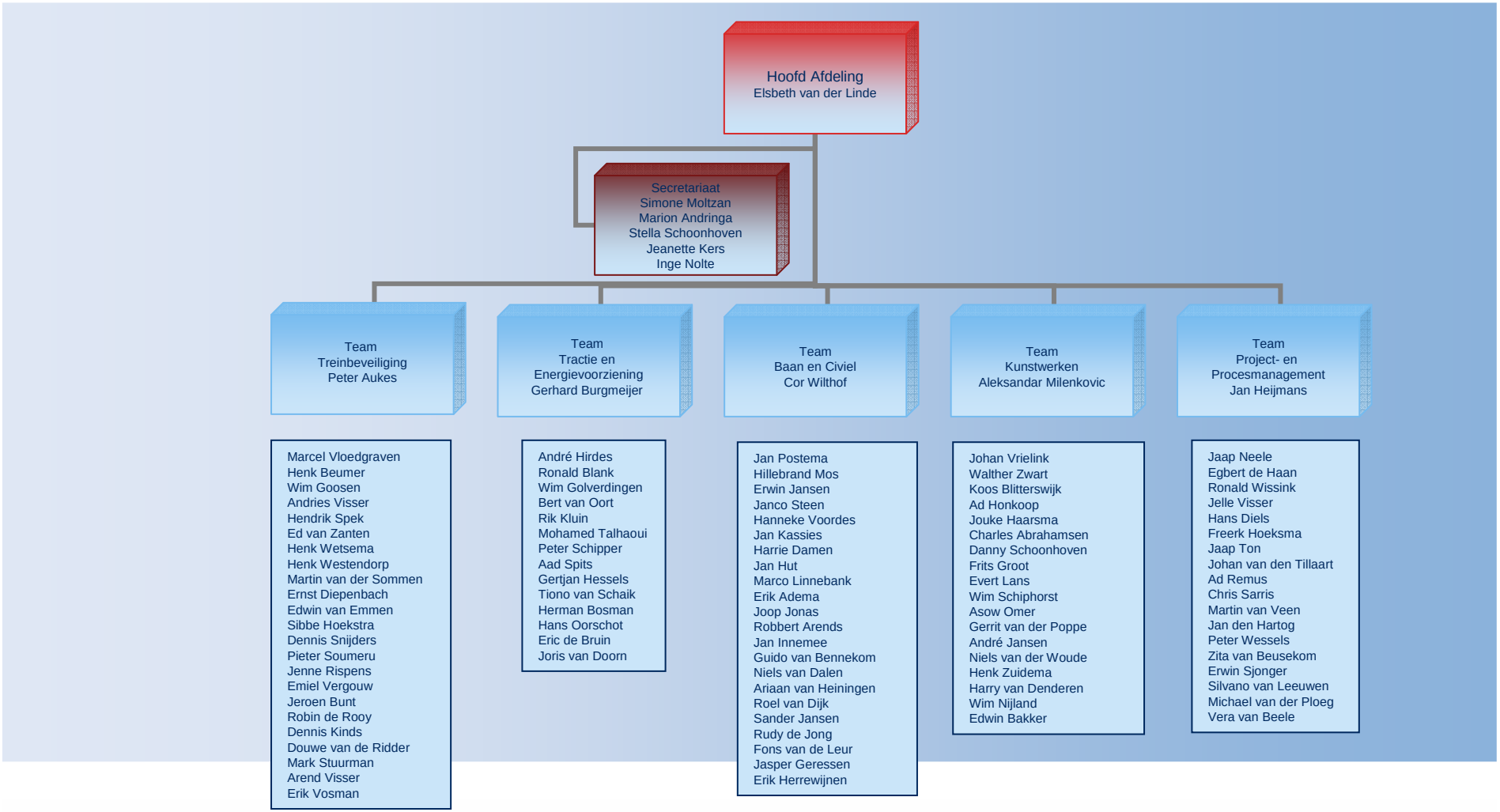
Organization structure Grontmij Nederland



Organization structure Grontmij
Infra structure & Milieu



Organization structure department Rail



Rail services

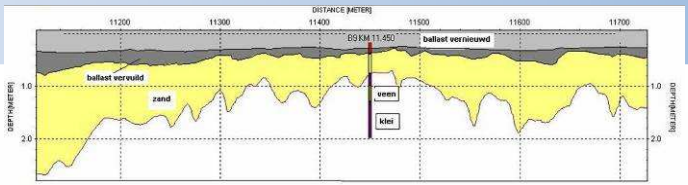
Asset based services

- Feasibility *(master planning, business case, EIA's, CBA's)*
- Contracting *(management contracting, EPC, risk based inspection)*
- Design *(life cycle, systems engineering, RAMS)*
- Asset management *(maintenance, monitoring, operation, GIS)*

Consultancy

- Technical advisor
- Project management
- Spatial planning, development & management

Philosophy



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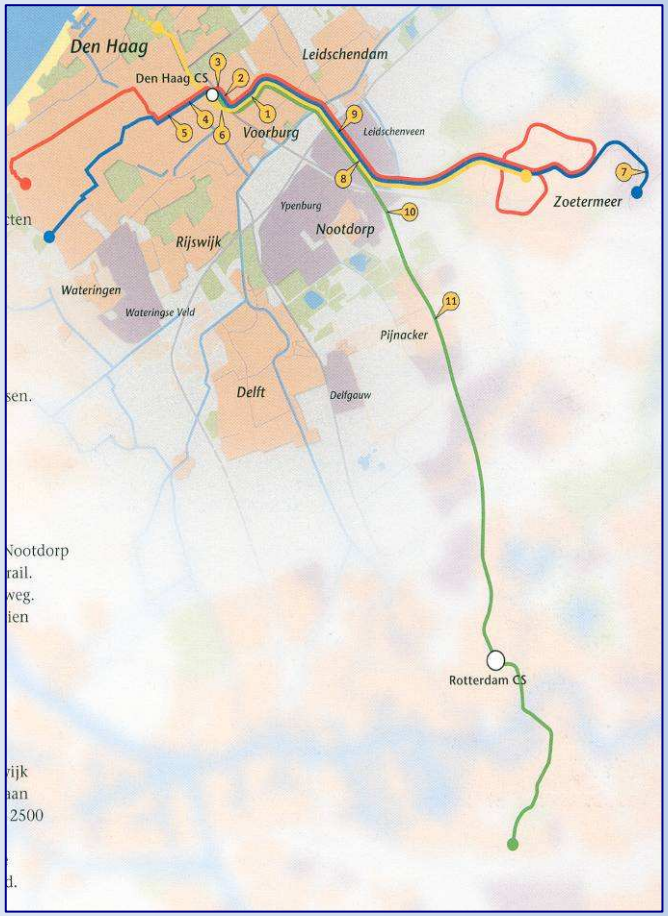
Rail: Oosterheem Line



Project description

The Oosterheem Line is a new 5 km stretch of light railway linking the Vinex site Oosterheem (20.000 inhabitants) with Zoetermeer, The Hague and Rotterdam.

Services delivered

Customer: Stadsgewest Haaglanden, city Zoetermeer

Services:

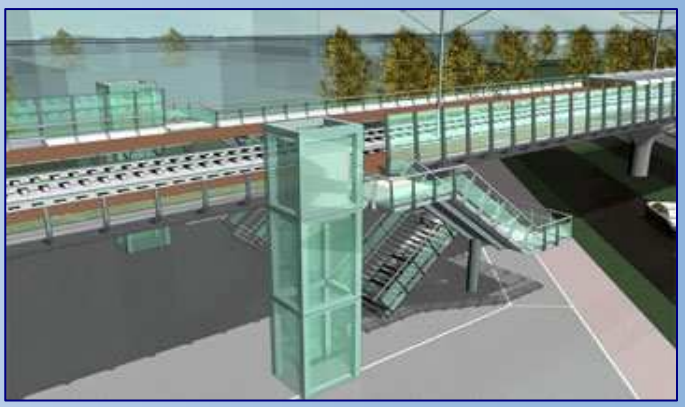
Feasibility study
Engineering
Tender-design
Permits
Assistance during procurement procedure
Contract engineering

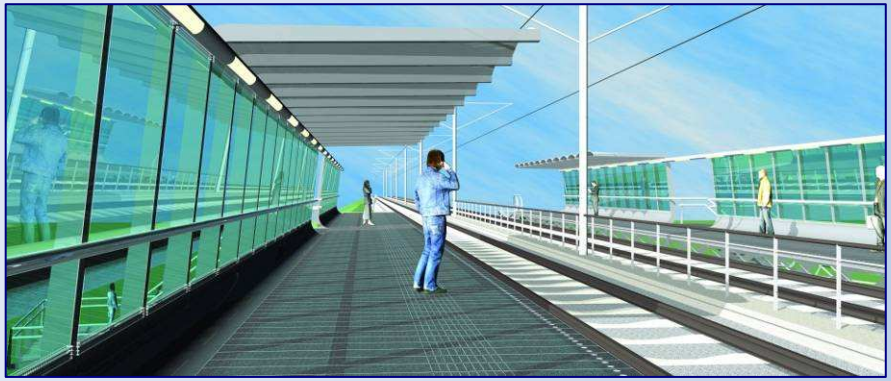
Year: 2000 – 2012

Rail: Oosterheem Line

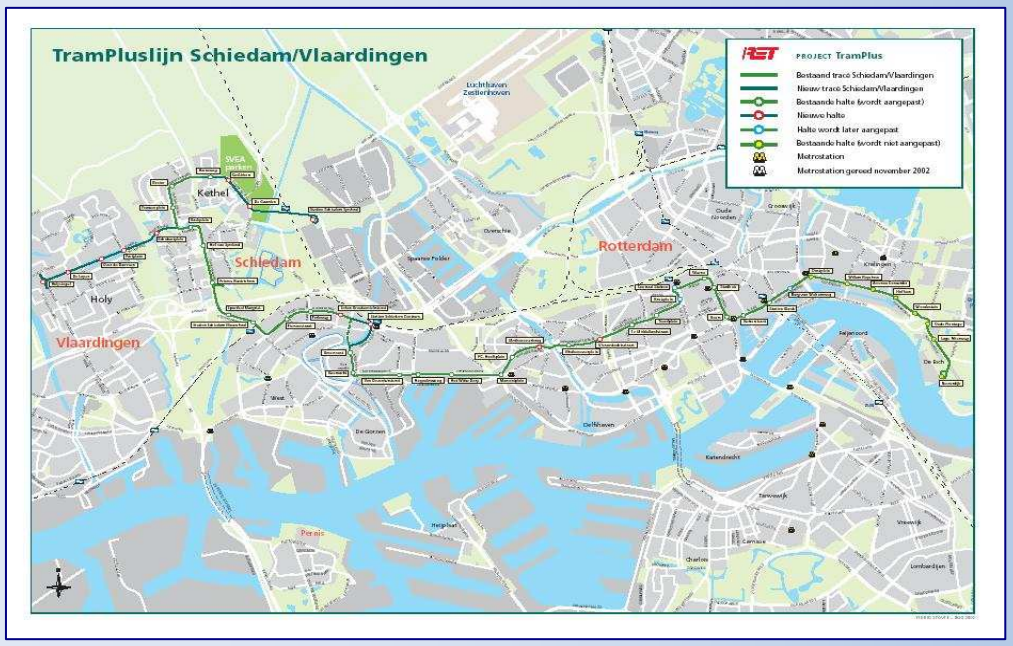
- 17 multilevel interchanges
- 5 stations
- 1200 metres long viaduct
- 6 metres above ground level
- Geotechnical investigations
- Structural design
- Track alignment
- Power supply
- Communications
- Environmental considerations
- Risk management

Rail: Oosterheem Line





Rail: RET Tramplus



Project description

Tramplus Line Rotterdam – Vlaardingen is partly a renewal of the existing light rail track, as well an entirely new tram track. The alignment is 19 kilometres long. Overhead lines. Stops.

Services delivered

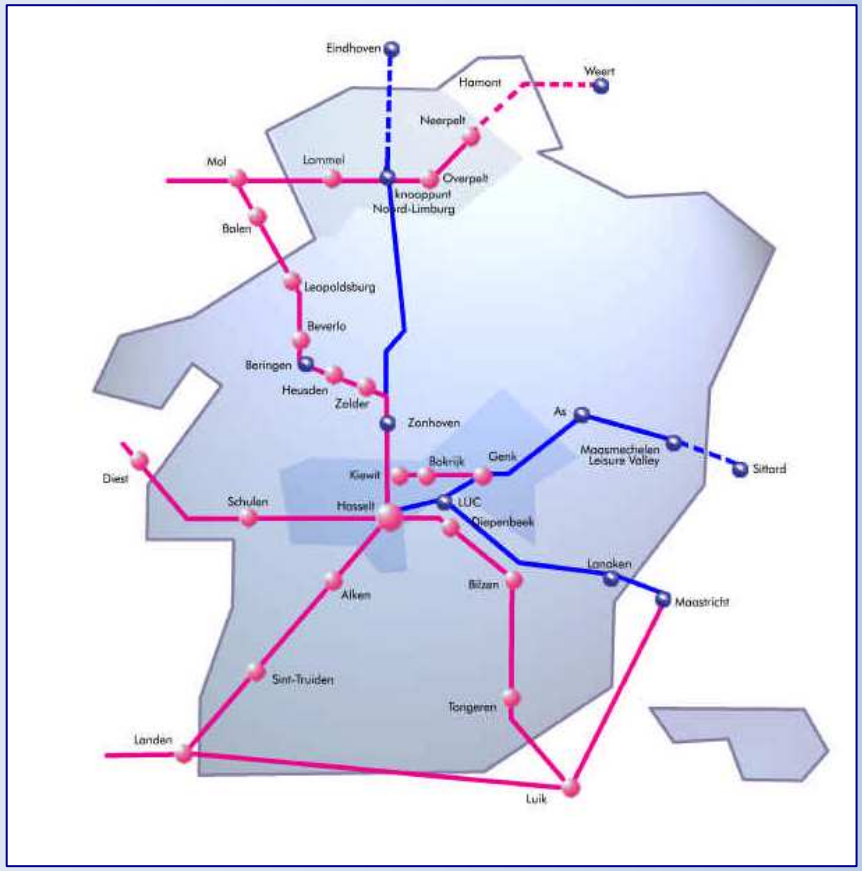
Customer: Rotterdam Electric Tram (RET)

Services:
Engineering
Assistance during procurement procedure
Contract engineering

Year: 2003 – 2009

Rail: RET Tramplus

Rail: Spartacus



Project description
The Spartacus plan aims to make an important contribution to the improvement of the infrastructure for public transport. The project will be realised via a DBFM procedure.
The current railway connections will be supplemented by three new rapid tram lines, which, together with the existing and new bus lines, are expected to create an efficient network of public transport.

Services delivered
Customer: Flemish Transportation Company ‘De Lijn’ (The Line)

Services:
Environmental impact studies
Target images
Project Memoranda
Reference design
Performance tender
Supervision of the tendering procedure

Year: 2007 – 2012

Rail: Spartacus

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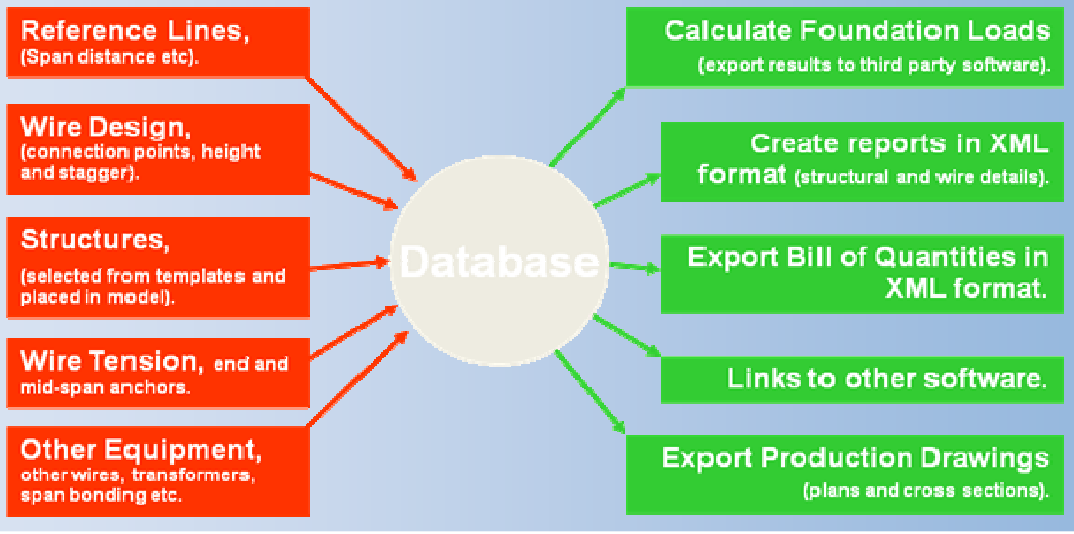
Why BROL?

- Makes use of Bentley rail track as basis for the track design.
- It’s simple to make cross sections.
- It’s simple to make a design check when there is a new track design.
- It’s a 3D design that is demanded more and more by the customer.
- You can extract lists with quantities.
- In the future BROL can be connected to Staad-Pro, in order to make the construction calculations.

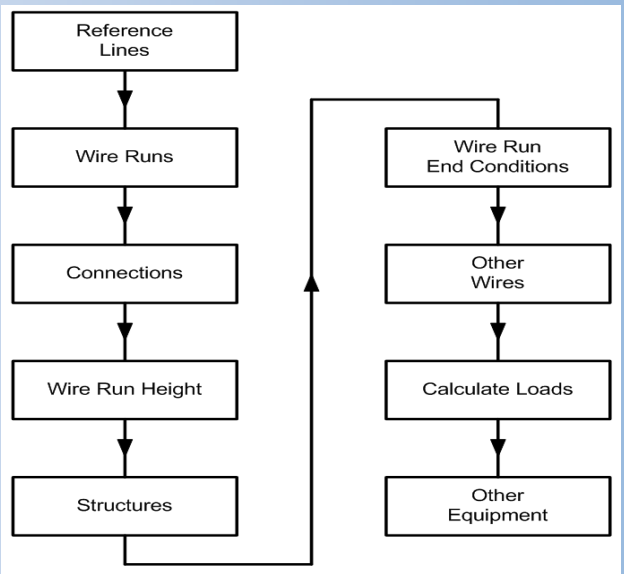
BROL - Grontmij

- The software has been designed so that it can be modified for use anywhere in the world. The contents of the design are contained within a Microsoft Access database to which items can be added and results extracted
- This software structure is illustrated on the diagram below:



BROL - Grontmij

- Bentley developed a work flow process which has been adopted for the software menu structure and is shown on the following diagram:



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What has been done so far?

- Dutch Overhead Line system has been talked through with Bentley.
- Algorithms from BROL have been investigated.
- The algorithms of the Dutch Overhead Line system calculations have been determined
- Dutch drawing specification has been submitted.

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EXISTING BROL CONFIGURABLE PARAMETERS

- Wire System
- Wire Span Lengths
- Stagger Calculations
- Height Calculations

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Additional Requirements for BROL Select series 1

Looking at the requirements for the B1 and B4 systems there are four new basic requirements that must be added to the algorithms and rules embedded in the current version of BROL.

These are:

- Snow loading.
- Pantograph width.
- Temperature.
- Wind speed defined by location.

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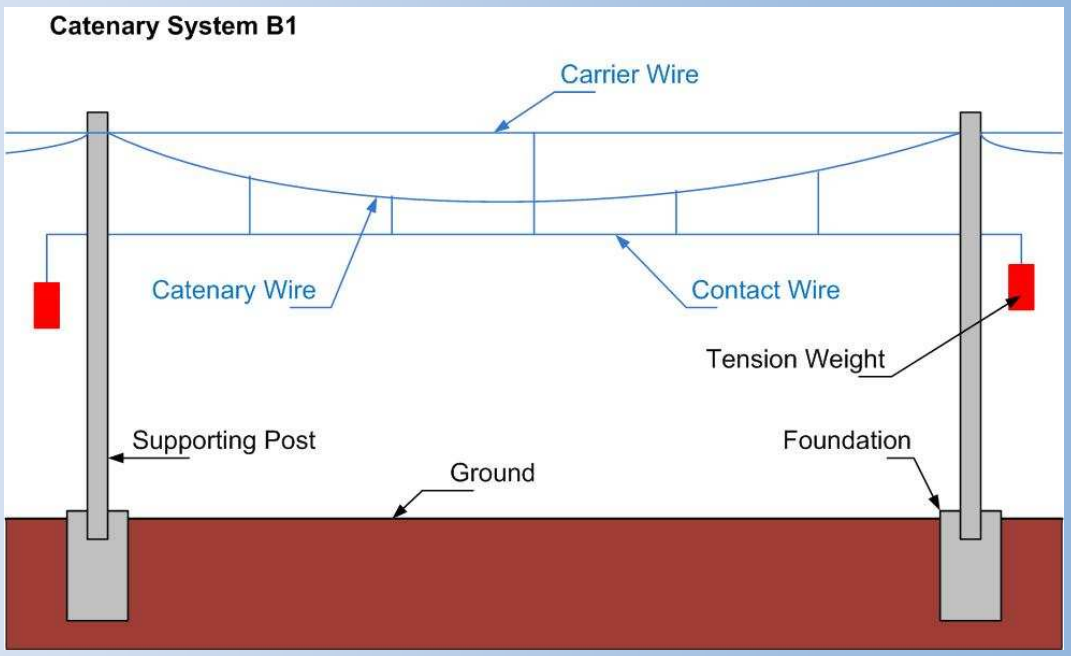
B1 System Tensioning Arrangements

The B1 type consists of three wires and is known as the “Classical” system where the carrier and catenary wires are fixed between the posts and the contact wire is tensioned (see diagram below):



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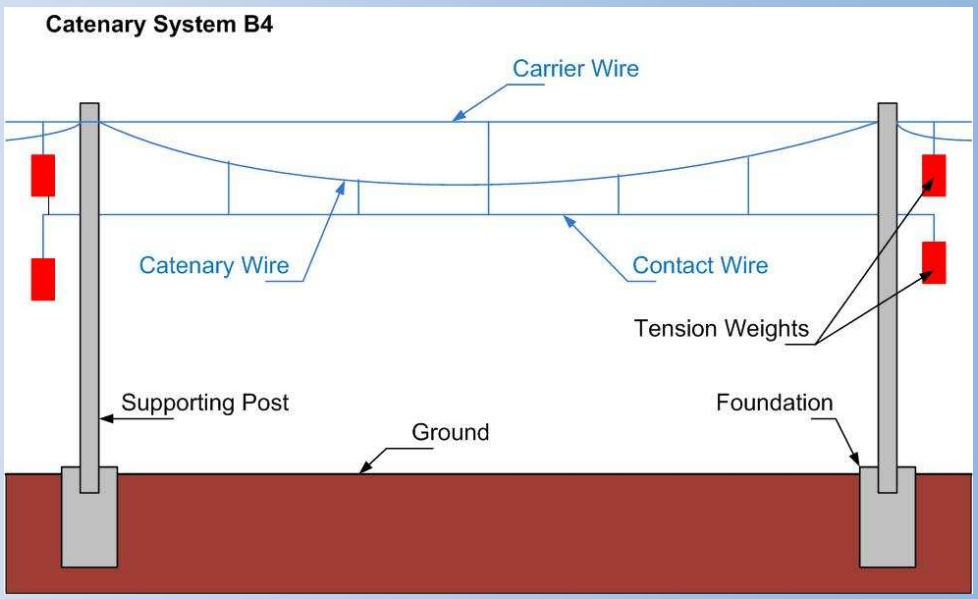
B4 System Tensioning Arrangements

The B4 is usually used on high speed lines and is known as the "Moving" system. It too is a three wire system, however the contact and carrier wires are tensioned in this system (see diagram below):



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Wind Blow Off Formula

The blow off value at a particular location is calculated from:

Abbreviation	Description
q	Wind pressure (N/m^2)
L	Span length (m)
H	Tension (N)
Formula	U_{max} (maximum wind blow off)

Formules:

$$U_{max} = \frac{q \cdot L2}{8 \cdot H}$$

$$U_a = \frac{4 \cdot a \cdot f_{max} (L1 - a)}{L12}$$

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Carrier Wire Sag

The formula calculates the maximum distance from the theoretical horizontal plane and perpendicular to it.

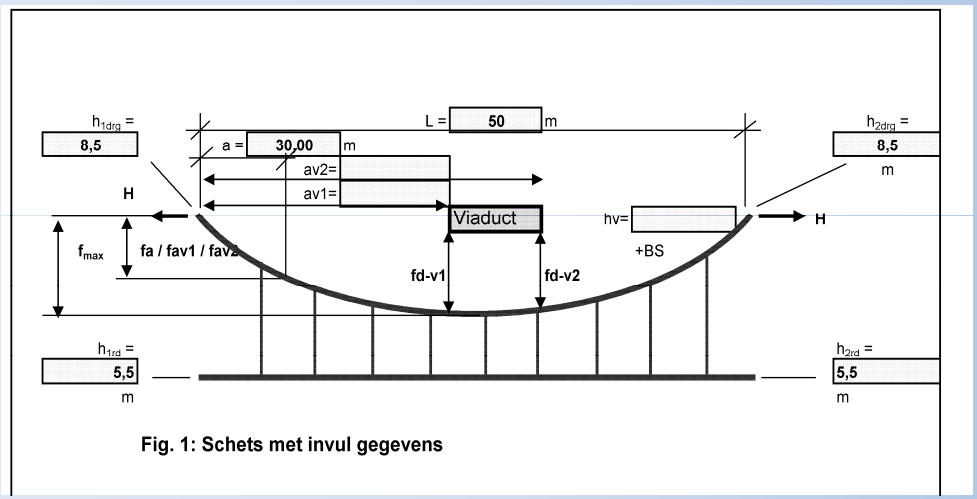

Fig. 1: Schets met invul gegevens

Formules:

$$f_{max} = \frac{q \cdot L2}{8 \cdot H} + \frac{h}{2} \cdot \left(1 + \frac{H \cdot h}{q \cdot L2}\right)$$

$$f_a = \frac{4 \cdot a \cdot f_{max} (L1 - a)}{L12}$$

$$\frac{L1}{2} = \frac{L}{2} + \frac{H \cdot h}{q \cdot L}$$

$$dLk = Lk \cdot a \cdot Dt$$

$$\frac{q12 \cdot L2}{24 \cdot H12} - \frac{q22 \cdot L2}{24 \cdot H22} = \frac{H1}{A \cdot E} - \frac{H2}{A \cdot E} - a \cdot (t2 - t1)$$

$$H = A \cdot E \cdot a \cdot Dt$$

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Production Drawings

As stated in the introduction BROL Select series 1 now has specific tools for creating user definable plans and cross sections

Bentley Rail Solutions\BROL AVIs\BROL BETA Demonstration Files\BROL - Draw Cross Section.wmv

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New “Assembly” and “Template” tools.

MicroStation cells used to create “Assemblies”.

Bentley Rail Solutions\BROL AVIs\BROL BETA Demonstration Files\BuildTemplates.avi

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What has to be done yet?

- Checking algorithms
- Filling of the library

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Questions…and conclusions