Transport Technologie - Consult Karlsruhe GmbH

LIGHT RAIL MODELLING WITH OPENTRACK

Examples and perspectives
IT13.rail – OpenTrack Userworkshop
Zürich, 18. January 2013

Johannes Meister
Fosca Romani

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TTK / Karlsruhe

TransportTechnologie-Consult Karlsruhe GmbH

- Founded in 1996
- 32 staff from Germany, France, Italy
- Headquarters in Karlsruhe – Germany
- Branch office in Lyon – France

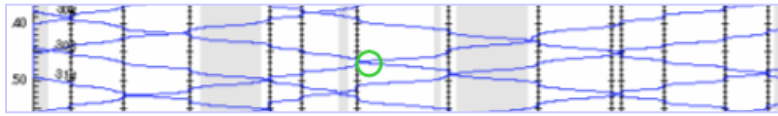
Subsidiary

- 51% PTV AG – Software and Consulting for Transport (VISUM, VISSIM)
- 44% AVG Albtal-Verkehrs-Gesellschaft mbH – Tramtrain Operator Karlsruhe

Focus on

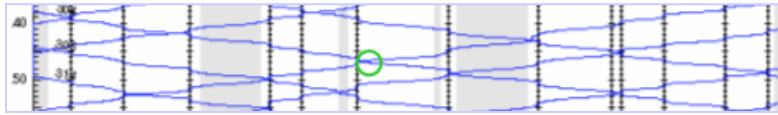
- Light Rail, Tramway and Tramtrain
- Operations and Design

Why LRT Modeling with OpenTrack?



OpenTrack ...

- ... was developed at the ETH Zürich, initially for heavy rail systems
- ... was adapted for light rail simulations with TTK's support (since 2007)
- ... allows the implementation of realistic operational behaviour
- ... allows with some restrictions the implementation of road traffic effects
- ... is a dynamic model which can also replicate perturbations



Open Track is being used ...

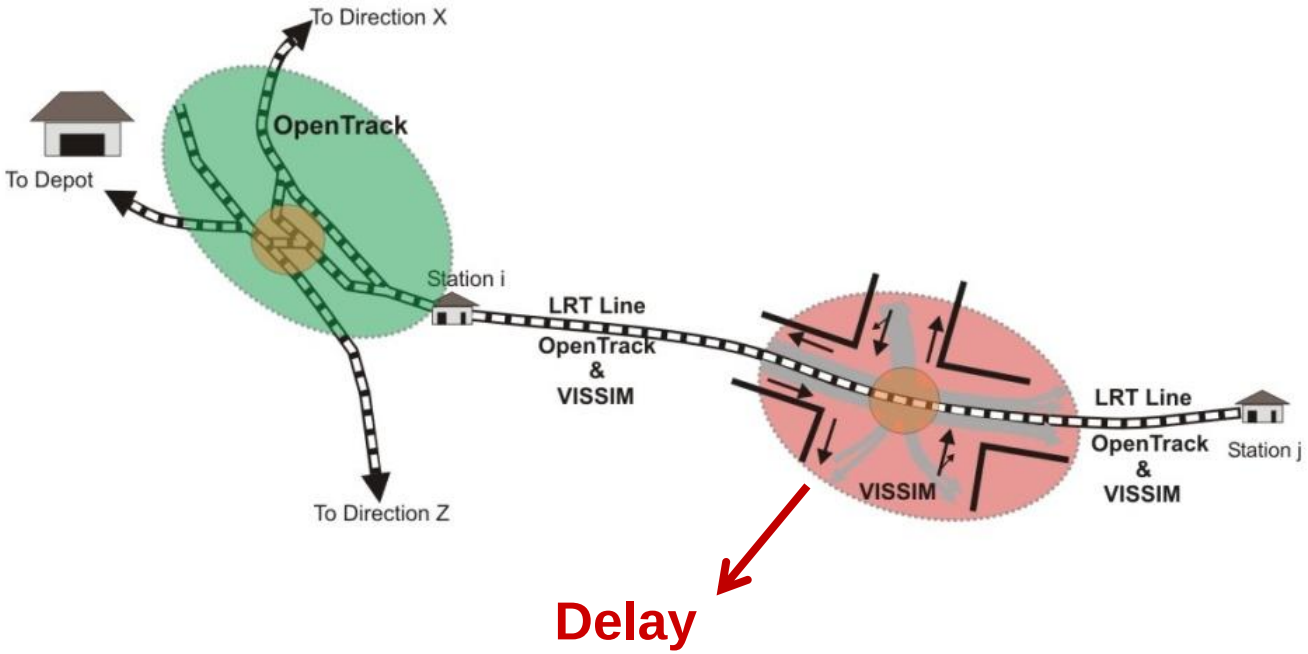
- ... to optimise operational activities on the LRT network
- ... to compare different operational concepts for existing and new lines/networks
- ... to determine the impacts of different infrastructure solutions

- **Visualisation of the operational activities allows the simple assessment of existing problems and solutions**
- **Depending on existing requirements, OpenTrack models can be implemented with relatively little effort or be very detailed**
- **Tasks can be carried out incrementally and iteratively**

Light rail modelling with OpenTrack

Why LRT Modeling with OpenTrack?

Simulation Capabilities for Tramway/LRT							
	Rail	LRT	Tramway	Bus	PrT	Pedestrain	
OpenTrack							VISSIM



OpenTrack:
Between microsimulation and static timetabling

- Microsimulation of intersections using VISSIM
  - Simulation of all transport modes (including pedestrians)
  - Detailed implementation of traffic signal controllers
  - software developed mainly for road simulation

- Dynamic simulation using OpenTrack
  - Assessment of service efficiency
  - Focus on “the operators perspective“
  - Determination of robust working timetables
  - Modelling of complex PT networks possible
  - Modelling of realistic LRT traffic behaviour
  - In many cases detailed road traffic simulation only required for individual intersections
  - Input of VISSIM results possible

- Static timetabling (using e. g. FBS)
  - Run time estimation
  - LRV rostering

Light rail modelling with OpenTrack

TTK main references for tram and LRT projects with OpenTrack

Existing Lines/Networks

Ludwigshafen (D)
VBL (Local Operator)
Operational optimisation

Heidelberg (D)
City of Heidelberg
Network Optimisation

Croydon (GB)
London Tramlink (Local operator) Network operations

Karlsruhe (GER)
City of Karlsruhe
Network robustness

New Lines/Networks

Bordeaux (FR)
CUB (Local authority)
Tramtrain extension/connectio

Nottingham (GB)
NET (Local authority)
Network extension (Call for tender)

New Lines/Networks

Utrecht (NL)
Regio Utrecht
Sneltram extension

Heilbronn (D)
City of Heilbronn
Comparison of alignments

Ulm Tram (D)
SWU (Local operator)
Network extension

Montpellier (F)
Montpellier Agglomeration
Network Development

Avignon Tram (F)
Grand Avignon (Local authority)
Network development

Edmonton (CAN)
City of Edmonton
New LRT Line and Depot

Light rail modelling with OpenTrack

Nottingham – Network extension (Call for tender)

Context

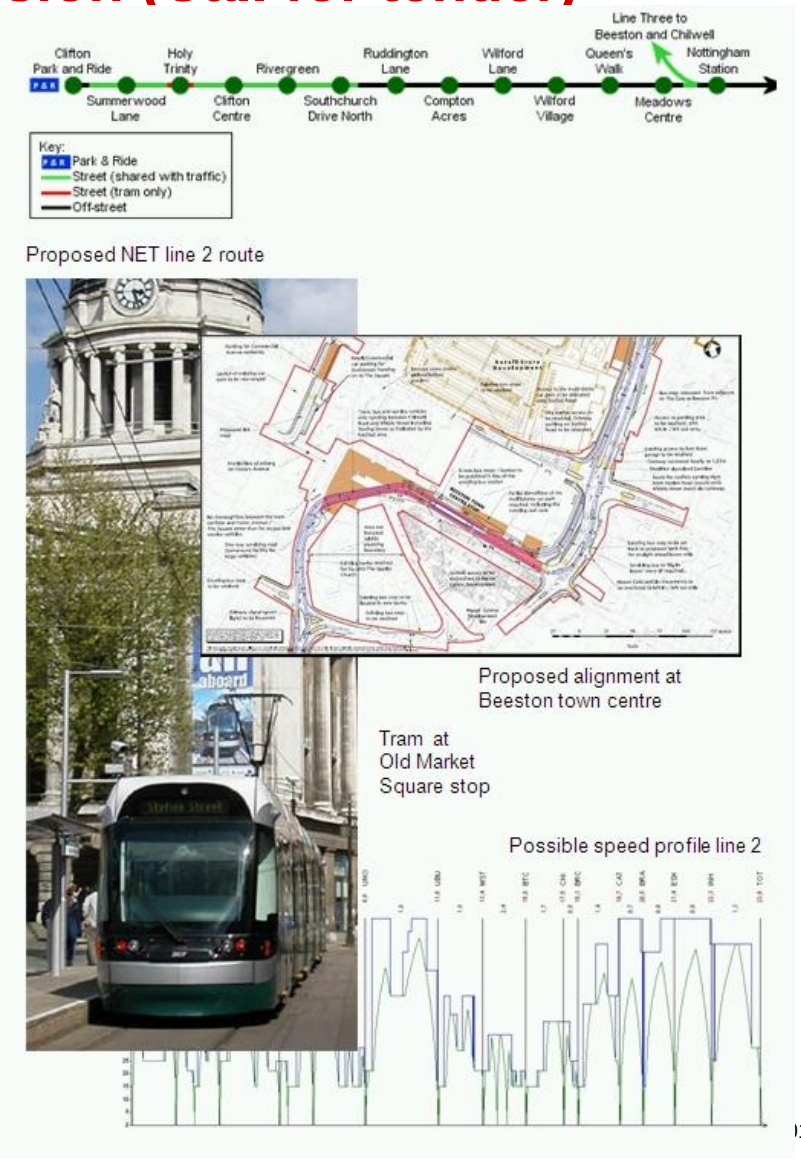
- Network extension (from 1 to 2 Lines)
- Call for tender
  - Standard operations
  - Incidents

OpenTrack tasks

- Assessment of
  - Run times
  - Rolling stock and rotations
- Perturbations
  - Different scenarios
  - Impact (recovering time) and mitigations measures

Highlight

- Findings from OpenTrack used as elements in the call for tender
- Interaction with Highway Authority (VISSIM Simulation)



Montpellier – Network development

Context

> Network development (from 2 up to 8 Lines)

OpenTrack tasks

> Assessment of
>> Run times and rolling stock
>> Operational robustness
>> Evaluation of “network” effects

> Comparison different network scenarios

> Perturbations
>> Impact and mitigations measures

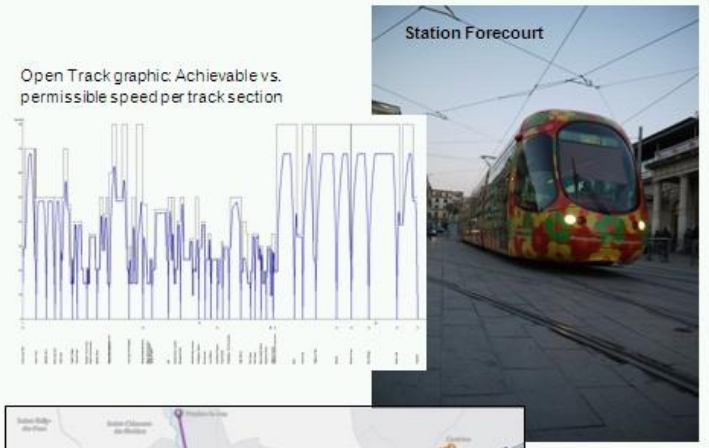
Highlight

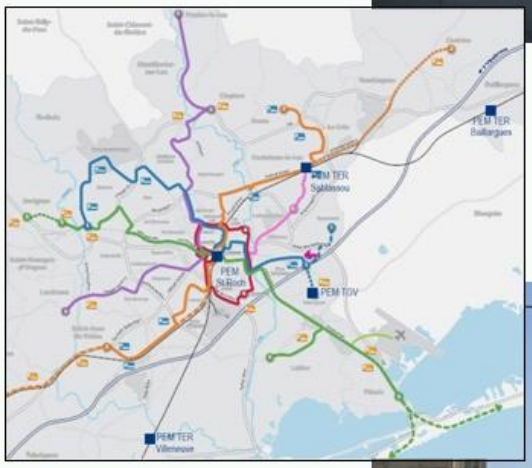
> Many lines highly interconnected

> High frequency on the common sections (each Line 5 min headway)

> Many complex nodal points

> Single and double stops





Network 2020

OPEN TRACK
OpenTrack Railway Technology Ltd.

Light rail modelling with OpenTrack

Karlsruhe – Network robustness

Context

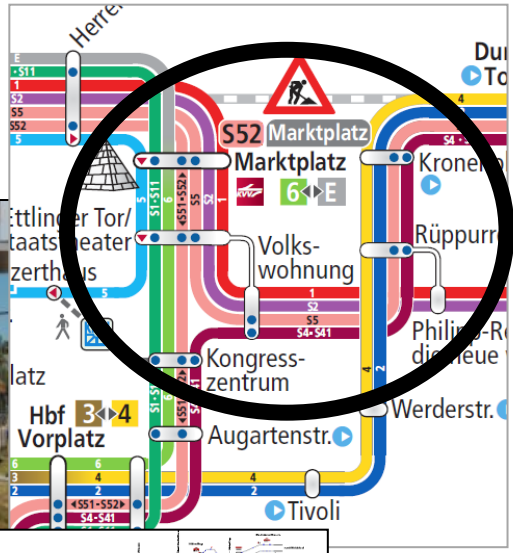
> Simulation of tramway and tram train deviations due to major infrastructure works

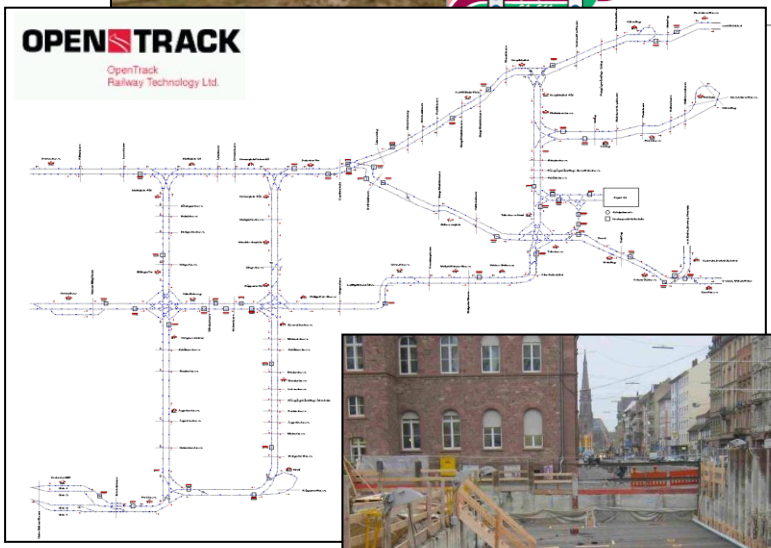
OpenTrack tasks

> Assessment of
  > Additional run times
  > Operational robustness
  > Interaction with private traffic at main road junctions
> Perturbations
  > Road traffic (from VISSIM) as incidents

Highlight

> integrated use of OpenTrack and VISSIM (PTV)
> Iterative simulations
> Support short terms decisions





Required improvements in LRT simulation field

To allow the simulation of specific LRT operational conditions with OpenTrack there are ...

> Missing additional functionalities

> Existing constrictions to eliminate

> Refinements needed to facilitate the simulation

> Need of attractive output to win over institutional clients

Simulation performance

> Crash of OpenTrack in case of simulation of complex networks (up to 6 Lines) with simultaneous on-line compilation of Train Graphs

> Higher simulation speed would allow increased efficiency

Required improvements in LRT simulation field

Input (not LRT specific)

- User friendly import of alignment information (from Excel tables/lists/…)
- User friendly modifications of courses and course connections
- Import of backgrounds in jpg format
- Semi-automatic definition of double track sections with optimized design

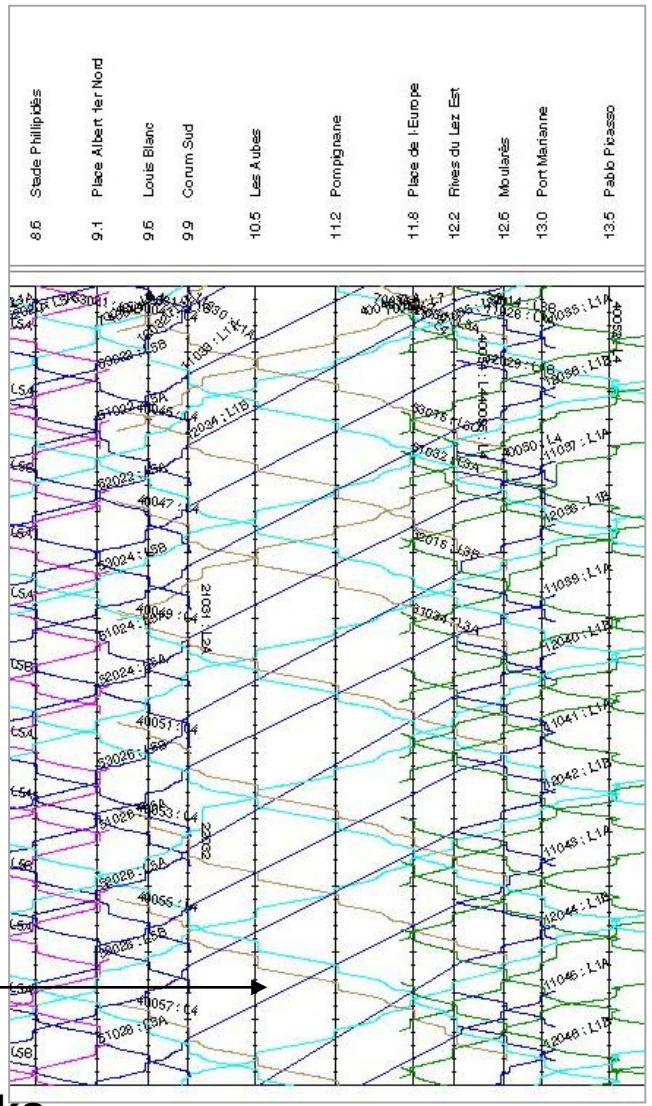
Simulation functionalities

- Priority rules at complex LRT nodal points between LRT lines
- Possibility of minimum time interval between two following trains at signals
- Stop on demand at stations
- Possibility to define different stop position at stations (depending on the line)
- Signal Stop Incident should function with discrete operation too

OpenTrack required improvements in LRT simulation field

Output/Statistics

- Attractive visualisation for institutional client
- Quantitative evaluations
  - run times
  - stop times
  - key values of variability
  - key values of reliability
- Timetable export in a table format
- Train Graphs of circular lines
- Train Graphs of lines using more than one common section



Train diagram cannot be used to show multiple use of part of the tracks

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Many thanks for your attention

Johannes Meister, TTK – johannes.meister@ttk.de
Fosca Romani, TTK – fosca.romani@ttk.de