Transport
Technologie -
Consult
Karlsruhe GmbH

Jokeri – Operation Model

First results
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Jokeri – Operation model

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  - Speed limits
  - Travel speed
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FBS (FahplanBearbeitungsSystem)

- Developed as a scheduling and time tabling system for railways by the University of Transportation in Dresden
  - Static simulation tool (allows sensitivity analysis)
  - Adapted to Light Rail and Tram usage by TTK
  - Used for studies of several LR and Tram systems all over Europe (not only TTK)

- Biggest network studied by TTK with FBS is NET in Nottingham (since 2007 ongoing)
  - Analysis of NET Phase 1 – Detailed study of current situation in place
  - Operational calculations of NET Phase 2 – Prognosis

- Other examples of ongoing TTK studies with FBS
  - Strasbourg extensions (since 2008)
  - Ludwigshafen (since 2008)
  - TramTrain network Tübingen-Reutlingen (Stuttgart area, since 2008)

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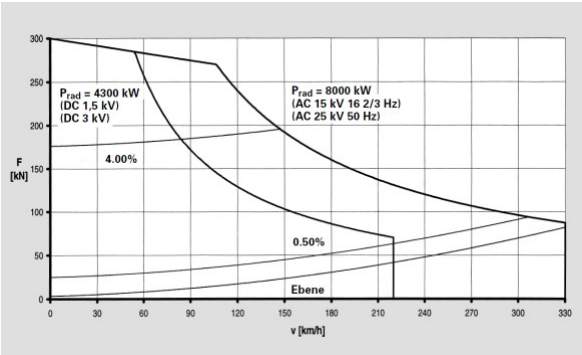
FBS (FahplanBearbeitungsSystem)

Calculation of travel speed by using specific vehicle and track alignment parameters

- Track, by e.g.
  - Topography
  - Speed limits

- Vehicle
  - Acceleration by the specific traction-speed diagram (Considering specific resistant of e.g. friction, rolling and wind)



  - Deceleration by -0,8 m/s^2 (based on TTK experience)

General parameters used

Speed limits

- Sections with right of way
  - Own track 70 kph
  - Segregated track (center or side running) 70 kph
- Street running sections
  - Speed limit of car traffic
  - Shared tracks with busses max 50 kph
- Junctions with car traffic (TTK experience)
  - Prioritised 30 kph
  - Not prioritised 30 kph plus one stop of 0 s (continuation immediately)
- Switches
  - Running over facing point from 15 kph (R<50 m) to 40 kph (R>125 m)
  - Other direction than over facing point has no influence on speed limits
- Single track sections
  - Basis are 50 kph
  - More than 50 kph need additional LRT protection systems (marginal advantage versus high investment and maintenance)

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General parameters used

Dwell times

- Stops with normal demand 24 s
  (can be reduced for some stops to 18 s, but detailed study needed)
- Stops with high demand 30 s
  - Leppävaraan Asema
  - Huopalahden Asema
  - Oylunkylän Asema

- No stops included on optional stops
  - Ravitie
  - Kauppamylyntie

General parameters used

Vehicle

- Bombardier Variobahn (Ludwigshafen/Mannheim) as a generic vehicle
  - Length of 30 m
  - 2/3 bogies motorised

- Take lower performance into account of vehicles with
  - 40m length
  - 2/4 bogies motorised

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Overall speed limits used

Sections (major speed limits)

>	Tapiola – 0,550	Street running (20 kph, safety aspects)
>	0,550 – 1,450	Segregated track (70 kph)
>	1,450 – 2,400	Street running (30kph)
>	2,400 – 5,600	Own track (70kph)
>	5,600 – 6,200	Street running (30 kph)
>	6,200 – 6,400	Segregated track (70 kph)
>	6,400 – 6,900	Street running (30kph)
>	6,900 – 2,200	Segregated or own track (70 kph)
>	2,200 – 2,410	Big roundabout (30kph)
>	2,410 – 3,880	PT only lane, track shared with busses (40 kph)
>	3,880 – 7,740	Segregated track (70 kph)
>	7,740 – 8,820	Street running (30kph)
>	7,740 – 8,400	Segregated track (70 kph)
>	8,400 – 11,160	PT only lane, track shared with busses (50 kph)
>	11,160 – 11,470	Own track (70kph)
>	11,470 – 11,900	Street running (30kph)
>	11,900 – Itäkeskus	Segregated or own track (70 kph)

Additional technical speed limits

Radii in street running vs. segregated track

- Based on lateral acceleration and possible cant, e.g.
  - R=50m: V_{max} 20 kph (in street) vs. 30 kph (in segregation)
  - R=100m: V_{max} 25 kph (in street) vs. 45 kph (in segregation)
  - R=200m: V_{max} 40 kph (in street) vs. 65 kph (in segregation)
  - R=400m: V_{max} 60 kph (in street) vs. 95 kph (in segregation)
  - R=550m: V_{max} 70 kph (in street) vs. >100 kph (in segregation)

First results

Topography

> No significant influence

Run times

> Total running time Tapiola Keskus – Itäkeskus (full prioritisation)
  > Single track bridge 64,3 min
  > Double track bridge 63,8 min
  > Own track (70 kph) on PT lane and single track bridge 64,2 min
  > Own track (70 kph) on PT lane and double track bridges 63,6 min

  > Influences not significant max. about 40 s

> Average Speed in any case about 23 kph

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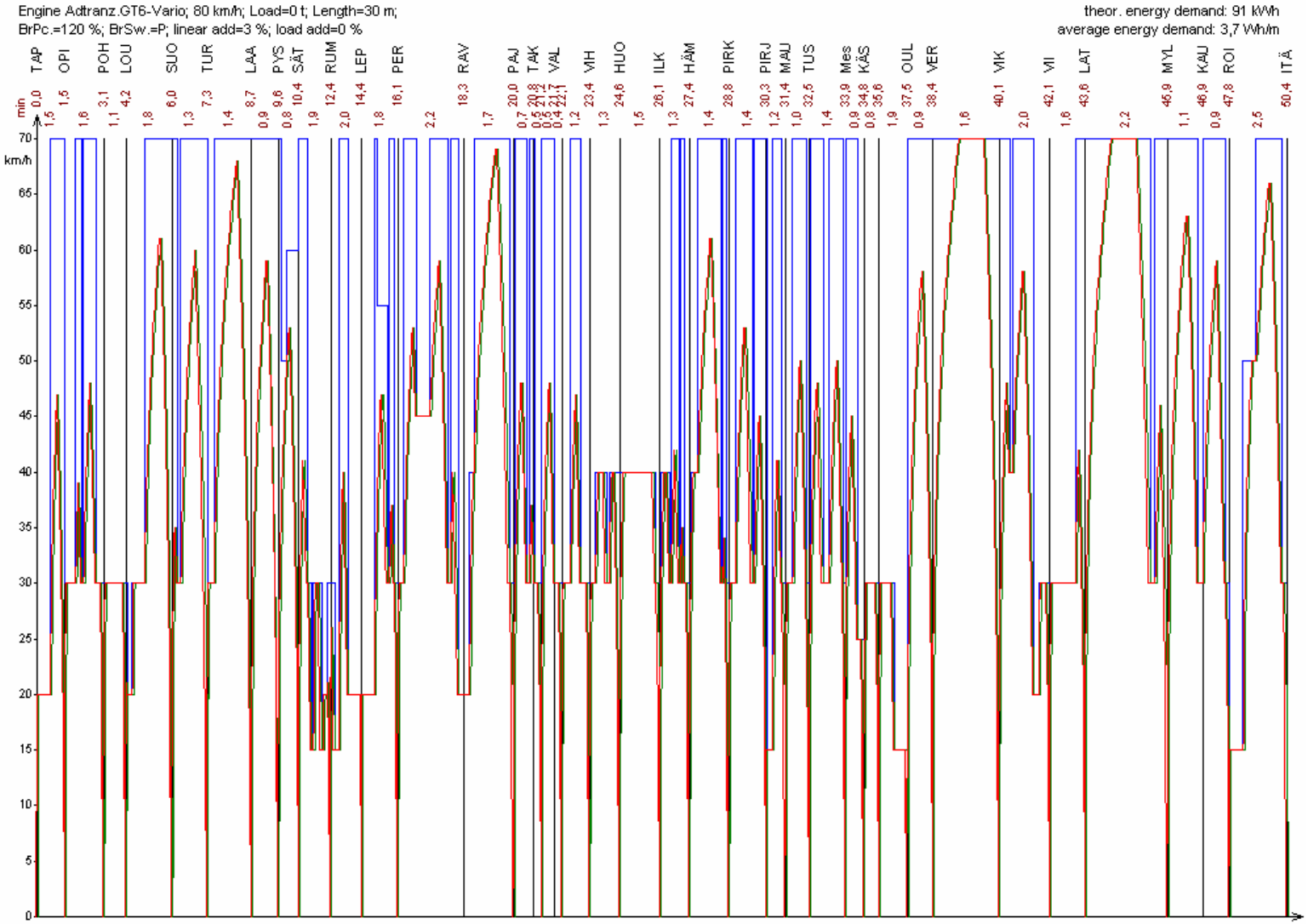
Speed-Distance Diagram



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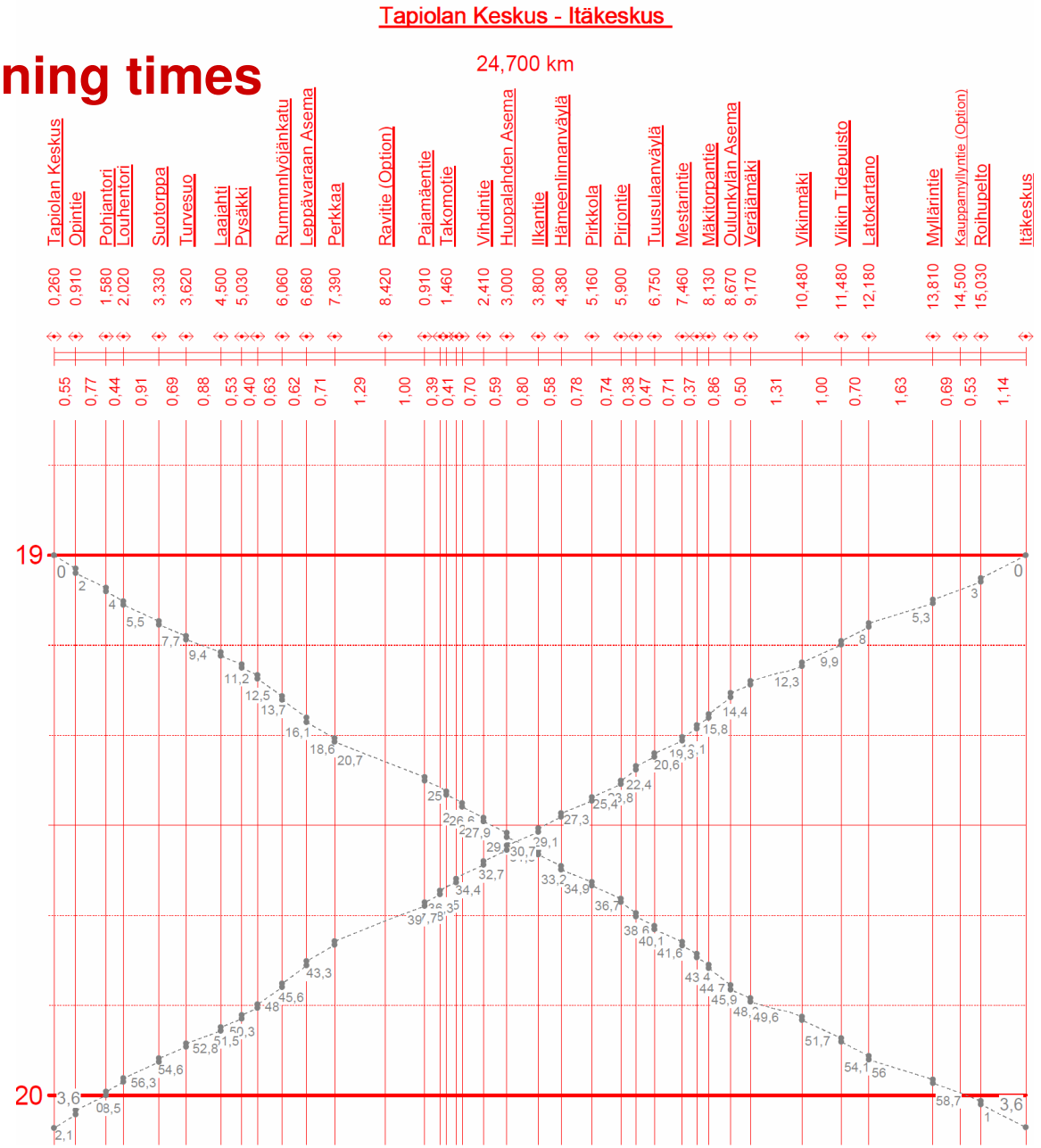
Running times



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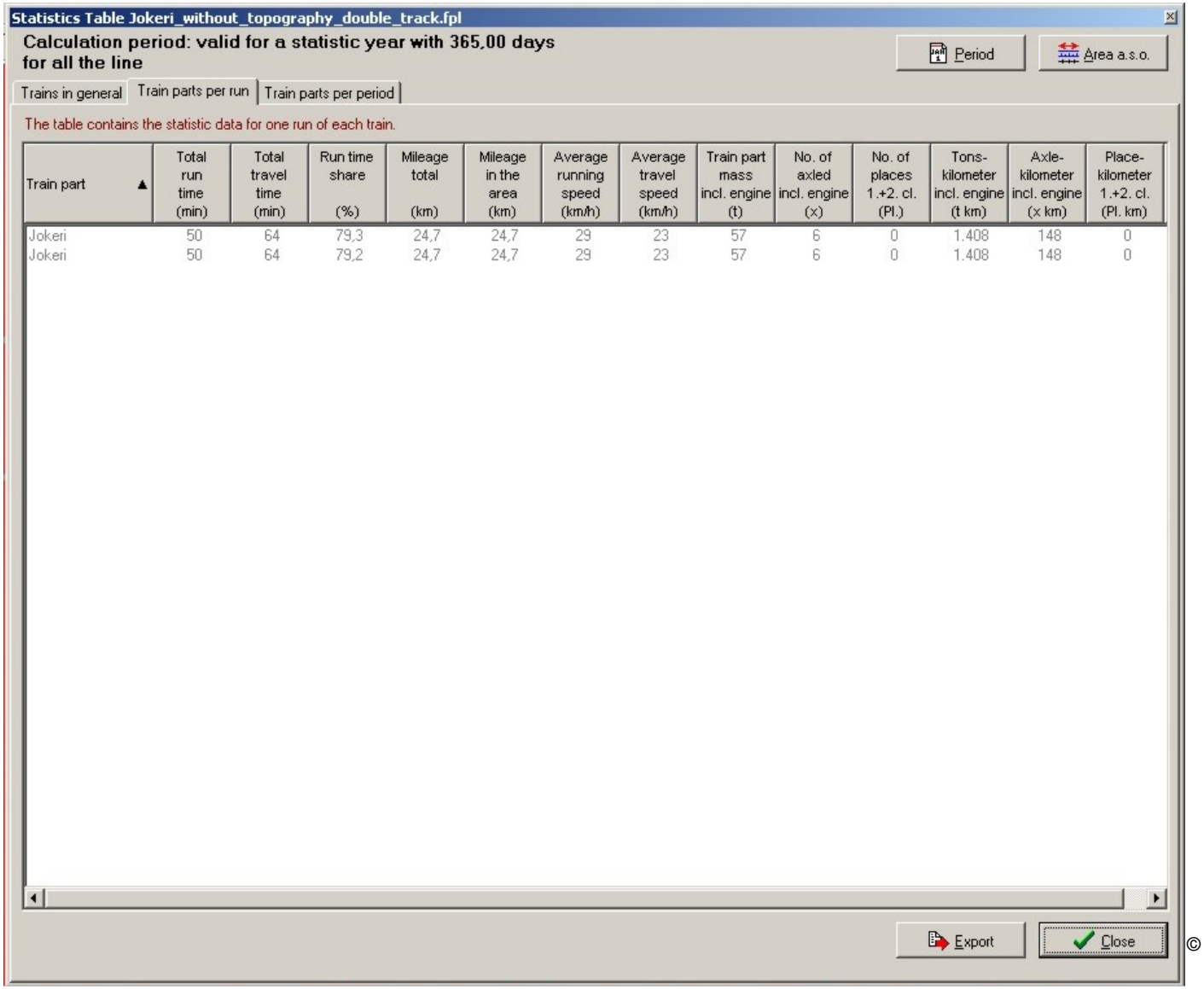
Operation statistics



Train part	Total run time (min)	Total travel time (min)	Run time share (%)	Mileage total (km)	Mileage in the area (km)	Average running speed (km/h)	Average travel speed (km/h)	Train part mass incl. engine (t)	No. of axled incl. engine (x)	No. of places 1.+2. cl. (Pl.)	Tons-kilometer incl. engine (t km)	Axle-kilometer incl. engine (x km)	Place-kilometer 1.+2. cl. (Pl. km)
Jokeri	50	64	79,3	24,7	24,7	29	23	57	6	0	1.408	148	0
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