Simulation Based Economic Efficiency Evaluation

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Motivation

- An increasing competition on the traffic market asks for more economic efficiency

- More economic efficiency can be reached through
  - a higher capacity on a fix infrastructure
  - decreasing costs by fulfilling the traffic demand

- **AIM**: economic efficiency evaluations of track equipment alternatives
Motivation

Microscopic Railway Operation Simulation Tools are used for dimensioning the infrastructure and/or timetable optimization

Problem:
- Costs for infrastructure, resources, staff, unavailability, etc. are not recorded (life cycle costs)
- Benefit is not quantified
- No economic efficiency evaluations possible with simulation tools

Solution:
- Extension of existing simulation tools with a tool for economic efficiency evaluations
Background (Microscopic Railway Operation Simulation)

Characterised through:

- Exact modelling of infrastructure including gradients, turning circle, etc.
- Modelling of individual infrastructure elements, e.g. warning signal, mandatory signal, balises, stop beards, etc.
- Modelling of trains with load, length, power, etc.

Field of application:

- Calculation of travel time
- Construction of time tables
- Stability- analysis of time tables
- Proof of infrastructure demand
- Calculation of capability
- etc.
Background (Economic Efficiency Evaluation – LCC)

- Global strategy evaluation implies the analysis of costs and benefits

- Evaluation of investment strategies for the signalling concerning their life cycle costs (LCC)

- Non-monetary criteria also included in the benefit evaluation
  - Safety
  - Delay reduction
  - Maximum speed
  - Etc.
The Tool Link

- Microscopic railway operational simulation tool
  - Infrastructure data
  - Timetable data
  - Results of simulation

- Tool for economic efficiency evaluation

- Economy efficiency evaluation

- Additional data through manual input
The Tool Link

- **Railway Operation Simulation Tool:**
  - Modelling the infrastructure, simulating the railway operation
  - Data export with *railML*

- **Economic Efficiency Evaluation Tool:**
  - Data import via *railML* - interface
  - Static information input through entry mask
  - Life Cycle Costs are calculated
  - Benefit is quantified
The Tool Architecture

- simulation tool
- import railML
- tool for economic efficiency evaluation
- input LCC

Graph showing cumulative costs over time for different alternatives.

Alternatives:
- Alt 1
- Alt 2
- Alt 3
- Alt 4
- Alt 5

Monetary vs. non-monetary values plotted.
The Tool Architecture

- railML schemas are mapped into an entity relationship diagram

- Currently infrastructure and timetable schemas implemented

- Application layer and GUI are next
Conclusion

railML specification is open, well structured, growing in acceptance

railML is well suited to import data from railway operation simulation tools

Integrated use of operation simulation, LCC calculation and benefit analysis enables an economic efficiency evaluation

Economic efficiency evaluation as decision support for infrastructure operators and/or train operating companies
Thank you for your attention!