nextRail19

Advanced Use Of The OpenTrack Script Mode

Or How To Make OpenTrack Do Things It Can’t Do Without Making You Do Things You Can’t Do

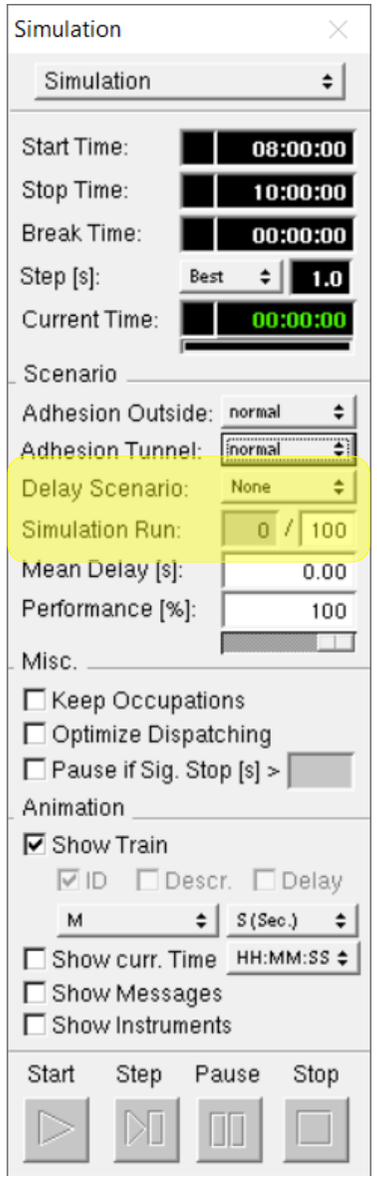
optimising railways

sma

Agenda

1. Random simulations and robustness
2. Script mode basics
3. Examples of advanced use
4. Demo
5. Homework challenge

Robustness? Random Simulation! Except…



- The robustness analysis is one of the main usages for simulations
- Robustness is the ability of the plan to offer operational reserves that counterbalance all the little random disturbances
- Random disturbance → random simulation → Monte Carlo Simulation
- Typically, for statistical robustness, about 100 randomized runs are necessary
  - OpenTrack can do that, but a limited number only

And then, we got the special cases…

Sometimes, impossible things are needed

Three example cases

- Output the actually used random values for primary delays
  - Check the model does what it is supposed
  - Advanced data analysis
- Use special dwell time distributions
  - Specific distributions per station, hour, timetable variant, vehicle…
  - Maybe based on analysis of real operations data
- Stops on demand
  - Critical on some lines
  - Typically quite random

But OpenTrack can’t do that?

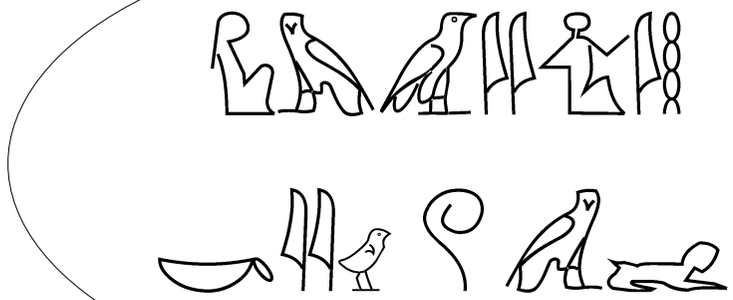
So, I asked Dani…

How can I do all that?

And how does that work?

Use the API!

Oh, it's very simple, look:



Do Not Despair! Do Script Mode!

Reminder: how to use it

1. Prepare the simulation in OpenTrack.
2. Start OT once with the parameter –scriptinit
3. Start OT n-1 times with the parameter –script
4. Analyse data collected in one file (txt or xml)

– For steps 2 and 3 in Windows, a batch file can be prepared easily
– On the Mac, Automator is probably the way to go

Useful Options for the Script Mode

Manual §3.20 (V1.9)

- -runfile
  - define files, folders, incidents, simulation parameters, etc…
- -asciitexttimetable
  - Create a timetable in the OpenTrack text format
  - Have it imported at the start of the simulation
- -delayscenario
  - Impose the delay scenario you want to be used
  - Defined can also be imposed!

But… how’s this useful?

Example

- Robustness analysis done 2018 on the Littorail line at Neuchâtel
- Future changes in rolling stock, frequency and demand

Case 1: Actual Random Primary Delays

- Random delays are known only for the “Defined” delay scenario
- But there’s only one…
  - … Except if you create the random values yourself in Excel
  - … Create a text format timetable 100 times, every time recalculating the Excel sheet
  - … import one of these timetables for each of the 100 runs

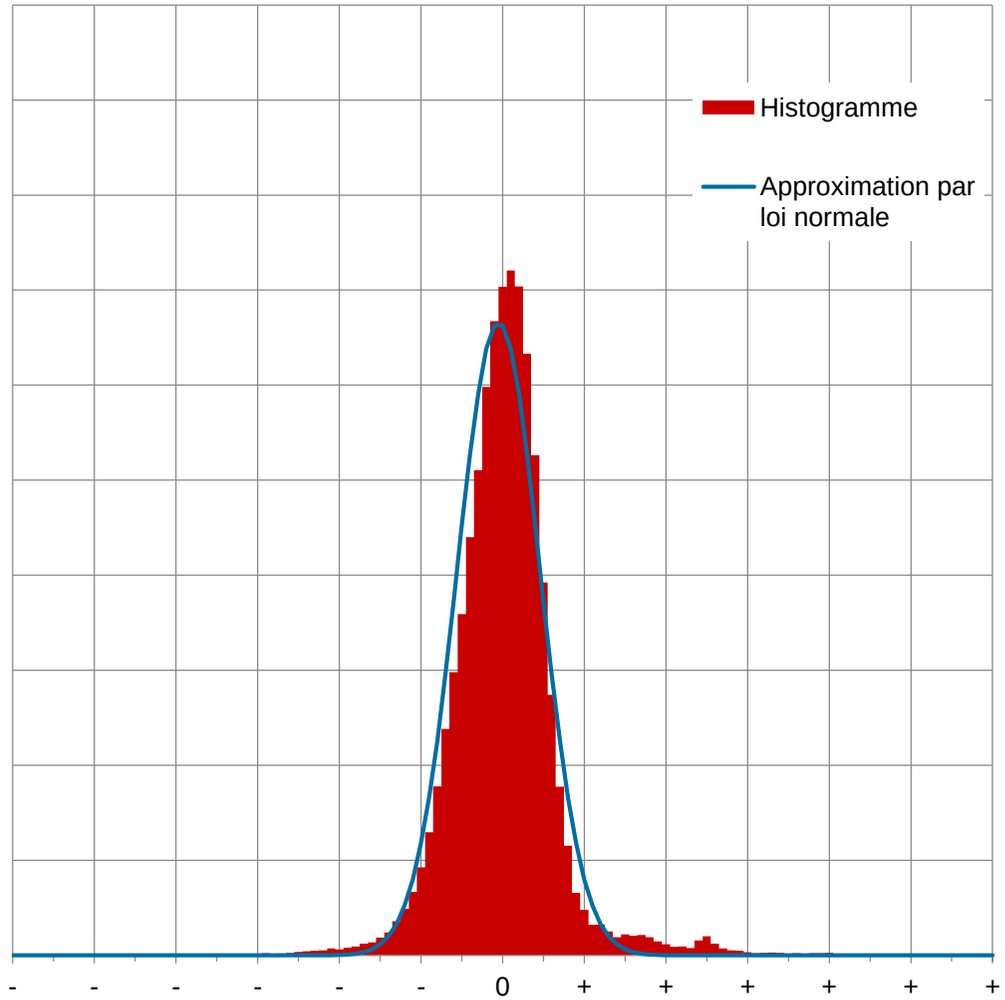
Case 2: Funny Distributions

- Example : comparison between old timetable with old rolling stock and several variants of new timetables with new rolling stock
- Analysis of real operations data
- Calibration of a dwell time model

→ Average dwell times calculated per station, hour, type of rolling stock, interval, etc.

→ Specific dwell time distribution adjusted around that value

→ Randomized calculation in Excel for each of the 100 Monte Carlo runs



Case 3: Stop On Demand

- Trains stop only, if there’s passenger wanting to get on or off
- Trains may have to slow down going through a station
- If real operations data is available:
  - Statistical analysis of the actual stops over a period of several months
  - Look for dependencies
  - Calculate stop probability per hour and direction
  - Impact of changing frequencies and demand?
- Use of random function in Excel to determine if the stop is made or not for each train at each stop-on-demand station

C? Java? Scala? Python? VBA!

- There are a lot of things to calculate
- There is a lot of data to manage
- Automation of the processes
  - Creation of random values
  - Export of randomized timetables
  - Management of random simulations in script mode
  - (Result analysis)
- Use of Excel for calculation

→ Use of VBA in Excel for automation

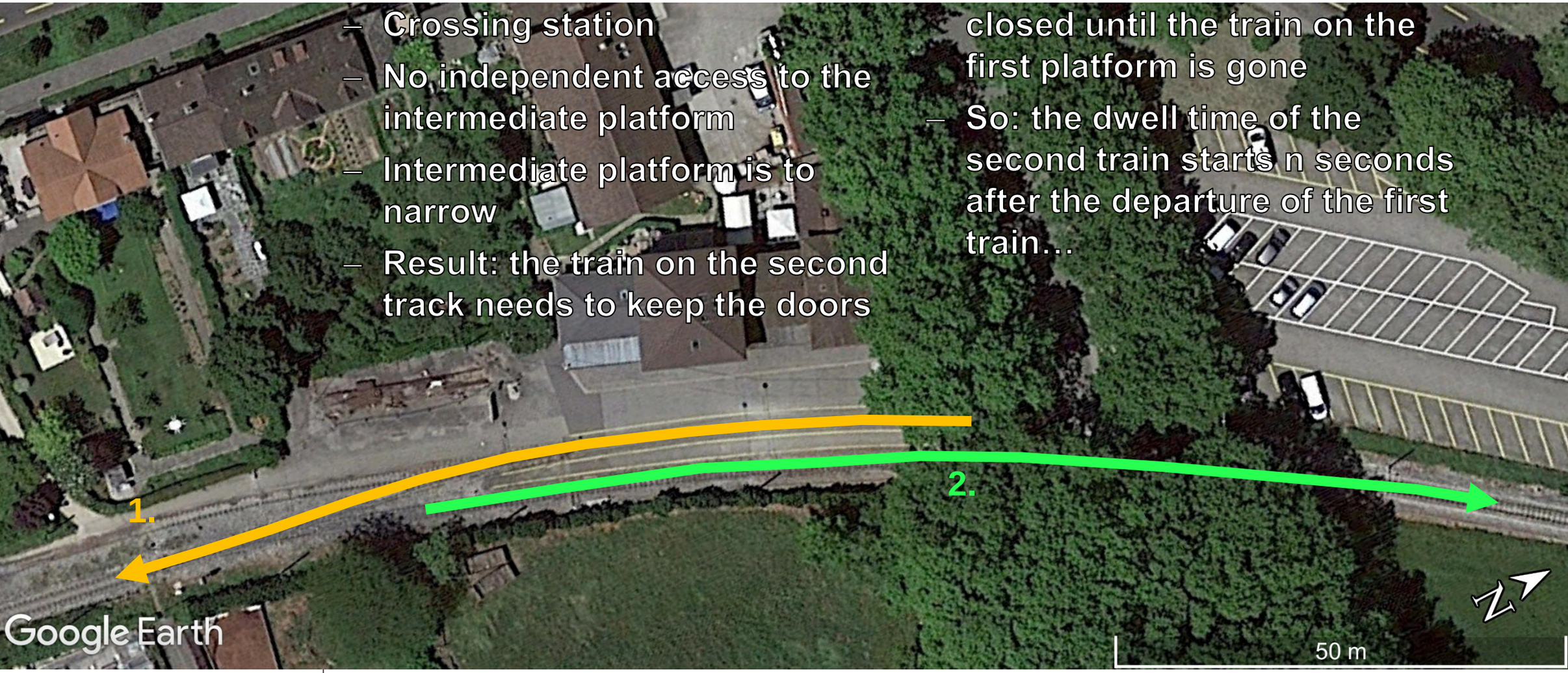
Does It Work?

You bet!

But There Are Limits!

- All is predefined → no reaction on what happens in the simulation
  - Iterative with the script mode
  - API…
- No action on the courses, only on the timetable
  - (peek at Dani…)

Homework Challenge



Questions?

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