A new digital approach to traffic management in stations

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What is DGEX SOLUTIONS?

- Customer based approach
- Working hand in hand with and for the field
- Partnerships with schools and research labs
- Over a 100 collaborators
- Teamed with the network operation studies department
- 1 patent
- 20 tools dedicated both to planning and real time
Planning phase
Case study : OpenGOV
The train platforming problem

- Which is the best track allocation for a train in a station taking into consideration all of the constraints?

**Inputs**

- Infrastructure topology (infrastructure constrains, paths, track length, etc.)
- Operations and customer service constraints
- Train schedule (train sets, train and personnel roster, direction, etc.)

**Optimisation model**

**Output**

- Track occupation diagram
Addressing Railway operations with Operational Research

<table>
<thead>
<tr>
<th>Operational research</th>
<th>Train platforming</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Problem-solving techniques and methods</td>
<td>• Complex problem</td>
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<tr>
<td>• Methods that help to make better decisions</td>
<td>• Millions of potential solutions</td>
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<tr>
<td>• Solve complex decision-making problems</td>
<td>• Relying on the know-how specialists</td>
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</tbody>
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Operational research methods are completely appropriate for train platforming.
How does it work?

- Minimize a weighted sum subject to constraints:
  - Hard constraint: cannot be violated
  - Soft constraint: can be violated but penalised in the objective function to ensure robustness
OpenGOV

Helps scheduling experts with their task, in order to guarantee an optimal capacity distribution

- Reducing time consuming task
- Highlighting conflicts
- Improving robustness
Monitoring real time

Case study: OpenGOV Real Time
The operation train platforming problem

• How to help decision maker during operation in real time?

Inputs:
• Infrastructure topology (infrastructure constrains, routes, track length, etc.)
• Operation and customer service constraints
• Transportation plan (set of moves, rolling stock set, direction, etc.)
• Real time disruption (delays, rolling stock change, etc.)
• Pre operational train occupation graph

Real time Optimization model

Output:
• Allocation change proposal
How does it work?

- A lexicographic multi-objective approach
  - Multiple objectives are declared
  - Objectives are ranked in order of preference
    - Minimise the number of train not assigned to a platform
    - Minimise the number of soft constraints violated
    - Minimise the change compare to the nominal situation (delays, platform change, path change)
  - Local search: quick solution for operation
What is it for?

Pre-operational data

Real time disruptions (delays, rolling stock changes, infrastructure availability etc.)

• Pre-operational data is often outdated
• Real time changes must be done
• Quick decisions must be taken
• Big pressure on operators

How can we help operators to make good decisions quickly?
OpenGOV Real Time

- Based on operational research
- Synchronized with real time data
- Helps supervise the smooth running of operation
- Quick provider of feasible solutions
NEXT STEPS
What’s next?

- Historical data
- Real time data
- Machine learning and improvement of the operational research model
- Help our teams in operation
- Continuous improvement
Thank you!
for your kind attention