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## Optimizing the response to large disruptions on railway networks

*A Data Management Plan created using DMPonline.be*

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### Project abstract:

In railway transport, disruptions are inevitable. Determining a new timetable when a disruption occurs is mostly done by relying on the experience of the dispatchers. The goal of this project is to develop mathematical models that can support the dispatchers in their decision-making to minimize the impact on passengers and freight trains. This will contribute to an overall better quality of service and more attractive railway services. The proposed mathematical models need to be useful in practice, hence they need to be easy to use by the dispatchers and a solution has to be found quickly. In this project, frequently occurring pieces of infrastructure will be identified. Models are then developed to optimize the timetable when a disruption occurs on each of those pieces. Together those pieces should cover almost the entire network. Disruptions in stations areas will also be considered.

Additionally, we examine the impact of delays that are already present on the proposed solution for the disruption. Finally, the methods developed in this project will be extended to be applicable in case of maintenance. Hence, this project will develop useful decision making tools to improve railway services for passengers and freight.

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### FWO DMP (Flemish Standard DMP)

#### 1. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data.

|                     |  |   |  | Only for digital data  | Only for digital data  | Only for digital data  | Only for physical data |
|---------------------|--|---|--|--|--|--|------------------------|
| Dataset Name        | Description  | New or reused   | Digital or Physical  | Digital Data Type  | Digital Data format  | Digital data volume (MB/GB/TB)   | Physical volume        |
|                     |  | <i>Please choose from the following options:</i> <ul style="list-style-type: none"> <li>• Generate new data</li> <li>• Reuse existing data</li> </ul> | <i>Please choose from the following options:</i> <ul style="list-style-type: none"> <li>• Digital</li> <li>• Physical</li> </ul> | <i>Please choose from the following options:</i> <ul style="list-style-type: none"> <li>• Observational</li> <li>• Experimental</li> <li>• Compiled/aggregated data</li> <li>• Simulation data</li> <li>• Software</li> <li>• Other</li> <li>• NA</li> </ul> | <i>Please choose from the following options:</i> <ul style="list-style-type: none"> <li>• .por, .xml, .tab, .csv, .pdf, .txt, .rtf, .dwg, .gml, ...</li> <li>• NA</li> </ul> | <i>Please choose from the following options:</i> <ul style="list-style-type: none"> <li>• &lt;100MB</li> <li>• &lt;1GB</li> <li>• &lt;100GB</li> <li>• &lt;1TB</li> <li>• &lt;5TB</li> <li>• &lt;10TB</li> <li>• &lt;50TB</li> <li>• &gt;50TB</li> <li>• NA</li> </ul> |                        |
| Infrastructure data | Information related to the infrastructure of a railway network                     | Reuse existing data   | Digital  | Software   | xml  | < 1GB  |                        |
| Timetable data      | Information related to the timetable, i.e. the trains that use the railway network | Reuse existing data   | Digital  | Software   | xml  | < 1GB  |                        |
| Passenger numbers   | Passenger number for the different trains that use the railway network             | Reuse existing data   | Digital  | Observational  | xml/pdf  | < 1GB  |                        |
| Disruption data     | Data about some disruptions that occurred and how the dispatchers handled them     | Reuse existing data   | Digital  | Software   | xml/txt/pdf  | < 1GB  |                        |

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type:

The necessary data will be provided by the railway companies, e.g. Infrabel.

**Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? Describe these issues in the comment section. Please refer to specific datasets or data types when appropriate.**

- No

**Will you process personal data? If so, briefly describe the kind of personal data you will use in the comment section. Please refer to specific datasets or data types when appropriate.**

- No

**Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, ...)? If so, please comment per dataset or data type where appropriate.**

- Yes

The methods we will develop could potentially be used by railway companies. In that case, our proposed algorithms would have to be implemented within the existing software of the railway companies, which is outside the scope of this project.

**Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/Data transfer agreements/ research collaboration agreements)? If so, please explain in the comment section to what data they relate and what restrictions are in place.**

- Yes

The data provided by the railway companies is confidential and cannot be shared with other researchers without permission from the data owners. Still, specific (benchmark) instances might be made available for other researchers to verify our work and to build further on or improve our work.

**Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain in the comment section to what data they relate and which restrictions will be asserted.**

- No

## 2. Documentation and Metadata

**Clearly describe what approach will be followed to capture the accompanying information necessary to keep data understandable and usable, for yourself and others, now and in the future (e.g., in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).**

Read-me files will be added to the code files to give an overview of what the code does, the required inputs and generated outputs. Relevant comments will also be included in the code itself.

**Will a metadata standard be used to make it easier to find and reuse the data? If so, please specify (where appropriate per dataset or data type) which metadata standard will be used. If not, please specify (where appropriate per dataset or data type) which metadata will be created to make the data easier to find and reuse.**

- No

The data that we receive from the railway companies is for our own use only and will therefore not be stored long-term. Possibly, we will create some artificial instances to test our algorithms. They will be described and made available online, for example on a website like this: <https://www.mech.kuleuven.be/en/cib/op>.

### 3. Data storage & back-up during the research project

#### Where will the data be stored?

- Shared network drive of the research group
- KU Leuven Onedrive

#### How will the data be backed up?

Both the shared network drive and the KU Leuven OneDrive are automatically backed-up by KU Leuven ICTS.

**Is there currently sufficient storage & backup capacity during the project? If yes, specify concisely.**

**If no or insufficient storage or backup capacities are available, then explain how this will be taken care of.**

- Yes

There is sufficient storage capacity available on the KU Leuven OneDrive and the shared drive for the complete project.

#### How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

The supervisor, prof. Pieter Vansteenwegen, will be responsible for the data management. The data that we received from the railway companies is confidential and will therefore not be shared. Possibly, we will create some artificial instances to test our algorithms, this data will be shared. As soon as research results are published, the data of these artificial benchmark instances (which is limited in size) will be made available (for at least 10 years) through a KU Leuven website (similar to this website: <https://www.mech.kuleuven.be/en/cib/op>). If a journal makes it possible, instances can also be uploaded together with the manuscript.

#### What are the expected costs for data storage and backup during the research project? How will these costs be covered?

There will be no additional cost related to data storage.

### 4. Data preservation after the end of the research project

**Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).**

All data will be preserved for 10 years according to KU Leuven RDM policy.

#### Where will these data be archived (stored and curated for the long-term)?

The data will be stored on the shared network drive of the research group.

**What are the expected costs for data preservation during the expected retention period? How will these costs be covered?**

There will be no additional cost for storing the data.

## 5. Data sharing and reuse

**Will the data (or part of the data) be made available for reuse after/during the project? In the comment section please explain per dataset or data type which data will be made available.**

- Yes, in an Open Access repository
- No (closed access)

The data that we received from the railway companies is confidential and will therefore not be shared. Artificial benchmark instances that we create ourselves will be shared on a KU Leuven website.

**If access is restricted, please specify who will be able to access the data and under what conditions.**

NA

**Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)? Please explain in the comment section per dataset or data type where appropriate.**

- Yes, Intellectual Property Rights

The data that we received from the railway companies is confidential and can therefore not be shared.

**Where will the data be made available? If already known, please provide a repository per dataset or data type.**

The data that we are allowed to share, i.e. artificial benchmark instances that we created ourselves, will be shared on a KU Leuven website similar to this one: <https://www.mech.kuleuven.be/en/cib/op>.

**When will the data be made available?**

The data will be made available upon publication of the research results.

**Which data usage licenses are you going to provide? If none, please explain why.**

None, artificial benchmark instances will be made freely available.

**Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, you have the option to provide it in the comment section.**

- Yes

Possibly for the artificial instances.

**What are the expected costs for data sharing? How will these costs be covered?**

There are no expected costs.

## **6. Responsibilities**

**Who will manage data documentation and metadata during the research project?**

Inneke Van Hoeck and Pieter Vansteenwegen

**Who will manage data storage and backup during the research project?**

Inneke Van Hoeck and Pieter Vansteenwegen

**Who will manage data preservation and sharing?**

Pieter Vansteenwegen

**Who will update and implement this DMP?**

Inneke Van Hoeck