ICT GROUP InTraffic
Mastering Mobility

4.A.1 and 4.B.1 Chain analysis RouteLint

2021

4A1_4B1_Chain analysis_RouteLint

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2. Introduction

InTraffic aspires to maintain level 5 of the CO_2 performance ladder. This report contains the results of the chain analysis required to meet requirement 4.A.1 from the CO_2 Performance Ladder Handbook 3.1:

"The organisation has demonstrable insight into the most material emissions from scope 3, and can present at least 2 analyses of GHG-generating (chains of) activities from this scope 3 emissions.*

**small organisations [such as InTraffic, ed.] only have to make 1 chain analysis for one of the two most material emissions from the ranking in requirement 4.A.1"* (CO_2 Performance Ladder Handbook 3.1)

And to claim 4.B.1:
*" The organisation has formulated CO_2 reduction targets for scope 3, based on 2** analyses *from 4.A.1. Or the organisation has formulated CO_2 reduction targets for scope 3, based on 2 material GHG-generating (chains of) activities. A corresponding action plan has been drawn up, including the measures to be taken. Objectives are expressed in absolute numbers or percentages in relation to a reference year and within a defined period*

**For small organisations [such as InTraffic, red] requirement 4.B.1 applies 'a CO_2 reduction target formulated on the basis of 1 chain analysis or chain of activities'"* (CO_2 Performance Ladder Handbook 3.1)

This report contains the quantitative chain analysis of RouteLint 3_2 reduction targets 4

2.1. RouteLint

Dutch Rail transport is expected to continue to grow substantially over the next 15 to 20 years. The forecast is that population growth and increased passenger kilometres will increase the need for mobility by approximately 30 percent. However, the funds available for the expansion of infrastructure are limited. As a result, rail capacity is under great pressure. For ProRail, this means the challenge of running more trains on the existing track. RouteLint ensures that the track is used efficiently and thus it makes optimal use possible.

RouteLint (see figure 1) is an application that provides train drivers with dynamic journey information about the current track occupancy of the railroad tracks. This provides the driver with information about the trains in front of it and the train behind it that is being hindered. RouteLint also provides information about inserting, branching and crossing trains and the current delay of the trains on the roadway. This information allows the driver to adjust his driving behaviour. This increases safety on the track, leads to lower energy consumption of the train, and a better flow on the track. RouteLint is available as a data stream for NS – they use the data to create their own app, and RouteLint is available as an app for other carriers. ProRail is the owner of RouteLint.

RouteLint has been in use since 2015 and has been using a single data source until 2020, the control system(PRL)of ProRail. The required data had already been processed and could be imported ready-made. Since 2020, RouteLint has been extracting the necessary data from multiple authentic data sources. This includes the timetable, delays, the position of the train on the track and the position of the switches and signals. These four independent data streams are combined to generate the same output as the earlier version of RouteLint, thus resulting in identical in system operation.

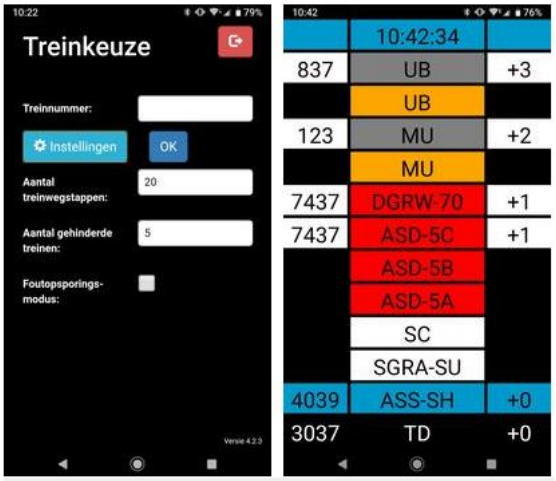

Figure 1: Screenshots of the RouteLint application (old)

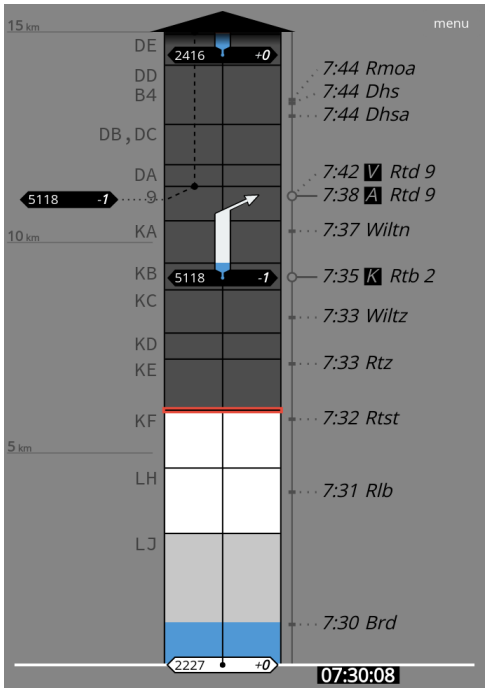

Figure 2: Screenshot of RouteLint application (new)

2.2. Approach to chain analysis

The approach as described in the SKAO Handbook version 3.1; requirement 4.A.1. has been followed to arrive at the chain analysis of emissions. As indicated in the CO_2 Performance Ladder Handbook 3.1, the chain analysis follows the structure as described in chapter 4 of "A Corporate Accounting and Reporting Standard" (WBCSD, 2004).

- Describe the chain in question (section 3.2)
- Determine which scope 3 categories are relevant (section 3.1)
- Identify the partners in the chain (section 3.3)
- Quantify the scope 3 emissions (section 3.4).

Functional unit: 1 year of use RouteLint, base year 2019

Since RouteLint is in permanent development, we choose to use RouteLint in a year's time. We choose this as the reference year 2019. This is because the data for 2020 is less representative because train traffic in the Netherlands was greatly reduced due to the corona pandemic. We see 2019 as a representative year for when train traffic no longer has restrictions due to the corona measures. Our other CO_2 performance ladder reports also take 2019 as the base year.

Data collection

The Manual 3.1 states the following about data collection:
"For a chain analysis, it is not necessary to immediately request extensive data from all kinds of suppliers. It usually has clear added value to request some crucial data from one or a few suppliers, so selectively. This is often sufficient for a good first version of a chain analysis."

We have collected data through interviews at InTraffic and chain partner ProRail. We supplemented the data that they could not provide via secondary data from scientific literature. We then had these assumptions checked by ProRail.

Emission factors

For this analysis, the CO_2 emission factors of CO_2 emissiefactoren.nl have been used, as indicated in Handbook 3.1.

3. Chain analysis RouteLint

3.1. Relevant scope 3 categories

Table 1 shows the relevant scope 3 categories per step in the chain, in accordance with the GHG Protocol (WRI & WBCSD, 2011). GHG Protocol develops guidelines to provide clarity on how specific sectors can apply GHG Protocol standards. We have used GHG Protocol, ICT sector guidance (2017) to determine which scope 3 categories are relevant and what should be included in this.

Step	Relevant scope 3 categories	Relevant	Speak
1. Materials & pre-production	1. Purchased goods and services	Yes	In the case of RouteLint, the data of ProRail (PRL) can be seen as materials.
2. Production	1. Purchased goods and services 2. Capital goods 6. Business travel	Yes	The production phase is the software development and testing process. The activities of the developers are the main source of emissions, and include: • Heating, lighting and air conditioning used for buildings used by developers and testers • Energy used by equipment used for development and testing • Consumables used during the development and testing process (e.g., paper and other office supplies) • Business trips related to the development and testing process
3. Distribution & storage	9. Downstream transport and distribution	Yes	RouteLint is distributed digitally. According to "GHG Protocol, ICT sector guidance, ch 6 p. 8" you must take the following distribution steps into account: • Storage and hosting of the software by servers (including mirror servers, if relevant) • Network usage for transferring and downloading the software • Use of the end user's computer to download the software
4. Use	11. Use of products sold	Yes	RouteLint uses energy during its use and prevents energy consumption by contributing to the efficient running of trains. In addition, it prevents maintenance on the track and equipment by preventing brakes.
5. End-of-life		No	RouteLint is delivered digitally. According to "GHG Protocol, ICT sector guidance, ch 6 p. 9" the end-of-life phase does not apply in that case.

Table 1Relevant scope 3 categories

3.2. Description of the chain

The chain is shown in a simplified way in Figure 2. At every step, energy, materials and labour are added and emissions to air, soil and water are released. Transport takes place between the steps. To describe the chain, the designation of the life cycle phases has been used as defined in "Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard" (WRI & WBCSD, 2011).

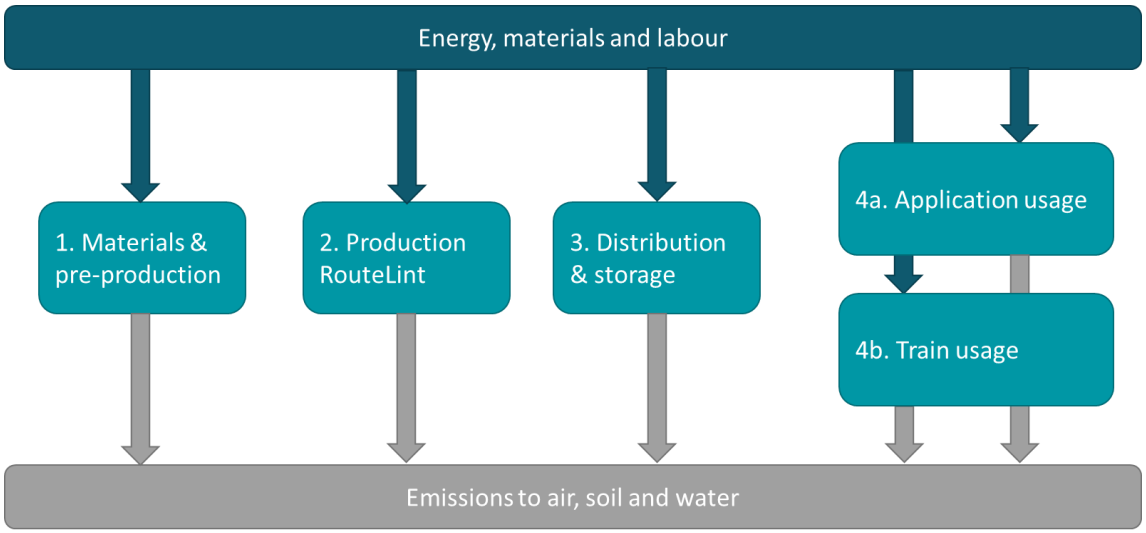

Figure 3: Simplified chain view RouteLint

Ref 1. Materials & pre-production

ProRail's PRL database can be seen as materials for RouteLint. RouteLint receives its data from PRL. ProRail reported on the CO_2 footprint of their servers for 2019 (ProRail, 2020), we used this research for this chain analysis.

Of course PRL is not only used for RouteLint, we have made an estimate of how much of the CO_2 footprint of the servers is attributable to the use of PRL by RouteLint.

Ref 2. Production RouteLint

In 2019, InTraffic, ProRail and NS worked on RouteLint. The CO_2 emissions are related to the activities of the developers. There is an app from RouteLint for the carriers. NS has made its own RouteLint application based on the data supplied by ProRail & InTraffic.

Ref 3. Distribution & Storage

RouteLint runs on ProRail servers and is distributed via the data network. The carriers that use the RouteLint app download the app of about 1 mb.

Ref 4a. RouteLint usage

Operators use RouteLint. They see a screen with dynamic trip information about the current track occupancy of the railroad tracks and can adjust their driving behaviour accordingly. Operators use a tablet to run RouteLint.

Ref 4b. Train usage

Using RouteLint saves CO_2 from train traffic in the following ways:

- Route tape shows the driver schematically which trains are present in front of and behind him. This information allows the operator to adjust his speed. In particular, the prevention of stops of trains and in particular freight trains will result in energy savings.
- RouteLint reduces wear and tear on the track and trains because drivers brake less. This leads to less repair work. This has an effect on fuel consumption of machines and vehicles during maintenance, and on materials required for maintenance. Since there was no data available on maintenance savings, this second advantage was not included in the calculations.

3.3. Identify partners in the chain

Table 2 shows the partners involved in the chain.

Step	Partners
1. Materials & pre-production	ProRail
2. Production	ProRail
3. Distribution & storage	ProRail
4. Usage	NS, DB Cargo, RheinCargo, BAM, Strukton, VolkerRail

Table 2: Chain partners RouteLint

3.4. Quantification of scope 3 emissions

Tables 3 and 4 show an elaboration of RouteLint's analysis. The complete calculations are available in the Excel sheet that accompanies this report: "210521_Chain analysis RouteLint".

The chain analysis includes a calculation of two scenarios: 0.5% energy saving trains by RouteLint and 2% energy saving trains by RouteLint. Since this is a very important assumption, we explain it in the following sections.

Assumption of train energy savings by RouteLint

Unfortunately, it is not known what percentage of energy savings is achieved by RouteLint. This is only known in combination with other energy-saving applications, such as roll-out advice. In addition, the savings are 4% at NS.

We have made a conservative estimate of train energy saving between 0.5 – 2 %. This assumption has been checked with InTraffic and ProRail and was found to be realistic. Since this is a very important assumption, we will investigate it in more detail (see section 3.1, last paragraph: Improvement measures Chain analysis).

Scenario 0.5% savings
Table 3 summarises the results for 0.5% train energy savings by using RouteLint for the year 2019.

Life cycle phase	Tonnes of CO2e RouteLint 2019
1. Materials & pre-production	21
2. Production	12
3. Storage & distribution	0.0001
4a. RouteLint DB Cargo Usage	0.4
4a. RouteLint NS Usage	1.5
4b. Train NS Usage	0
4b. Train DB Cargo Usage	-293
	-258

Table 3 CO2 footprint RouteLint usage 2019, scenario 0.5% savings

The largest saving of CO_2 is in energy savings by trains (phase 4b). On an annual basis, this is 8 times more than the CO_2 emissions released during the one-off development of the application (phases 1, 2, 3, 4a).

Scenario 2% savings
Table 4 summarises the results for 2% train energy saving by using RouteLint for the year 2019.

Life cycle phase	Tonnes of CO2e RouteLint 2019
1. Materials & pre-production	21
2. Production	12
3. Storage & distribution	0.0001
4a. RouteLint DB Cargo Usage	0.4
4a. RouteLint NS Usage	1.5

4b. Train NS Usage	0[1]
4b. Train DB Cargo Usage	-1172
	-1136

Table 4: CO_2 footprint use RouteLint 2019, scenario 2% savings

The largest saving of CO_2 is in energy savings by trains (phase 4b). On an annual basis, this is 33 times more than the CO_2 emissions released during the one-off development of the application (phases 1, 2, 3, 4a).

[1] Because NS uses green electricity from Dutch soil, the CO2 emission is zero.

4. Reduction targets (4.B.1)

We have set the following reduction targets for requirement 4.B.1. The requirements for this are as follows:

" The organisation has formulated CO_2 reduction targets for scope 3, based on 2 analyses from 4.A.1. Or the organisation has formulated CO_2 reduction targets for scope 3, based on 2 material GHG-generating (chains of) activities. A corresponding action plan has been drawn *up, including the* measures to be *taken. Objectives are expressed in absolute numbers or percentages in relation to a reference year and within a fixed period.*

**For small organisations [such as InTraffic, ed.], requirement 4.B.1 applies 'a CO_2 reduction target formulated on the basis of 1 chain analysis or chain of activities'"* (CO_2 Performance Ladder Handbook 3.1).

4.1. Objectives

As InTraffic, we have set ourselves two goals in relation to RouteLint. A direct and indirect goal.

User growth by 5% annually
The indirect goal is that we work with ProRail to increase the number of users. We are aiming for 5% annual growth of the number of users.

This results in 70 tonnes of CO_2 savings *annually (based on* scenario *2% savings).*

Increase train energy saving by new versions of RouteLint of 0.1% annually
The immediate goal is that we continue to work on RouteLint to make the energy savings of trains as large as possible. We are currently working on a new version of RouteLint. This version also has an integrated timetable so that drivers know if they are still on track or ahead of schedule so they can drive slower. In addition, the design of the new version is more intuitive. We expect that this version will save more energy as a result. We are aiming for an annual increase of energy savings of new versions of RouteLint of 0.1%.[2]

This will result in 59 tonnes of CO_2 savings annually (based on scenario *2% savings).*

[2] N.B. the demonstrability of this measure is difficult. One can think of a baseline measurement with the old and new versions of RouteLint. Or drivers can be asked how they experience the new version versus the old version and whether they think that they drive even more economically as a result.
In addition, it is expected that the 0.1% savings are a conservative estimate.

4.2. Measures

These objectives include the following measures:

Measure 1: Sharing sustainability information from chain analysis with account managers ProRail
Measure 2: Mapping the number of users & sharing with ProRail
Measure 3: Investigating the integration of roll-out advice in RouteLint
Measure 4: Sharing chain analysis with ProRail to raise awareness of CO_2 impact ProRail servers
Measure 5: Expressing results in energy savings
Measure 6: Increasing insight into energy savings by RouteLint
Measure 7: Increasing insight into the chain through further analysis of server use RouteLint

The measures are explained in more detail in the following sections.

Measures to increase user growth

Measure 1: Sharing sustainability information from chain analysis with account managers ProRail
InTraffic, in collaboration with ProRail, will share the results of this chain analysis with account managers so that they can also take environmental benefits into account when acquiring customers for RouteLint.

Explanation
RouteLint allows InTraffic to contribute to reducing the CO_2 footprint of Dutch train traffic. There is growth potential for RouteLint, so not every carrier is connected yet. Our chain partner ProRail wants to use the results of this study to increase the user group of RouteLint.

If all freight transporters use RouteLint, 216 tonnes of CO_2 to 863 tonnes of CO_2 will be saved over the entire chain. If all regional train services use RouteLint, 132 tonnes of CO_2 to 528 tonnes of CO_2 will be saved over the entire chain.

Measure 2: Mapping the number of users & sharing with ProRail
InTraffic will map the use of RouteLint more accurately, based on data analysis. We will share this information with the account managers of ProRail, so that they can provide feedback to their customers. The customers can then define actions to increase the use of RouteLint, such as communication to increase awareness of the benefits of RouteLint among operators.

Explanation
Not all NS & DB Cargo operators use RouteLint yet. If the user group is increased from the current 75% to 100%, an additional 98 tonnes of CO_2 to 391 tonnes of CO_2 will be saved.

Measures regarding RouteLint's design

Measure 3: Investigating the integration of roll-out advice in RouteLint
InTraffic, in collaboration with ProRail & NS, is investigating the option of integrating roll-out advice into RouteLint.

Explanation
In our design for RouteLint, we are striving to make it as easy as possible for the operator to save energy. The focus is on an intuitive design and adding new features.

Interesting features to add to RouteLint include the Dutch train timetable and roll-out advice. The Dutch train timetable has already been added to the version of RouteLint that we are currently working on. This is important information for drivers because it will let them know whether they are ahead of schedule (so they can take it easy), drive on time, or are behind schedule.

In addition, adding the timetable offers the option of giving roll-out advice. If drivers know they have enough time to arrive at a station, they can have their train slow down gradually, instead of driving fast into the station and having to brake. NS has developed this feature for their operators and the combination with RouteLint achieves 4% energy savings. It is interesting to see whether this feature can also be built into RouteLint, so that regional carriers and goods carriers can also use this information.

If, through integration roll-out advice, the energy savings increase from 0.5% or 2% to 4%, then 1172 tonnes of CO_2 to 2050 tonnes of CO_2 will be saved.

Other measures

Measure 4: Sharing chain analysis with ProRail to raise awareness of CO2 impact ProRail servers
We share this chain analysis with ProRail so that the CO_2 impact of hosting becomes visible.

Explanation
We mainly focus on the above measures, as they have the greatest potential. But there is another *low hanging fruit* measure that we want to mention. If ProRail starts using Dutch green electricity for their servers, approximately 21 tonnes of CO_2 will be saved over the chain (reference year 2019).

Improvement measures for the chain analysis

We will use these measures to improve the data collection for this chain with the following points of attention:

Measure 5: Expressing results in energy savings
In the next version of this chain analysis, we will also express the results in energy savings.

Explanation
At the moment there seems to be no advantage with NS trains, since they have a CO_2 emission factor of 0 due to the use of Dutch green electricity. However, if NS saves green energy and other parties use this energy, the NS will ensure that social CO_2 savings can be achieved.

Measure 6: Increasing visibility in energy savings by RouteLint
We work together with ProRail/NS to increase insight into the effects of RouteLint.

Explanation
At the moment, the energy savings by RouteLint are based on an assumption. We are currently working on energy meters in the trains, and this can be a nice source of information for the effect of RouteLint.

Measure 7: Increasing insight into the chain through further analysis of server use RouteLint
In order to better substantiate this assumption of server consumption RouteLint, we are going to enter into a conversation with the ICT department of ProRail. This will not result in energy savings, but it will improve the insight into this chain.

Explanation
The percentage of RouteLint server consumption is an assumption. This assumption has been checked by ProRail and InTraffic.

Sources

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