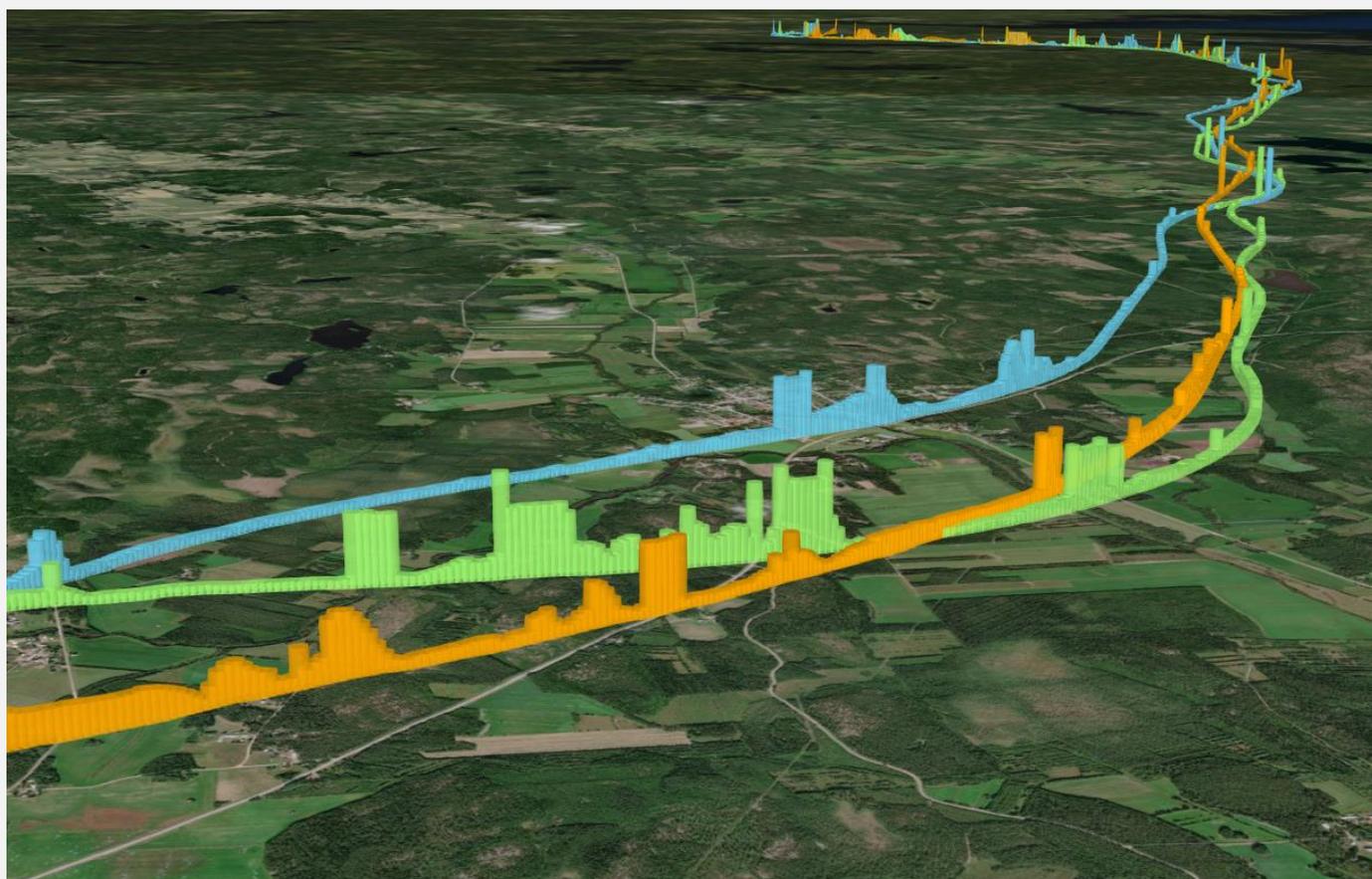


Final report NordLCA

Life Cycle Analysis tools to assess climate impact of road building



<u>Project</u> NordLCA: Life Cycle Analysis tools to assess climate impact of road building	<u>Report number</u> 2021-02
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<u>Report title</u> Final report NordLCA	<u>Scientific partners</u> Asplan Viak, Destia, Norsus, Tyréns
<u>Summary</u> The NordLCA project lasted from 2017 until 2020 and focused on tools for Life Cycle Assessment (LCA) for infrastructure. NordLCA delivered a state of the art for existing tools for LCA, a road map for development of LCA and a guide for the use of LCA. Thus, NordLCA contributed to the development of better (use of) LCA-tools, better understanding for scopes of application of the various LCA-tools and a more common ground for green public procurement criteria. Furthermore, seminars were organized, relevant reports were translated, networks were built, etc. The participating countries learned from each other and had the possibility to use and copy each other's tools.	
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Description of the project

Background

Reduction of climate impact is highly prioritized and need methods and tools that help good decisions and choices through all processes from planning to designing and construction further to operation and maintenance. Existing tools have different background in their development because of aim. They stand well alone but would gain of cross-linking. The Nordic countries have largely similar conditions in terms of road construction, raw materials and machinery and intend to introduce more focus on climate in road building and contracts. Therefore, they wish to further develop the respective Nordic tools.

Possible applications of the tools are:

- Environmental budget to be used by NRA internally
- Tender procedures (requirement or award criterion)
- Accounting for environment after/during construction

For early project stages, we need tools to consider the environmental impact of road projects and to compare various road alternatives. At these stages decisions are made that have large impacts on emissions. Efforts in early stages may save time and money in later stages.

For late project stages, we need tools to be able to compare different contractors, and to enable contractors to see how various measures affect the climate impact. The contractors are often Nordic and work across borders, so it would be useful if road authorities and contractors can use comparable tools.

In-house developed late-stage-tools meet comments from contractors on how models are constructed, their system boundaries, emission data, and transparency. A recurring view is that it is difficult for contractors to present their inventions and proposed solutions because these cannot be modelled in the tools. Solution might be further standardizing, broader use of EPDs (Environmental Product Declaration) and linking LCA to BIM-systems (Building Information Models).

Content

LCA and LCA tools are relatively new themes, which have become more important lately. The Nordic NRA's have had different ways of development, which has led to different actual situations.

The project started with a start phase in which a state of the art for existing tools for LCA was written. Further activities were defined in the following road map for development of LCA. The project found out that, to reach the goals, it was not necessary to use the same tools in all countries. Interfaces may be different, as long as calculation methods and boundaries are the same. This led to the writing of a guide for the use of LCA for infrastructure.

Apart from this, seminars were organized, relevant reports were translated, networks were built, etc.

NordLCA delivered a state of the art for existing tools for LCA, a road map for development of LCA and a guide for the use of LCA. Thus, NordLCA contributed to the development of better (use of) LCA-tools, better understanding for scopes of application of the various LCA-tools and a more common ground for green public procurement criteria. Furthermore, the participating countries learned from each other and had the possibility to use and copy each other's tools. Dissemination was secured by well attended seminars.

Goals

The main goal the project started with was to improve existing LCA tools and make more efficient use of these tools.

The project aimed to get:

- Better, more universal and more applicable LCA-tools
- Better understanding for scopes of application of the various LCA-tools
- Common ground for green public procurement criteria

During the project, it became clear that improving the basis for the tools should have focus, rather than the tools themselves. The basis consists of good guidance on calculation methods and system boundaries.

Organization

NordLCA started with three funding partners: Norwegian Public Roads Administration, Swedish Transport Administration and Finnish Transport Infrastructure Agency. From 2020, Danish Road Directorate joined the project team, without funding.

NordLCA operated with a steering group consisting of one or more members from each country. The actual work was carried out by various consultants from various countries. In some cases, they were asked to cooperate across borders.

Results

Deliverables

State of the Art

There are several benefits for common way of working with LCA. One is to get comparable results. Other benefits are to help visualize environmental impact through all processes from planning to designing and construction further to operation and maintenance and follow-up.

Possible applications of the LCA-tools are:

- Environmental budget to be used by the NRA internally
- Tender procedures (requirement or award criterion)
- Accounting for environment after/during construction

The State of the Art report describes the most common tools used by the transport administrations in Finland, Norway and Sweden. The objective was to find similarities within the tools, to find a common way of working with LCA in infrastructure projects, and to learn from each other.

The tools described are;

Finnish tools: *MELI* (earthworks, pavements and soil improvement) developed in 1999 by VTT. *FORE* is a set of tools for calculation of construction costs of roads, railways and streets and other infra in Finland. *Fore-Scope* is used at city planning level, *Fore-Hola* is used at planning level and *Fore-Rola* is used at design level. *One Click LCA* is an automated tool for LCA and LCC assessment for construction industry with local data.

Norwegian tools: The methodology *Climate Module in EFFEKT* is for assessing the socioeconomic cost-benefit for road projects. It is mandatory to be used in early planning stage, particularly to compare various road alignments. The tool *VegLCA* handles road infrastructure and is designed for use at later planning phase and in the design and contract phase respectively. A *preliminary method for applying LCA* at an early stage of infrastructure planning was under development when the state of the art was written, and has been implemented in *VegLCA* later.

Swedish tools: The *EKA tool* ("Energy, Carbon dioxide, Asphalt production") calculates greenhouse gas emission and the primary energy used in asphalt manufacturing - from input materials to finished coating of a road. *Geokalkyl* is a GIS-tool which uses the spatial information of topography, infrastructure placement, soil depth and soil types to calculate mass balance, construction cost, energy, and CO_{2e} emissions. *Klimatkalkyl* is a tool to calculate greenhouse gas emissions and energy use of road and railway infrastructure. It is used to follow-up climate reduction goals.

- Deliverable: State of the Art of LCA Tools and Methods for Infrastructure for Finland, Sweden and Norway (Destia, Asplan Viak, Tyrens, 2017)

Road map

The roadmap of the NordLCA project was mainly based on the NordLCA state of the art assessment, the NordLCA workshop held at Arlanda at 14th of September 2017 and the discussions with the involved national road authorities during the writing process. The road map gave structure to and defined a number of work packages including goals, responsibilities and activities.

- Deliverable: NordLCA Roadmap of Developing LCA for Road and Rail Infrastructure Management for Finland, Sweden and Norway (Destia, Finnish Transport Agency, Norwegian Public Roads Administration, Swedish Transport Administration, 2018).

LCA Guide

Several LCAs have been performed and LCA tools have been developed for civil engineering works, mainly focusing on Green House Gas (GHG) emissions. The experience is that LCA can vary in results significantly. It is very important to clarify why those differences occur. Minimizing these differences and ensuring results reliability is needed. Thus, a guide for how to use LCA for Road and Railway projects has been developed.

The scope of the guide is to define how LCA is to be used within road and railway planning, construction and maintenance and narrow down the room for interpretation when using standards which will result in more comparable results. The focus of this guide is carbon emissions, but the guide is applicable for other environmental impact categories.

The target audience is LCA users within the National Road and Railway Authorities, including project leaders, planners and procurement professionals. Tool developers and tool buyers may benefit from the guide as well as LCA consultants/service providers and those responsible for procuring these services.

The Guide contains the following parts:

Part 1 (chapters 1-3): Introductory text – ensure clear understanding

Part 2 (chapter 4): Definition of methodology aspects – in combination with chapter 5

Part 2 (chapter 5): Guidance on implementation – specific issues to each planning stage addressed

Part 2 (chapters 6-9): Additional information – ensure clear understanding of results communication

- Deliverables:
 - Guide for LCA of Road and Rail Infrastructure. A report (Tyrens 2020 and Østfoldforskning 2019).
 - Published in web format on NordFoU web page (2020). www.nordfou.org - [LCA Guide - Startside](#)
 - Translations of the Guide into Finnish, Norwegian, Danish and Swedish. See national web pages.

Implementation

The guide for the use of LCA is published on several websites and will help developing LCA and tools for LCA in a right direction. An example might be that greenhouse gas emissions as a result of transport of personnel now will be included in the Norwegian LCA tool. Danish Road Directorate even implemented a complete tool as a result of NordLCA. Swedish Transport Administration used the NordLCA guide for developing a national LCA guide within governmental mission on environmental targets. Within Finnish Transport Infrastructure Administration, the NordLCA guide has been published in the official series of guides and serves as a basis for the development of further detailed guidance on the use of LCA.

Other

NordLCA has created a Nordic network of LCA experts in the participating countries. This network enables the sharing of knowledge and experiences. In tender procedures, NordLCA made sure that consultants needed to cooperate across borders, thus creating a Nordic network amongst consultants as well.

A good example of the value of the network is that Danish Road Directorate decided to use the Norwegian Public Roads Administration tool as a basis for further development of a new Danish LCA-tool, thus reducing the development time and costs. Also, the possibility to discuss issues around LCA with others is of great value (practical matters on implementation, theoretical matters about LCA, etc).

Dissemination

Seminars

NordLCA has been the host for three seminars in resp Helsinki (2018), Trondheim (2019) and Copenhagen (2020, webinar). A smaller workshop was held in Stockholm in 2017. At the seminars, there was ample room for presentations about LCA for infrastructure and networking. Moreover, results from NordLCA were shown and input for further work was gathered in interactive parts.

The seminars were well attended and appreciated by ca 70 participants from the participating countries. The webinar even reached 150 participants. Among the participants were road authorities, consultants, contractors and universities.

A number of presentations from the seminars have been uploaded to the NordFoU website.

Other

Other dissemination has been secured during several presentations and meetings, as well as uploading on the NordFoU site and national websites.

Goal achievement

The goal 'better LCA-tools' was reformulated to 'better use of tools', which was met by making a guide for this. The guide, the sota and other exchange of knowledge led to better understanding for scopes of application of the tools. In the long term, the deliverables of NordLCA will lead to better tools, better understanding for scopes of application of the various LCA-tools and a more common ground for green public procurement criteria.

Furthermore, the participating countries learned from each other and had the possibility to use and copy each other's tools. Dissemination was secured by well attended seminars and a workshop.

Further work

NordLCA has led to better understanding of the needs for further development of procedures and tools for LCA and has shown the clear benefits of Nordic cooperation in this field. Therefore, a new project NordLCA+ ('Life Cycle Analysis to assess and reduce climate impact of infrastructure building, part 2') started after NordLC had finished.

Both Norway and Denmark are about to use LCA-calculations at a larger scale and in relation to tender procedures, something Sweden already has done for a couple of years. This will lead to a significant increase of need for guidance, and suggestions for adjustments of calculations. In this phase, Nordic cooperation and coordination is even more wanted for.

All participating countries are in a process of implementing BIM. Combining BIM with LCA offer new opportunities with regard to user friendliness and accuracy. Development of links between LCA and BIM are not going as fast as the development of BIM and LCA separately. NordLCA+ will investigate if there are possibilities to speed up the linking of LCA and BIM as both become increasingly mature. Here, it is important to cooperate with the new NordFoU project on BIM (if approved).

Important developments and activities that are foreseen for NordLCA+ are:

- Evaluate and if necessary, update the LCA guides from NordLCA
- Contribute to development of LCA functions in BIM
- Develop common ways/guide for how to ensure good LCA in D+B contracts, and present good examples
- Improve existing calculations by using and comparing tools from participating organizations
- Improve the use of LCA to reduce greenhouse gas emissions
- Continued sharing of knowledge by organizing seminars and meetings
- Continued dissemination of LCA guides from NordLCA, a.o. by making them accessible at website

The full title of the new NordLCA+ project differs slightly from the full title of the old NordLCA project to reflect a small change in direction: "Life Cycle Analysis to assess and reduce climate impact of infrastructure building" instead of "Life Cycle Analysis tools to assess climate impact of road building". Nevertheless, 'part two' is added to the full title.

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