PavementLCM

SUSTAINABILITY ASSESSMENT COMPASS

CEDR Pavement LCM | Elisabeth Keijzer & Suzanne de Vos

TNO innovation for life

Picture: Rijkswaterstaat beeldbank

WHAT IS PavementLCM?

- PavementLCM is a CEDR project running from Oct. 2018 till June 2021
- University of Nottingham (coordinator), TNO, VTI and University of Palermo

- Aim: to create a platform to gather together national road authorities of CEDR and experts towards the definition of a comprehensive package to perform life cycle management of road pavements. The project will also look at defining “green asphalts” and create datasets with information on sustainability and durability of selected green asphalt candidates. (More information on the project can be given upon request).

This presentation focuses on gathering of and guidance in sustainability data & tools, in a practical tool: the Sustainability Assessment Compass

WHY IS THIS SUSTAINABILITY ASSESSMENT COMPASS DEVELOPED?

Problem: many tools and databases with sustainability information exist, but NRAs (and other users) do not know about all of them, nor which one is the best for which situation.

Aim of the Sustainability Assessment Compass*:

1. To create an overview of all available tools and datasets for sustainability assessments of road pavement materials and road pavement activities, including descriptions of their characteristics
2. To create an automatic function which helps the NRA to find the best tool for a certain situation.

*in the proposal phase, this tool was called “look-up tool”

WHY THIS PRESENTATION?

To introduce to you:

- What is the intended use of the compass and what is the mechanism behind it
- What the compass looks like (quick user guide)

DEVELOPMENT TIMELINE

1. First set-up created by project team (Oct-Dec. 2018)
2. First set-up sent to PEB for discussion (Dec. 2018)
3. Receive feedback via email and/or during interviews (Jan. 2019)
4. Data collection + organizing the Sustainability Assessment Compass (2019)
5. Finalization of the Sustainability Assessment Compass (2020-2021)

FIRST DESIGN IN HEADLINES

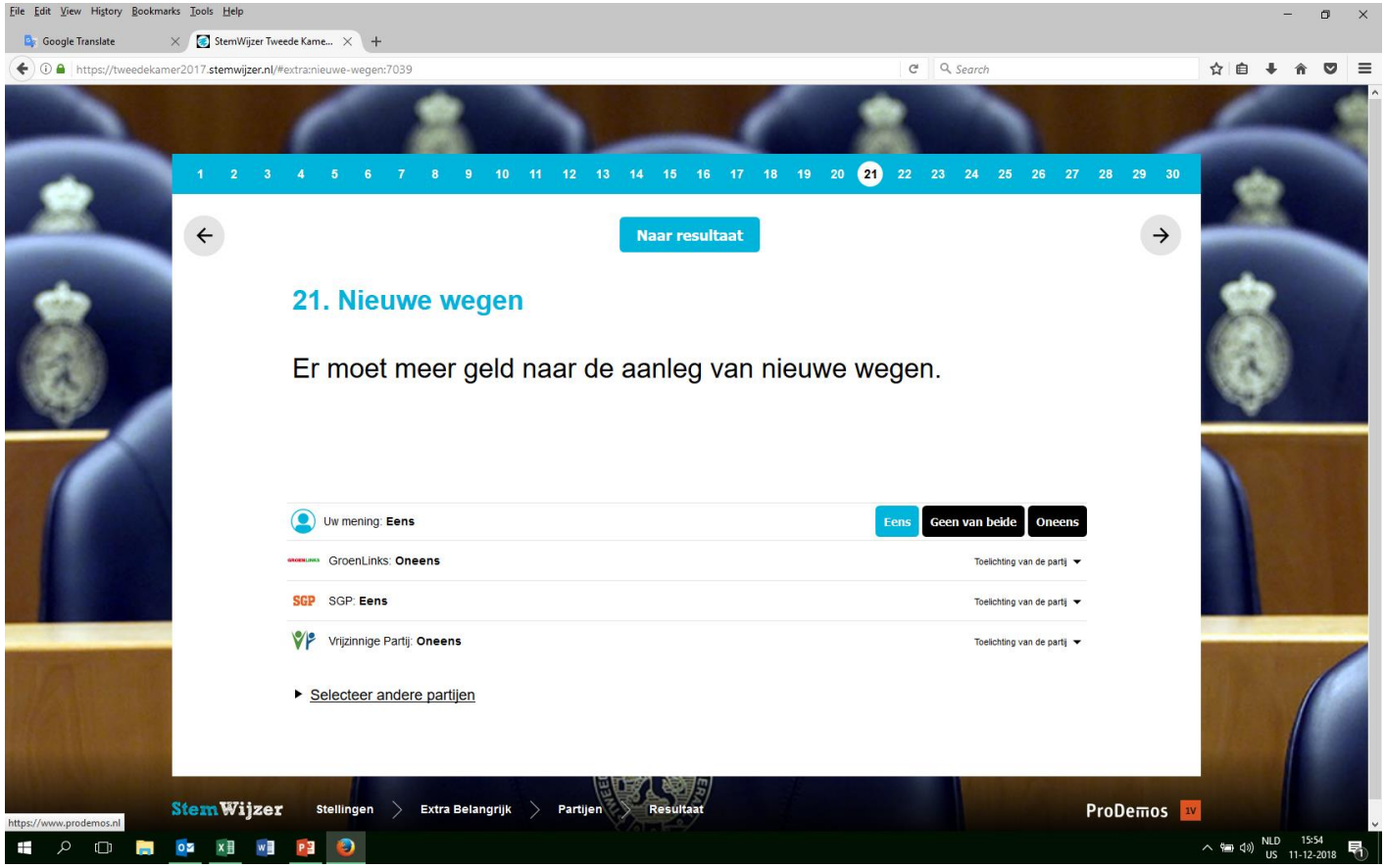
- **Format:**
  - excel-based tool, containing info sheets for each tool/dataset and a function which creates lists of best matching tools/datasets
  - For now in excel, but could be upgraded to other interface in later stage, e.g. online tool → please let us know what you prefer

- **Structure:**
  - Principle of the Dutch “voting compass”, which helps the electors in finding out which political party matches best with their criteria
  - See next slides for illustration of this principle

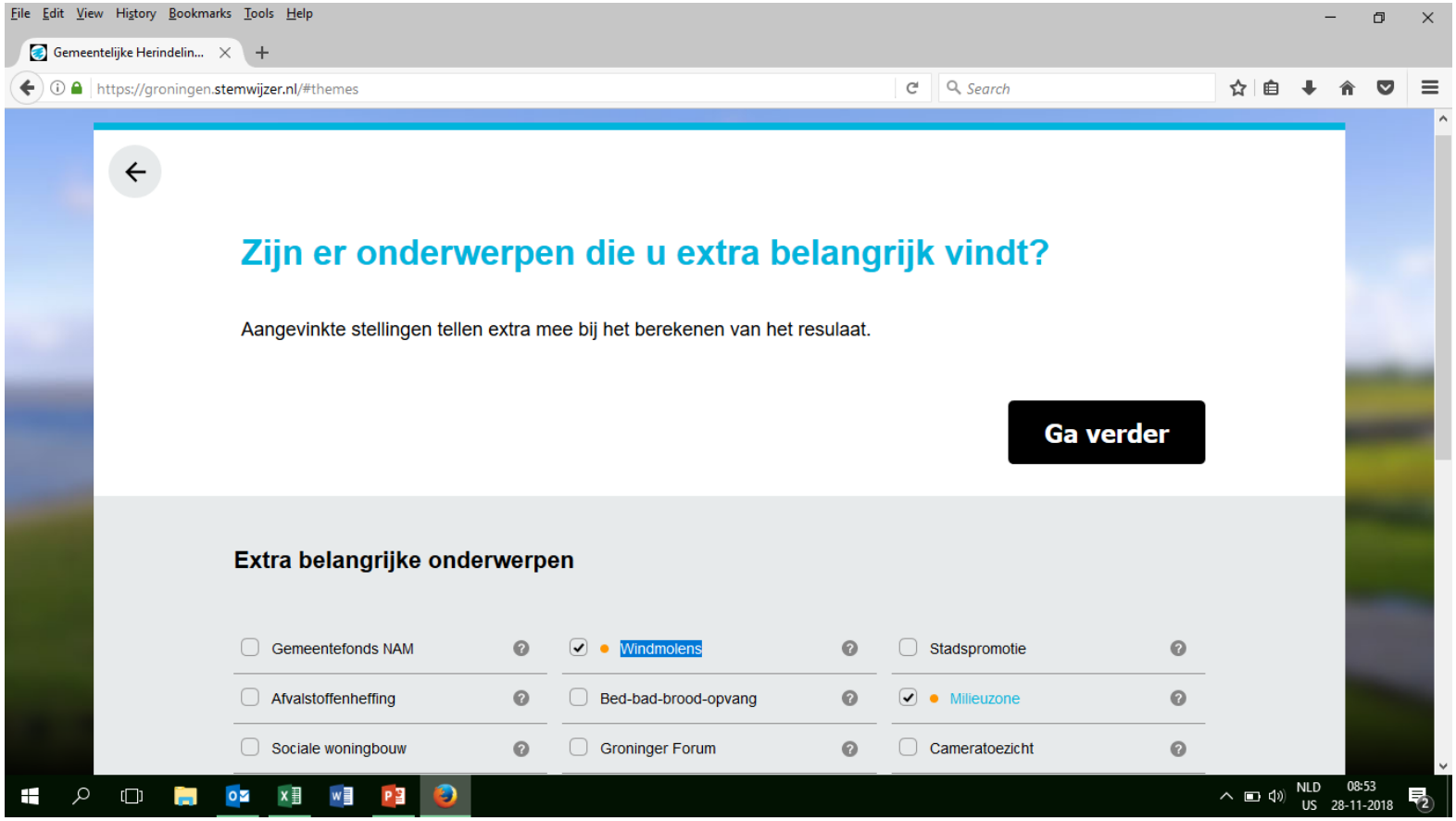
EXAMPLE: DUTCH VOTING COMPASS

STEP 1. ANSWER SOME QUESTIONS: "DO YOU NEED THIS ASPECT OR NOT?"

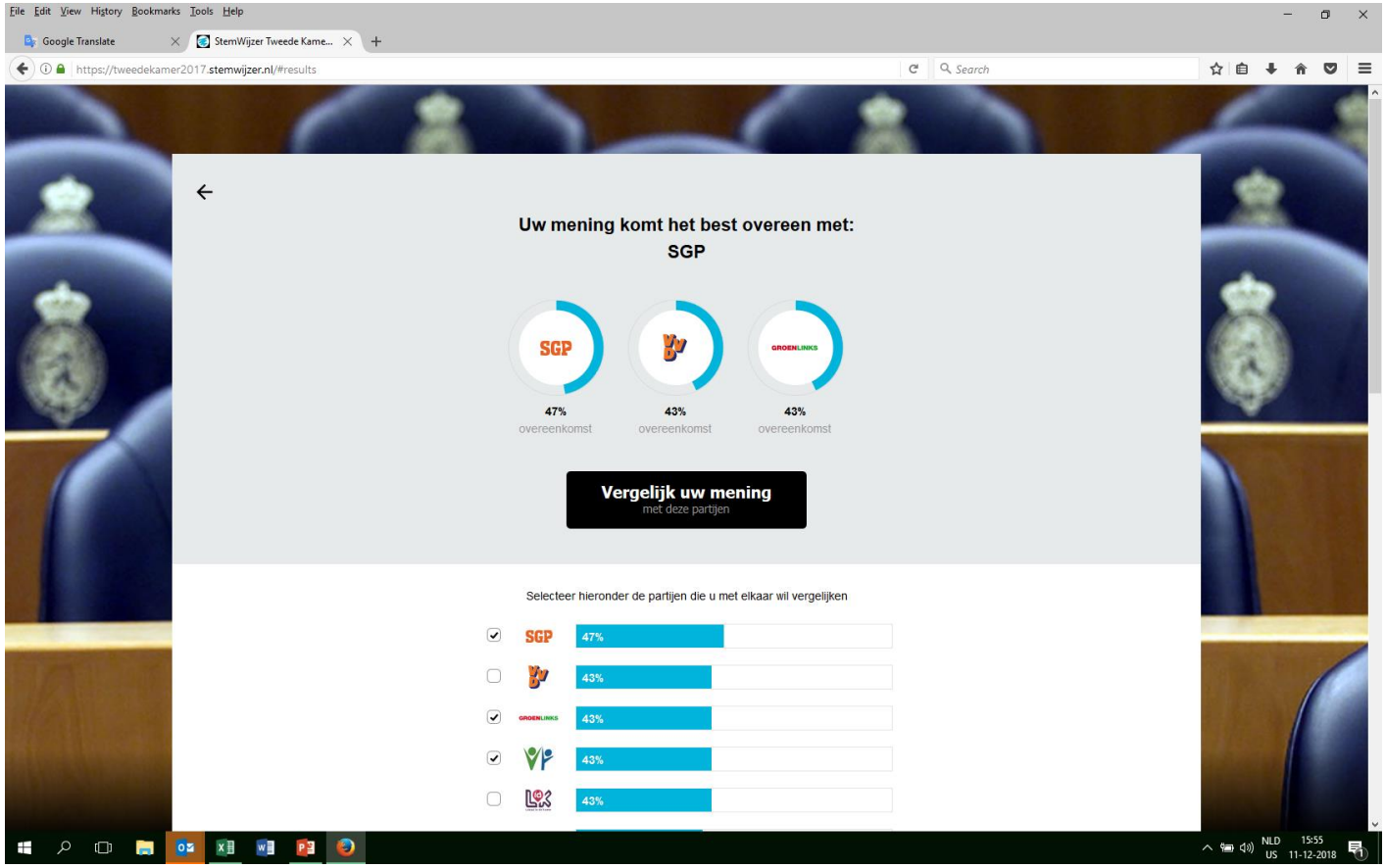
STEP 2: YOUR PREFERENCES ARE COMPARED TO THE PARTY PROGRAMS



STEP 3: YOU CAN SELECT WHICH TOPICS YOU FIND MOST IMPORTANT



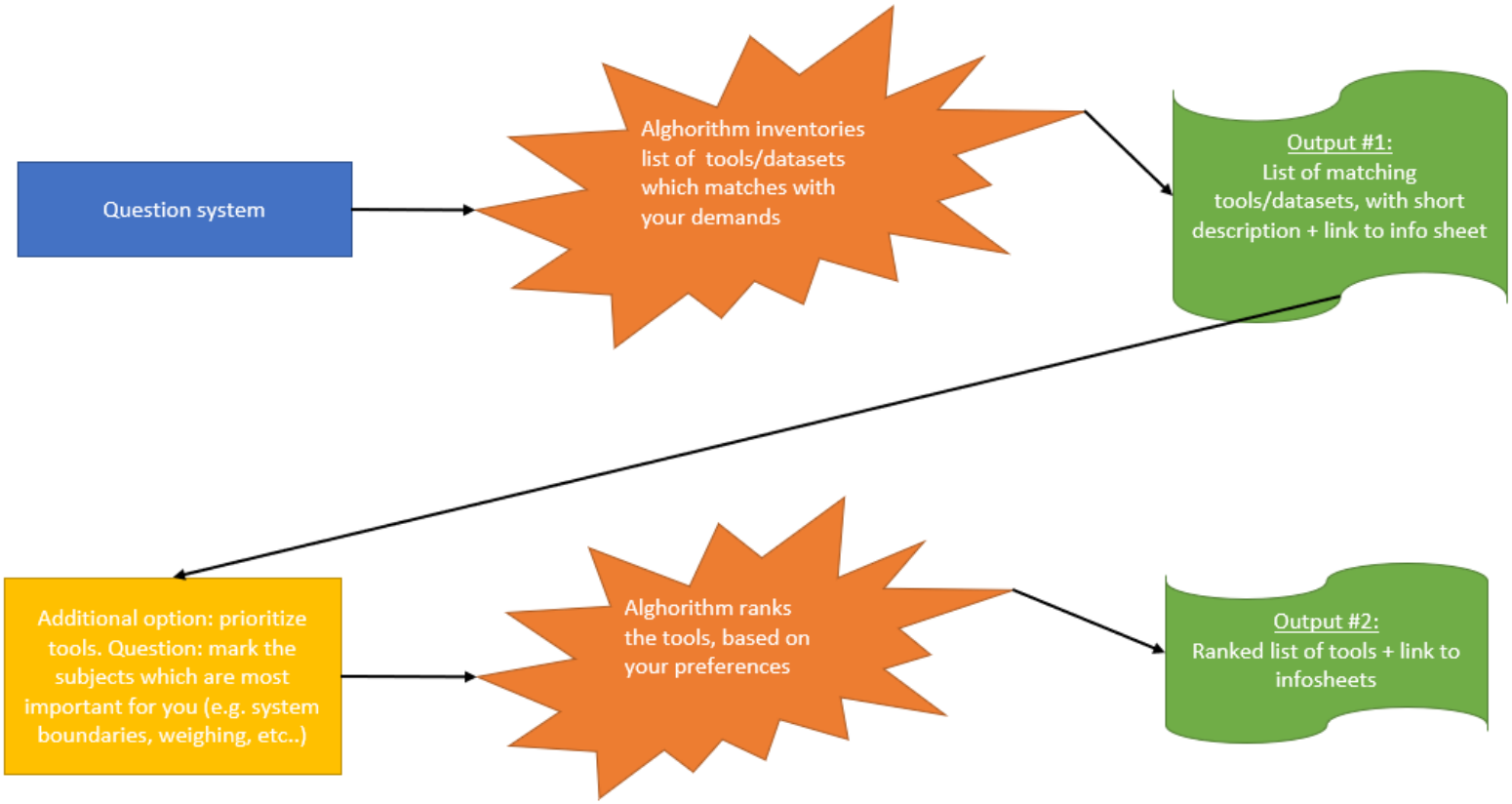
STEP 4: A RANKED LIST OF PARTIES, DEPENDING ON THE MATCH FACTOR



FROM VOTING COMPASS TO SUSTAINABILITY ASSESSMENT COMPASS

- Principle of “voting compass” translated into “sustainability assessment compass”:
  - The user answers a small set (~5) of questions about his tool or data demands
  - The tool generates a list of matching tools with only names, short description and link to more information (info sheets)
  - The user can now select which other principles he/she finds most important (for example: weighing of impacts should be available)
  - The tool now creates a ranked list, showing which tool/dataset is the best match for the desires of the NRA (+ link to info sheets)

SCHEMATIC SET-UP



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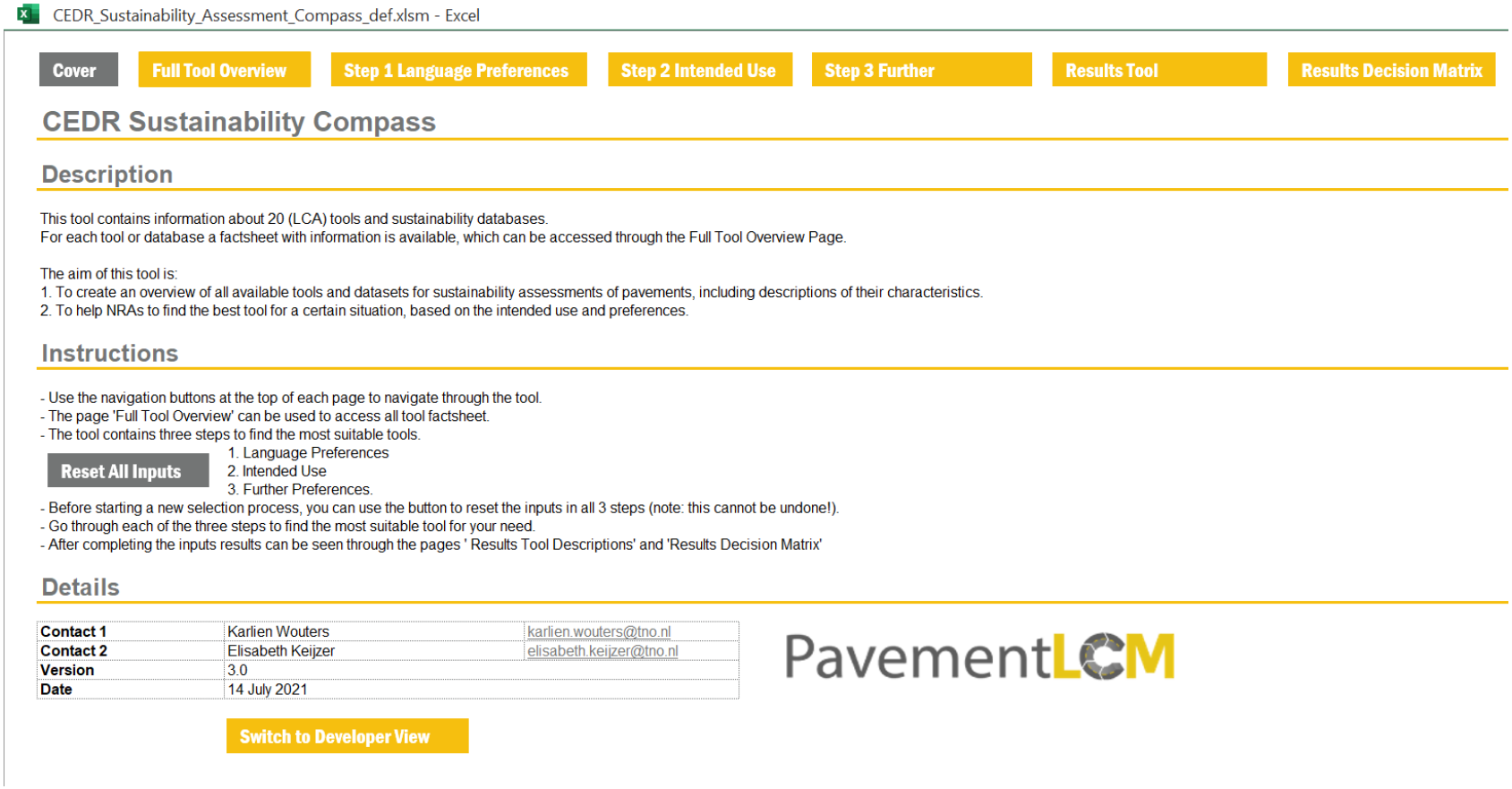
VISUAL IMPRESSION

1ST PAGE: INTRODUCTION TEXT



CEDR_Sustainability_Assessment_Compass_def.xlsm - Excel

Cover | Full Tool Overview | Step 1 Language Preferences | Step 2 Intended Use | Step 3 Further | Results Tool | Results Decision Matrix

CEDR Sustainability Compass

Description

This tool contains information about 20 (LCA) tools and sustainability databases.
For each tool or database a factsheet with information is available, which can be accessed through the Full Tool Overview Page.

The aim of this tool is:
1. To create an overview of all available tools and datasets for sustainability assessments of pavements, including descriptions of their characteristics.
2. To help NRAs to find the best tool for a certain situation, based on the intended use and preferences.

Instructions

- Use the navigation buttons at the top of each page to navigate through the tool.
- The page 'Full Tool Overview' can be used to access all tool factsheet.
- The tool contains three steps to find the most suitable tools.

Reset All Inputs

1. Language Preferences
2. Intended Use
3. Further Preferences.

- Before starting a new selection process, you can use the button to reset the inputs in all 3 steps (note: this cannot be undone!).
- Go through each of the three steps to find the most suitable tool for your need.
- After completing the inputs results can be seen through the pages ' Results Tool Descriptions' and 'Results Decision Matrix'

Details

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Version	3.0	
Date	14 July 2021	

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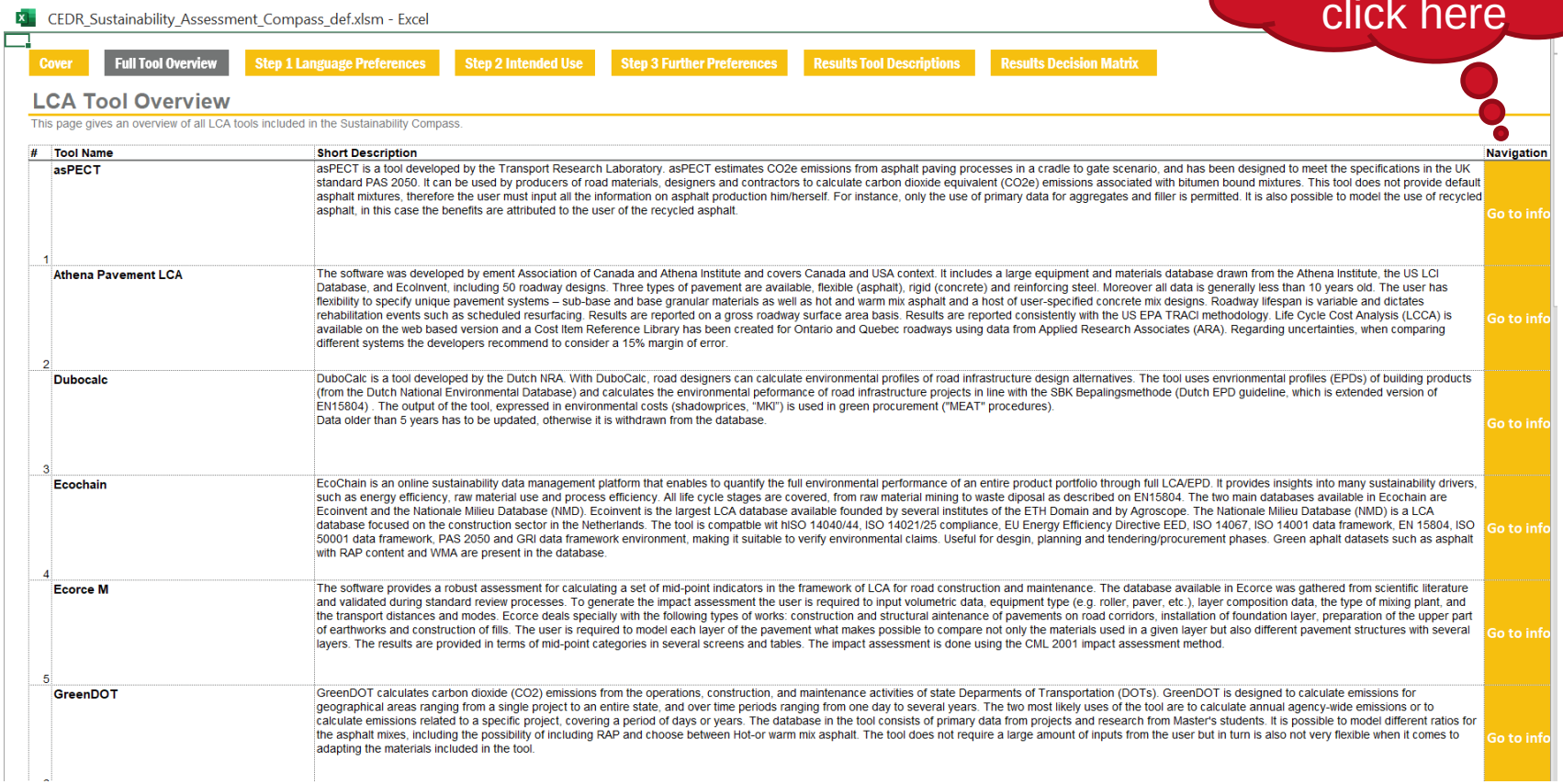
Switch to Developer View

2ND PAGE: FULL OVERVIEW OF MAIN TOOLS AVAILABLE

More information: click here



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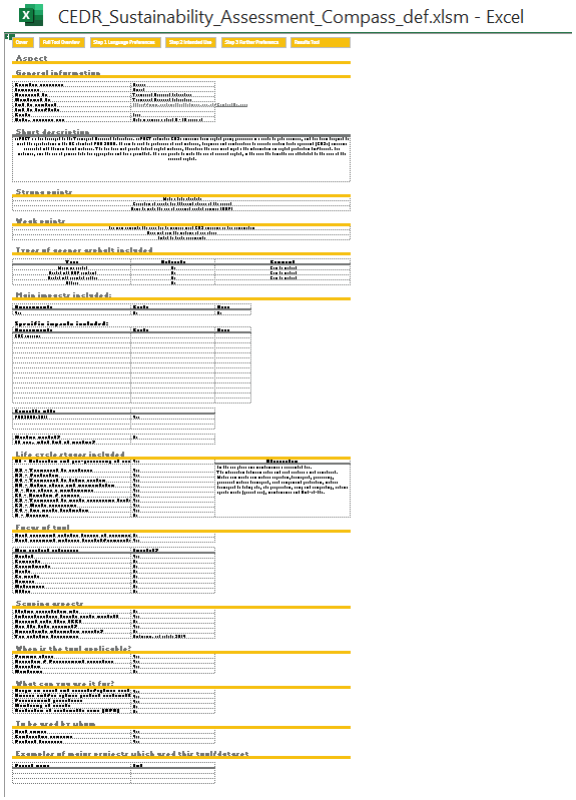
LCA Tool Overview

This page gives an overview of all LCA tools included in the Sustainability Compass.

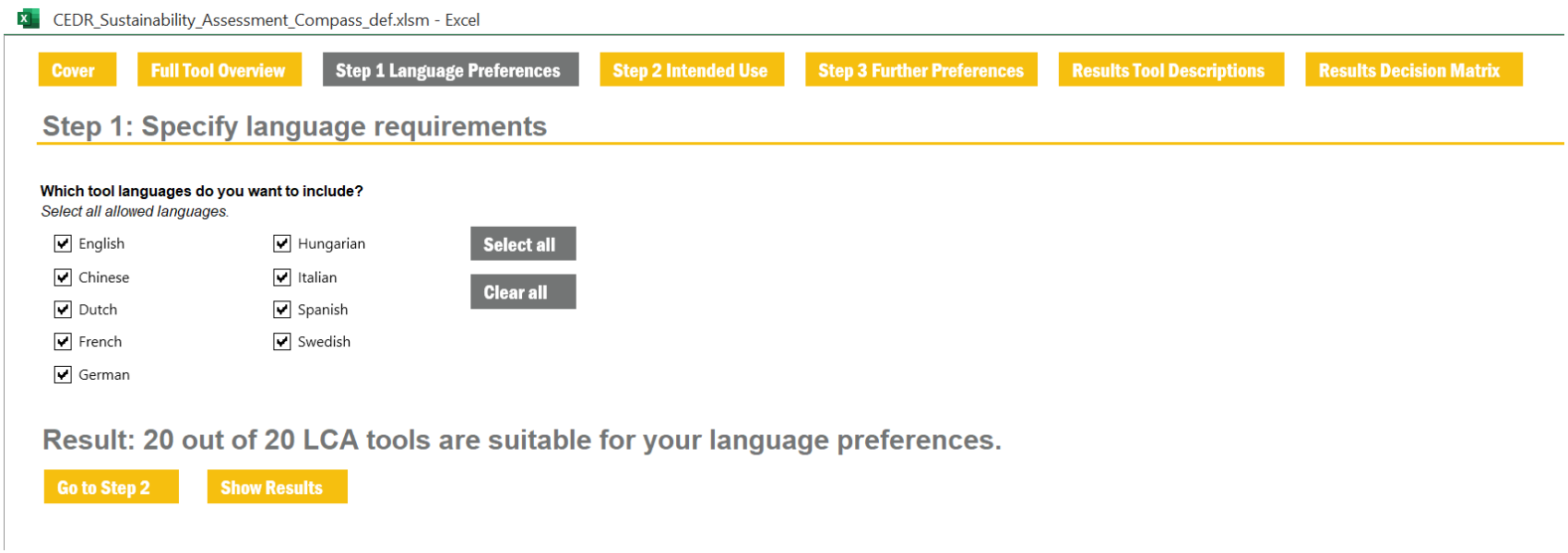
#	Tool Name	Short Description	Navigation
1	asPECT	asPECT is a tool developed by the Transport Research Laboratory. asPECT estimates CO2e emissions from asphalt paving processes in a cradle to gate scenario, and has been designed to meet the specifications in the UK standard PAS 2050. It can be used by producers of road materials, designers and contractors to calculate carbon dioxide equivalent (CO2e) emissions associated with bitumen bound mixtures. This tool does not provide default asphalt mixtures, therefore the user must input all the information on asphalt production him/herself. For instance, only the use of primary data for aggregates and filler is permitted. It is also possible to model the use of recycled asphalt, in this case the benefits are attributed to the user of the recycled asphalt.	Go to info
2	Athena Pavement LCA	The software was developed by ement Association of Canada and Athena Institute and covers Canada and USA context. It includes a large equipment and materials database drawn from the Athena Institute, the US LCI Database, and EcoInvent, including 50 roadway designs. Three types of pavement are available, flexible (asphalt), rigid (concrete) and reinforcing steel. Moreover all data is generally less than 10 years old. The user has flexibility to specify unique pavement systems – sub-base and base granular materials as well as hot and warm mix asphalt and a host of user-specified concrete mix designs. Roadway lifespan is variable and dictates rehabilitation events such as scheduled resurfacing. Results are reported on a gross roadway surface area basis. Results are reported consistently with the US EPA TRACI methodology. Life Cycle Cost Analysis (LCCA) is available on the web based version and a Cost Item Reference Library has been created for Ontario and Quebec roadways using data from Applied Research Associates (ARA). Regarding uncertainties, when comparing different systems the developers recommend to consider a 15% margin of error.	Go to info
3	Dubocalc	DuboCalc is a tool developed by the Dutch NRA. With DuboCalc, road designers can calculate environmental profiles of road infrastructure design alternatives. The tool uses envrionmental profiles (EPDs) of building products (from the Dutch National Environmental Database) and calculates the environmental peformance of road infrastructure projects in line with the SBK Bepalingsmethode (Dutch EPD guideline, which is extended version of EN15804) . The output of the tool, expressed in environmental costs (shadowprices, "MKI") is used in green procurement ("MEAT" procedures). Data older than 5 years has to be updated, otherwise it is withdrawn from the database.	Go to info
4	Ecochain	EcoChain is an online sustainability data management platform that enables to quantify the full environmental performance of an entire product portfolio through full LCA/EPD. It provides insights into many sustainability drivers, such as energy efficiency, raw material use and process efficiency. All life cycle stages are covered, from raw material mining to waste diposal as described on EN15804. The two main databases available in Ecochain are Ecoinvent and the Nationale Milieu Database (NMD). Ecoinvent is the largest LCA database available founded by several institutes of the ETH Domain and by Agroscope. The Nationale Milieu Database (NMD) is a LCA database focused on the construction sector in the Netherlands. The tool is compatble wit hISO 14040/44, ISO 14021/25 compliance, EU Energy Efficiency Directive EED, ISO 14067, ISO 14001 data framework, EN 15804, ISO 50001 data framework, PAS 2050 and GRI data framework environment, making it suitable to verify environmental claims. Useful for desgin, planning and tendering/procurement phases. Green aphalt datasets such as asphalt with RAP content and WMA are present in the database.	Go to info
5	Ecorce M	The software provides a robust assessment for calculating a set of mid-point indicators in the framework of LCA for road construction and maintenance. The database available in Ecorce was gathered from scientific literature and validated during standard review processes. To generate the impact assessment the user is required to input volumetric data, equipment type (e.g. roller, paver, etc.), layer composition data, the type of mixing plant, and the transport distances and modes. Ecorce deals specially with the following types of works: construction and structural aintenance of pavements on road corridors, installation of foundation layer, preparation of the upper part of earthworks and construction of fills. The user is required to model each layer of the pavement what makes possible to compare not only the materials used in a given layer but also different pavement structures with several layers. The results are provided in terms of mid-point categories in several screens and tables. The impact assessment is done using the CML 2001 impact assessment method.	Go to info
	GreenDOT	GreenDOT calculates carbon dioxide (CO2) emissions from the operations, construction, and maintenance activities of state Deparments of Transportation (DOTs). GreenDOT is designed to calculate emissions for geographical areas ranging from a single project to an entire state, and over time periods ranging from one day to several years. The two most likely uses of the tool are to calculate annual agency-wide emissions or to calculate emissions related to a specific project, covering a period of days or years. The database in the tool consists of primary data from projects and research from Master's students. It is possible to model different ratios for the asphalt mixes, including the possibility of including RAP and choose between Hot-or warm mix asphalt. The tool does not require a large amount of inputs from the user but in turn is also not very flexible when it comes to adapting the materials included in the tool.	Go to info

WHAT'S ON THE INFO SHEET?

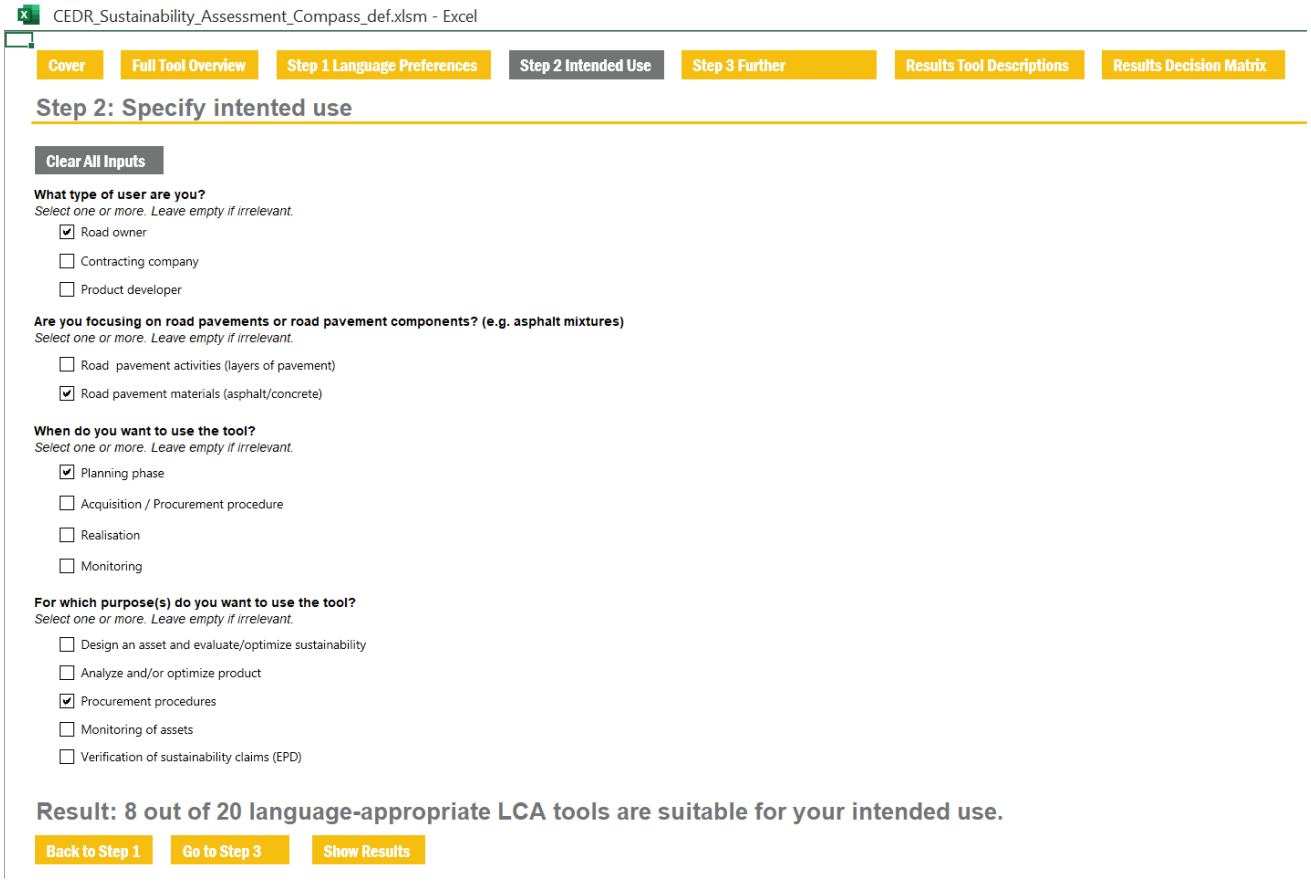
- 1 info sheet per tool, contains all important characteristics concerning environmental, cost and/or social impact assessment
- Long list of characteristics
- See appendix slides for the whole list of characteristics



3RD TILL 5TH PAGE: QUESTION SECTION; ENTER YOUR PREFERENCES



3RD TILL 5TH PAGE: QUESTION SECTION; ENTER YOUR PREFERENCES



3RD TILL 5TH PAGE: QUESTION SECTION; ENTER YOUR PREFERENCES

CEDR_Sustainability_Assessment_Compass_def.xlsm - Excel

Cover | Full Tool Overview | Step 1 Language Preferences | Step 2 Intended Use | Step 3 Further Preferences | Results Tool Descriptions | Results Decision Matrix

Step 3: Specify further requirements and preferences

In this step you can add futher requirements and preferences by using the drop-down menus. These will be treated as follows:
- Requirements: LCA Tools that do not meet the requirement will be excluded from there results.
- Preference: Applicable tools will be ranked based on the amount of preferences met by te tool.
You can skip any elements that are not important to you.

Clear All Inputs

What are your preferences

What is the maximum allowed user cost?	Free
Is this a requirement or a preference?	

What are your preferences regarding country coverage?

World	
Canada	
Europe	Requirement
France	
Netherlands	
Sweden	
USA	

Which life cycle stages do you prefer to be included?

A1 - Extraction and pre-processing of raw materials	Requirement
A2 - Transport to producer	
A3 - Production	
A4 - Transport to building location	
A5 - Building phase and implementation	
B - Use stage + maintenance	
C1 - Demolition / removal	
C2 - Transport to waste processing facility	
C3 - Waste processing	
C4 - Final waste destination	
D - Recycling	Preference

Which main impacts do you prefer to be included?

Environmental	Requirement
Costs	Preference
Social	Preference

Which product categories do you prefer to be included?

Asphalt	Preference
Concrete	
Groundworks	
Roads	
Civil works	
Railways	
Waterways	

Do you prefer weighing to be included?

Weighing	

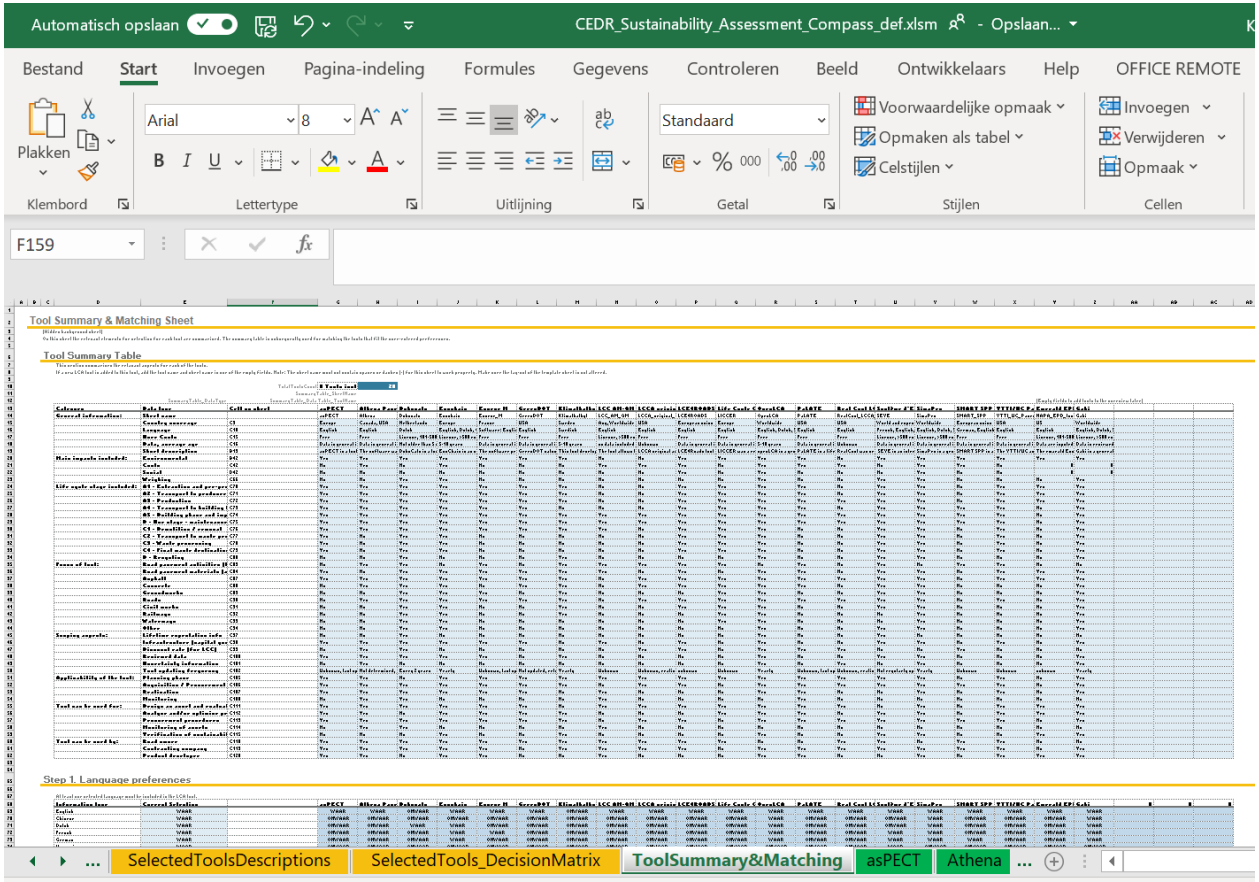
Which scoping aspects do you prefer to be included?

Lifetime expectation info	
Infrastructure (capital goods included)	Preference
Discount rate (for LCC)	
Reviewed data	Preference
Uncertainty information	

Result: 4 match your requirements. These will be ranked based on your preferences.

Show Results

HIDDEN PAGE: BIG ALGORITHM



6TH PAGE: (RANKED) LIST OF SUITABLE TOOLS

CEDR_Sustainability_Assessment_Compass_def.xlsm - Excel

Cover | Full Tool Overview | Step 1 Language Preferences | Step 2 Intended Use | Step 3 Further Preferences | Results Tool Descriptions | Results Decision Matrix

Results - Selected LCA tools - Descriptions

This overview shows all LCA tools applicable to your requirements. Results are ranked based on your preferences.

For more details : Go to Decision Matrix

Rank	Tool Name	Short Description
1	**Ecochain**	EcoChain is an online sustainability data management platform that enables to quantify the full environmental performance of an entire product portfolio through full LCA/EPD. efficiency, raw material use and process efficiency. All life cycle stages are covered, from raw material mining to waste diposal as described on EN15804. The two main data Database (NMD). Ecoinvent is the largest LCA database available founded by several institutes of the ETH Domain and by Agroscope. The Nationale Milieu Database (NMD Netherlands. The tool is compatble wit hISO 14040/44, ISO 14021/25 compliance, EU Energy Efficiency Directive EED, ISO 14067, ISO 14001 data framework, EN 15804, I environment, making it suitable to verify environmental claims. Useful for desgin, planning and tendering/procurement phases. Green aphalt datasets such as asphalt with RAF
2	**LCE4ROADS**	LCE4Roads tool integrates the certification methodology developed for road products and infrastructures alongside the LCE4Roads project allowing the evaluation of the ove Indicators (KPIs) selected. The tool is able to model and calculate the impact of the materials and activities involved in all phases of its life cycle (design, construction, use, ma (environmental, economic, social and technical). The software comes with a pre-loaded database based on EcoInvent, literature research and primary data collection, whic of from different sources and country mixes and other materials used in the EU. It is also possible to add custom data and use in the projects but it is not possible to change data and a certificate may be emitted and exported to a PDF file.
3	**Système d'Evaluation des Variantes Environnementales (SEVE)**	SEVE is an internet based tool, widely used by industries in France and has been officially recognized by the French government as a tool for evaluating bids in the frame of maintenance works or building works to be compared on the same level regarding environmental claims. During a call for tenders, the users can enter parameters for each as of manufacture of the pavement, composition of the application workshops, distances and modes of transport. It is not possible to calculate the environmental impacts of a cor suitable for carrying out a greenhouse gas emissions assessment. The tool is associated with a database of materials, equipment, products, ... common to all users and a bas station (bituminous materials production tools or concrete). SEVE can thus calculate the environmental indicators of the projects according to the specific environmental cost calculated according to several criteria: Distance and type of transport from the raw materials to the item Type of fuel Asphalt temperature Percentage of aggregates added to the software devolved to the calculations of the environmental costs of the basic solutions and variants. The result is delivered in terms of the specific environmental cost of the
4	**asPECT**	asPECT is a tool developed by the Transport Research Laboratory. asPECT estimates CO2e emissions from asphalt paving processes in a cradle to gate scenario, and has 2050. It can be used by producers of road materials, designers and contractors to calculate carbon dioxide equivalent (CO2e) emissions associated with bitumen bound mixt user must input all the information on asphalt production him/herself. For instance, only the use of primary data for aggregates and filler is permitted. It is also possible to mode the user of the recycled asphalt.

7TH PAGE: INSIGHT IN ADVANTAGES AND DISADVANTAGES OF SELECTED TOOLS

CEDR_Sustainability_Assessment_Compass_def.xlsm - Excel

Cover | Full Tool Overview | Step 1 Language Preferences | Step 2 Intended Use | Step 3 Further Preferences | Results Tool Descriptions | Results Decision Matrix

Results - Selected LCA tools - Decision Matrix

This overview shows all LCA tools applicable to your requirements. Results are ranked based on your preferences.
The color coding shows which of your preferences are met by each tool.

Back to Tool Descriptions

Legend:

	Requirement/Preference	No Preference
	Within scope	Within scope
	Not within scope	Not within scope

				Country coverage						Life cycle stages												Impacts			Product categories									Scoping aspects				
Rank	Tool Name	Go To Information Sheet	User costs	World	Canada	Europe	France	Netherlands	Sweden	USA	A1 - Extraction and pre-processing of raw material	A2 - Transport to producer	A3 - Production	A4 - Transport to building location	A5 - Building phase and implementation	B - Use stage + maintenance	C1 - Demolition / removal	C2 - Transport to waste processing facility	C3 - Waste processing	C4 - Final waste destination	D - Recycling	Environmental	Costs	Social	Asphalt	Concrete	Groundworks	Roads	Civil works	Railways	Waterways	Weighing	Lifetime expectation info	Infrastructure (capital goods included)	Discount rate (for LCC)	Reviewed data	Uncertainty information
		Entered preferences->	Free																																		
1	Ecochain	Go to information sheet	License, >500 euros/year																																		
2	LCE4ROADS	Go to information sheet	Free																																		
3	Système d'Evaluation des Variantes Environnementales (SEVE)	Go to information sheet	License, >500 euros/year																																		
4	asPECT	Go to information sheet	Free																																		

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APPENDIX: INFOSHEETS IN MORE DETAIL

INFOSHEETS IN MORE DETAIL (1)

CEDR_Sustainability_Assessment_Compass_def.xlsm - Excel

Aspect

General information

Country coverage	Europe
Language	English
Developed by	Transport Research Laboratory
Maintained by	Transport Research Laboratory
Link to contact	http://www.sustainabilityofhighways.org.uk/ContactUs.aspx
Link to tool/data	
Costs	Free
Data, average age	Data in general is about 5 - 10 years old

Short description

asPECT is a tool developed by the Transport Research Laboratory. asPECT estimates CO2e emissions from asphalt paving processes in a cradle to gate scenario, and has been designed to meet the specifications in the UK standard PAS 2050. It can be used by producers of road materials, designers and contractors to calculate carbon dioxide equivalent (CO2e) emissions associated with bitumen bound mixtures. This tool does not provide default asphalt mixtures, therefore the user must input all the information on asphalt production him/herself. For instance, only the use of primary data for aggregates and filler is permitted. It is also possible to model the use of recycled asphalt, in this case the benefits are attributed to the user of the recycled asphalt.

Strong points

Model is highly adaptable
Calculation of results for different phases of the project
Allows to model the use of reclaimed asphalt planings (RAP)

Weak points

For new elements the user has to manually input CO2 emissions or fuel conumption
Does not allow the modelling of use stage
Limited to flexible pavements

INFOSHEETS IN MORE DETAIL (2)

CEDR_Sustainability_Assessment_Compass_def.xlsm - Excel

Types of geener asphalt included

Type	Datasets	Comment
Warm mix asphalt	No	Can be modelled
Asphalt with RAP content	No	Can be modelled
Asphalt with crumbed rubber	No	Can be modelled
Others	No	

Main impacts included:

Environmental	Costs	Social
Yes	No	No

Specific impacts included:

Environmental	Costs	Social
GHG emissons		

Compatible with:	
PAS2050:2011	Yes

Weighing included?	No
If yes, what kind of weighing?	

INFOSHEETS IN MORE DETAIL (3)

CEDR_Sustainability_Assessment_Compass_def.xlsm - Excel

Life cycle stages included

A1 - Extraction and pre-processing of raw materials	Yes	**Observation**
A2 - Transport to producer	Yes	In the use phase only maintenance is accounted for. The interaction between vehicle and road surface is not considered. Models can include raw material acquisition,transport, processing, processed material transport, road component production, material transport to building site, site preparation, laying and compacting, scheme specific works (project level), maintenance and End-of-Life.
A3 - Production	Yes	
A4 - Transport to building location	Yes	
A5 - Building phase and implementation	Yes	
B - Use stage + maintenance	Yes	
C1 - Demolition / removal	Yes	
C2 - Transport to waste processing facility	Yes	
C3 - Waste processing	Yes	
C4 - Final waste destination	Yes	
D - Recycling	No	

Focus of tool

Road pavement activities (layers of pavement)	No
Road pavement materials (asphalt/concrete)	Yes

Main product categories	**Included?**
Asphalt	Yes
Concrete	No
Groundworks	No
Roads	No
Civil works	No
Railways	No
Waterways	No
Other	No

Scoping aspects

Lifetime expectation info	No
Infrastructure (capital goods included)	Yes
Discount rate (for LCC)	No
Are the data reviewed?	Yes
Uncertainty information available?	No
Tool updating frequency	Unknown, last update 2019

INFOSHEETS IN MORE DETAIL 4)

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When is the tool applicable?

Planning phase	Yes
Acquisition / Procurement procedure	Yes
Realisation	Yes
Monitoring	No

What can you use it for?

Design an asset and evaluate/optimize sustainability	Yes
Analyze and/or optimize product sustainability	Yes
Procurement procedures	Yes
Monitoring of assets	No
Verification of sustainability claims (EPD)	No

To be used by whom

Road owner	Yes
Contracting company	Yes
Product developer	Yes

Examples of major projects which used this tool/dataset

Project name	**Link**