LCA background report

RWS vaarweg- en kribvaksuppletie Waal - Maatregel M3 (zaaknummer 31163438)

RHDHV

Calculation number:	EPD-NIBE-20211222-23822
Generation on:	14-01-2022
Issue date:	
Valid until:	
Status:	in-progress

R<THiNK

powered by nibe

Table of content

1 Verification of the life cycle assessment

CEN standard EN 15804 serves as the core PCR. In compliance with ISO 14040:2006 and 14044:2006.
EPDs of construction products may not be comparable if they do not comply with NEN-EN15804 and additional PCR.

Independent verification of the declaration according to EN ISO 14025:2006.
☐ Internal ☐ External

1.1 STATEMENT EXTERNAL REVIEWER EPD PRODUCT CALCULATION

2 General

2.1 INTRODUCTION

This report for review is a result of a life cycle analysis (LCA) made by using the RETHiNK application. The report is based on the following chapters which correspond to the phases of a LCA.

- Goal and scope definition
- Life cycle inventory
- Impact assessment
- Interpretation

2.2 COMPANY INFORMATION / DECLARATION OWNER

[company has no logo]

Manufacturer: RHDHV

Production Location: VKS Waal M3

Address: VKS Waal M3, 6511 PSNijmegen

E-mail: info@rhdhv.com

Website: www.rhdhv.com

2.3 EPD INFORMATION

EPD for: RWS vaarweg- en kribvaksuppletie Waal - Maatregel M3 (zaaknummer 31163438)

Calculation number: EPD-NIBE-20211222-23822

Generation on: 14-01-2022

Date of issue:

End of validity:

Version NIBE's EPD Application: v2.0

Version Environmental Profile database: v3.07 (2021-11-08)

PCR: NMD Determination method Environmental performance Construction works v1.0 July 2020 incl. amendment oct '20 + feb '21 + okt '21 | EN15804+A1

2.4 CALCULATION BASIS

LCA Method: NMD Det. Meth. v1.0 | set 1 / SBK Det. Meth. v3.0

LCA Software: Simapro 9.1.1

Characterization method: Bepalingsmethode, jan 2021 (NMD 3.3)

LCA database profiles: EcoInvent versie 3.6

Version database: v3.07 (2021-11-08)

2.5 COMPILER LCA

The project team for the drafting this LCA consists the following persons:

Peter Gosselink, adviseur duurzame en circulaire infrastructuur

2.6 USED ABBREVIATIONS

EPD
Environmental Product Declaration

ECI
Environmental Cost Indicator

RSL
Reference service life

LCA
Life Cycle Assessment

NMD
Nationale Milieu Database (Dutch National Environmental Database)

PCR
Product Categorie Rules

SBK
Stichting Bouw Kwaliteit (Foundation for Building Quality)

2 General

3 Goal and Scope Definition

3.1 PURPOSE AND TARGET GROUPS

The purpose of this LCA is to compile environmental data of materials and products used in the built environment. So that the environmental data can be used in calculations of buildings and / or civil works. The purpose of this report is to draw up a review dossier for the product based on the NMD Determination method Environmental performance Construction works v1.0 July 2020. This document defines a standardized method for a LCA in the Netherlands, of a product used in the build environment, in addition to EN 15084+A1. The review dossier is in accordance with EN15804+A1, ISO14040 and ISO14044.

The target groups of this LCA study are: Users of the NMD or programs that use this database, such as BREEAM-NL, GPR gebouw and GPR bouwbesluit, MRPI freetool, DuboCalc, etc..

3.2 FUNCTIONAL AND DECLARED UNIT

keer

Declared unit: piece (p)

Eenmalige projectrealisatie

3.3 ENVIRONMENTAL PROFILE AND RATINGS REPRESENTIVE

The input data are representative for RWS vaarweg- en kribvaksuppletie Waal - Maatregel M3 (zaaknummer 31163438), a product of RHDHV. The data are representative for Netherlands.

3 Goal and Scope Definition

3.4 SCOPE OF DECLARATION

This is a cradle to grave EPD. The life cycle stages included are as shown below:
(X = included, MND = module not declared)

A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	MND	MND	MND	MND	X	X	X	X	X

The modules of the EN15804 contain the following:

Module A1 = Raw material supply	Module B5 = Refurbishment
Module A2 = Transport	Module B6 = Operational energy use
Module A3 = Manufacturing	Module B7 = Operational water use
Module A4 = Transport	Module C1 = De-construction / Demolition
Module A5 = Installation process	Module C2 = Transport
Module B1 = Emissions during use stage	Module C3 = Waste Processing
Module B2 = Maintenance	Module C4 = Final Disposal
Module B3 = Repair	Module D = Benefits and loads beyond the system boundaries
Module B4 = Replacement	

3 Goal and Scope Definition

3.5 CUT-OFF CRITERIA

In the Life cycle assessment the following is included in this study:

Product stage (A1-A3)

The production stage consists of the extraction of raw materials, transportation of the raw materials, processing the raw materials into materials and the production of the product. The required energy for production, external treatments, ancillary materials, packaging material and production emissions are included.

Construction process stage (A4-A5)

This stage consists the transport of the product from production plant to the construction site.

It also includes the loss of material during construction. The additional needed production, transport and end-of-life of the lost material during construction is included.

The end-of-life of packaging material up to the end-of-waste state or disposal of final residues is also included.

The installation of the product including manufacture, transportation and end-of-life of ancillary materials and any energy or water use required for installation or operation of the construction site are taken into account.

Use stage (B1-B3)

This stage consists of the impacts arising from components of the building and construction works during their use.

The stage also covers the combination of all planned technical and associated administrative maintenance actions during the service life to maintain the product installed in a building, in a construction works or its parts in a state in which it can perform its required functional and technical performance, as well as preserve the aesthetic qualities of the product. This will include preventative and regular maintenance activities.

Product replacement (B4) and renovation (B5) only apply when the product is considered in a lifespan (of a building, work , etc.).

Operational water and energy use are not considered.

End of life stage (C1-C4)

When the end of the life stage of the building is reached, the de-construction/demolition begins. This EPD includes de-construction/demolition (C1), the necessary transport (C2) from the demolition site to the sorting location and distance to final disposal. The end of life stage includes the final disposal to landfill (C4), incineration (C3) and needed recycling processes up to the end-of-waste point (C3). Loads and benefits of recycling, re-use and exported energy are part of module D.

The default end-of-life scenarios of the annex (november 2020) to the NMD Determination method v1.0 have been used for the various materials in the product.

Benefits and loads beyond the system boundary (D)

This stage contains the potential loads and benefits of recycling and re-use of raw materials/products. The loads contain the needed recycling processes from end-of-waste-point up to the point-of-equivalence of the substituted primary raw material and a load for secondary material that will be lost at the end-of-life stage.

The loads and benefits of recycling and reuse are included in this module. The benefits are calculated based on the primary content and the primary equivalent.

In addition, the benefits of energy recovery are granted at this stage. The amount of avoided energy is based on the Lower Heating Values of the materials and the efficiencies of the incinerators as mentioned in the NMD Determination method v1.0 or EcoInvent 3.6 (2019).

3.6 TIME PERIOD DATA COLLECTION

22 december 2021

3.7 ALLOCATION

Allocation used environmental profiles / datasets

There is no allocation applied for the environmental profiles / datasets used in this LCA.

3 Goal and Scope Definition

4 Product

4.1 PRODUCT DESCRIPTION

MKI berekening als referentie voor de aanbesteding van het werk:

RWS vaarweg- en kribvaksuppletie Waal - Maatregel M3, zaaknummer 31163438

Confidential information (only visible in this report)

Verwezen wordt naar de Ontwerpnotitie M3 Kribvaksuppletie, met kenmerk BH8088MINT2109221200, op 11 november 2021 opgesteld door RHDHV.

4.2 DESCRIPTION PRODUCTION PROCESS

Confidential information (only visible in this report)

Klantvertrouwelijk

4.3 DESCRIPTION CONSTRUCTION PROCESS

4.4 REFERENCE SERVICE LIFE

RSL Product

Projectlevensduur volgens klanteis.

RSL parts

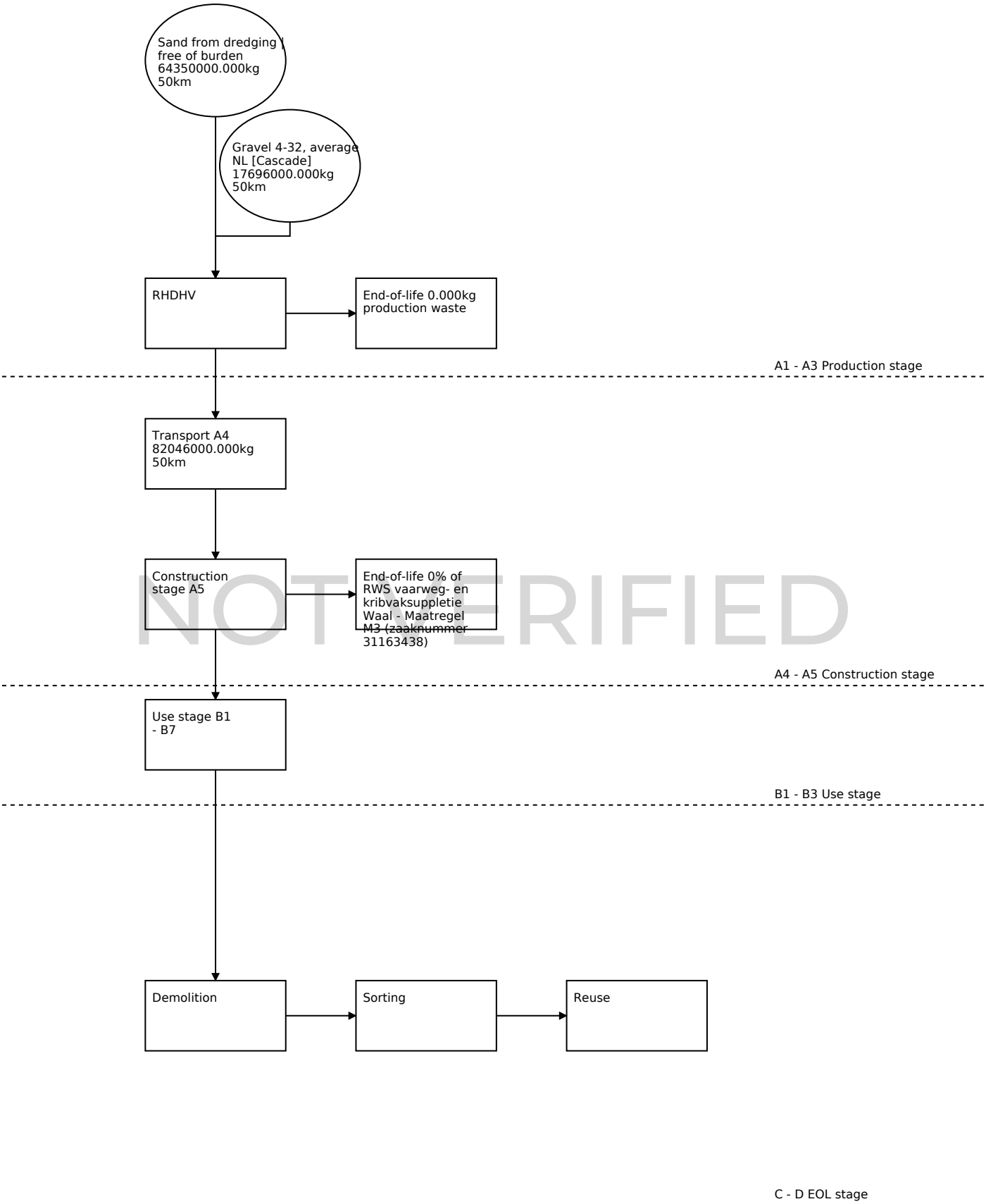
Used RSL in the LCA calculation

Product	RSL [yr]
RWS vaarweg- en kribvaksuppletie Waal - Maatregel M3 (zaaknummer 31163438)	50

Description	Material	RSL [yr]

4 Product

4.5 PRODUCT FLOW DIAGRAM



5 Life Cycle Inventory

5.1 RAW MATERIALS SUPPLY (A1)

To produce the product the following raw material inputs are needed per piece.

Description	Environmental profile / dataset used*	Amount [kg]	Secondary content [%]	Supplier	Comments
Zand	Sand from dredging | free of burden	64350000.000	100.00	Leverancier	Zand nat 2.000 kg/m3
Grind	Gravel 4-32, average NL [Cascade]	17696000.000	0.00	Leverancier	1.650 kg/m3
Total		**82046000.000**			

* A shortened name for the used process/dataset is presented in the report. The complete name of the used dataset is shown at Annex 1.3

5.2 TRANSPORT TO MANUFACTURER (A2)

The raw materials are transported from the production location and/or mining location of the supplier to the production location of the manufacturer. The following transport conveyances and distances are applicable for suppliers of the raw materials.

Supplier	Transport Conveyance 1	Distance 1 [km]	Transport Conveyance 2	Distance 2 [km]	Transport Conveyance 3	Distance 3 [km]
Leverancier	Barge (inland waterways)	50				
Leverancier	Barge (inland waterways)	50				

5.3 PRODUCTION PROCESS (A3)

Energy Consumption

To produce the product there's no energy used

Emissions

To produce the product there are no (significant) emissions to soil, water and/or air caused

External Treatments

To deliver the product to the client no (onetime) packaging materials are used.

Production waste

The following amount of waste is generated during production per piece of the product. The additional needed raw materials, transport to the production plant and end-of-life

5 Life Cycle Inventory

scenario of the production waste are all included in module A3. Detailed information of the used waste scenario(s) can be found at chapter 6 Waste scenarios.

Description	Environmental profile / dataset used*	Amount of production waste [kg]	Secondary content [%]	Supplier	Waste scenario used
Zand	Sand from dredging | free of burden	0.000	100.00	Leverancier	no waste (empty scenario) (NMD ID 26)
Grind	Gravel 4-32, average NL [Cascade]	0.000	0.00	Leverancier	no waste (empty scenario) (NMD ID 26)
Total		**0.000**			

Packaging Materials

To deliver the product to the client no (onetime) packaging materials are used.

Ancillary Materials

For the production of the product there are no ancillary materials used.

5 Life Cycle Inventory

Output flows at Module A3

The waste scenario(s) applicable for the production waste and/or ancillary materials are resulting in the following output flows at module A3:

Description	Not removed (stays in work) [kg]	Landfill [kg]	Incineration [kg]	Recycling [kg]	Re-use [kg]
Production waste					
Zand	0	0	0	0	0
Grind	0	0	0	0	0
Total	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

In the EN15804 is stated that, as a general rule, potential loads or benefits from modules A1-A3 do not appear in module D. Therefore the potential loads or benefits from A1-A3 are declared in module A3. The following table shows the amount of potential loads and/or benefits outside the system boundaries that are taken into account.

When applicable, the primary equivalent accounted as benefit when recycling and/or re-using primary material are stated in chapter 6 Waste scenarios. This chapter also contains the process taken into account for energy recovery for the energy amount as stated in the following table.

Description	Avoided primary material [kg]	Energy recovery [MJ]	Secondary material lost [kg]	Primary equivalent accounted as load*
Production waste				
Zand	0	0	0	
Grind	0	0	0	n.a.

5.4 TRANSPORT TO CONSTRUCTION SITE (A4)

Transport scenario

The following scenario is applicable for transport of the product to the construction site;

Transported mass [kg]	conveyance 1	Distance 1 [km]	conveyance 2	Distance 2 [km]	conveyance 3	Distance 3 [km]
82046000.000	Barge (inland waterways)	50				

5 Life Cycle Inventory

5.5 CONSTRUCTION STAGE (A5)

Input flow(s) construction stage

The following inputs are needed at the construction stage. When applicable, the production of the raw materials, transport to and at the construction site, energy use and end-of-life of the use raw materials during the construction stage are included. The following table shows the needed inputs for the product at the construction stage.

Description	Environmental profile / dataset used*	Amount	Production Waste	Unit	Secondary content [%]	Supplier	Comments
Brandstofverbruik varend werkmaterieel	Diesel, burned in machine (incl. emissions)	20000.000	0.000	l	n.a.	n.a.	Betreft het brandstofverbruik bij de verwerking van zand en grind in de waterbodem, uitgaande van een gemiddeld brandstofverbruik van 250 l/dag per vaartuig en de inzet van: 1x duwboot 25 dagen + 1x ploegschip 5 dagen + 1x kraanschip 5 dagen + 1x beunschip 5 dagen + 1x meetvaarthuig 30 dagen + 2x scheepvaartbegeleiding 5 dagen.

The waste scenario(s) applicable for the raw materials used at the construction stage are resulting in the following output flows at module A5: Detailed information of the used waste scenario(s) can be found at chapter 6 Waste scenarios. The potential loads and/or benefits as a result of energy recovery, recycling and/or reuse are included in module D.

Description	Not removed (stays in work) [kg]	Landfill [kg]	Incineration [kg]	Recycling [kg]	Re-use [kg]
Brandstofverbruik varend werkmaterieel	0.000	0.000	0.000	0.000	0.000
Total	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

Waste flow(s) product

Waste output flows as a result of losses at the construction site is assumed to be 0%.

5.6 USE STAGE (B1)

5.7 MAINTENANCE (B2)

No maintenance is needed to fulfil the requirements as stated in the applicable functional unit (3.2) and to achieve the reference service life as stated in chapter 4.4.

5 Life Cycle Inventory

5.8 REPAIR (B3)

No repairs are needed to fulfil the requirements as stated in the applicable functional unit (3.2) and to achieve the reference service life as stated in chapter 4.4.

5.9 DE-CONSTRUCTION, DEMOLITION (C1)

No inputs are needed for the product at the de-construction / demolition phase

5.10 TRANSPORT END-OF-LIFE (C2)

The applicable end-of-life transport scenarios are in detail described in chapter 6 Waste scenarios.

5 Life Cycle Inventory

5.11 WASTE PROCESSING (C3)

After demolition and transport of the waste streams to the applicable waste processing routes, the waste is processed for final disposal or recycling and/or reuse. The calculated quantities and the applicable end-of-life scenario are shown below. The processes taken into account for waste processing are shown in chapter 6.3.

Description	Incineration [kg]	Recycling [kg]	Used waste scenario

5.12 FINAL DISPOSAL (C4)

Some waste streams are not used for reprocessing or energy recovery but are final disposed. This is the case when the material is landfilled and/or when the product is not removed and stays in the work. The following amounts per final disposal stream are applicable for the product. The processes taken into account for the type of final disposal can be found at the applicable waste scenario in chapter 6.4.

Description	Not removed (stays in work) [kg]	Landfill [kg]	Used waste scenario

5.13 BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY (D)

When materials are recycled or reused a benefit may be taken into account in module D. According to the EN15804 the benefit may only be calculated for the net primary input that comes available for the next life cycle stage by recycling or re-use (net output flow of secondary material). The amount assumed for recycling and re-use are listed per input in the table below. The amount of avoided production of primary material is also shown.

In chapter 6.6 the avoided primary equivalent and the assumed Q factor (Qr out / Qsub) are listed per waste scenario. In chapter 6.5 the additional needed loads to equal the avoided primary equivalent after reaching the end-of-waste state are declared.

Description	Recycling [kg]	Re-use [kg]	Avoided primary material [kg]	Used waste scenario
Raw materials				
Construction stage				

The following amount of energy (MJ) is taken into account for energy recovery by incineration of the materials. The avoided energy mix and efficiency of energy recovery taken into account is shown at chapter 6.7.

5 Life Cycle Inventory

Description	Lower heat value [MJ/kg]	Energy recovery [MJ]	Used waste scenario
Raw materials			
Construction stage			

When a secondary material is lost at the end-of-life stage, by leaving the product in the construction work/ground, incinerating or landfilling a load for the lost secondary material must be taken into account in module D. The following table shows the amount of secondary material lost and when applicable which primary equivalent is taken into account for calculating the load to address to module D.

Description	Secondary material lost [kg]	Primary equivalent accounted as load
Raw materials		
Construction stage		

6 Waste Scenarios

In this chapter the used waste scenarios for waste generated during production, construction, use and end-of-life are shown. Per needed input at every stage of the life cycle assessment the used waste scenario is declared. The used scenario design, used processes for impacts and other assumptions are listed per paragraph in this chapter.

6.1 SCENARIO DESIGN

The following scenario design is used per type of waste scenario.

Waste scenario	Region	Not removed (stays in work) [%]	Landfill [%]	Incineration [%]	Recycling [%]	Re-use [%]
no waste (empty scenario) (NMD ID 26)	NL	0	0	0	0	0

The following considered transport conveyance(s) and distances per waste flow are used for the (different) waste scenario(s).

Waste scenario	Transport conveyance *	Not removed (stays in work) [km]	Landfill [km]	Incineration [km]	Recycling [km]	Re-use [km]
no waste (empty scenario) (NMD ID 26)	Lorry (Truck), unspecified (default)	0	0	0	0	0

6.2 END OF WASTE POINT

In accordance with the EN15804 all process needed up until the end-of-waste point must be taken into account in module C. In the following table the used end-of-waste point for recycling for each used waste scenario is listed. When not applicable, when for example the scenario consists only of 100% incineration, it is declared at the waste scenario.

Waste scenario	Substantiation End-of-Waste point
no waste (empty scenario) (NMD ID 26)	n.a.

6 Waste Scenarios

6.3 WASTE PROCESSING

The following processes are taken into account for each waste processing type. The applicable amount(s) can be found at chapter 5, where all inventory data is declared.

Waste scenario	Waste processing type	Used environmental profile / dataset*

6.4 FINAL DISPOSAL

For final disposal the following process(es) are considered for the different types of final disposal. The applicable amount(s) can be found at chapter 5, where all inventory data is declared.

Waste scenario	Type of final disposal	Used environmental profile / dataset*

6.5 LOADS BEYOND END-OF-WASTE POINT

When the substituted process for recycling and/or reuse of primary content goes beyond the end-of-waste point. An additional burden should be taken into account in module D for the difference between the end-of-waste point and the substituted process. When applicable, in the following table the additional process taken into account is declared per waste scenario.

Waste scenario	Loads beyond end-of-waste point	Used environmental profile / dataset*

6.6 BENEFITS RECYCLING AND/OR RE-USE

When recycling or reusing a raw material of product a benefit may be taken into account in module D. The following table shows the waste scenario's where recycling is applicable and which process is used as avoided primary equivalent. Also the used Q factor is declared and substantiated.

Waste scenario	Benefit for	Avoided primary equivalent	Q factor (Qr out / Qsub)	Substantiation Q factor

6 Waste Scenarios

6.7 LOADS SECONDARY MATERIAL LOST

When secondary material used in the product is lost, by landfilling or incineration, a load must be taken into account at module D. At the modules where secondary material is lost the amount and primary equivalent counted as load are declared. The following table shows the Q factor used for secondary material lost and the substantiation.

Waste scenario	Q factor (Qr out / Qsub)	Substantiation Q factor

6.8 BENEFITS ENERGY RECOVERY

When waste is used for energy recovery with an overall efficiency that meets the requirements as stated in the EN15804, a benefit may be taken into account in module D. The following table shows the waste scenario where energy recovery is applicable, which energy process is taken into account for avoided energy production and the used electrical en thermal efficiency.

Waste scenario	Environmental profile / dataset used

7 Results

For the impact assessment the characterisation factors of the method Bepalingsmethode, jan 2021 (NMD 3.3). Long-term emissions (>100 years) are not considered in the impact assessment. The results of the impact assessment are only relative statements that do not make any statements about end-points of the impact categories, exceedance of threshold values, safety margins or risks. The following tables show the results of the indicators of the impact assessment, of the use of resources as well as of waste and other output flows.

7.1 ENVIRONMENTAL EFFECTS PER PIECE (P)

Environmental effects	Unit	A1	A2	A3	A4	A5	B1	B2	B3	C1	C2	C3	C4	D	Total
ADPE	Kg Sb	9.10E-2	1.53E+0	0.00E+0	1.53E+0	1.01E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.25E+0
ADPF	Kg Sb	2.50E+2	1.20E+3	0.00E+0	1.20E+3	4.28E+2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.07E+3
GWP	Kg CO2 Equiv.	3.34E+4	1.95E+5	0.00E+0	1.95E+5	6.49E+4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.87E+5
ODP	Kg CFC-11 Equiv.	3.40E-3	2.79E-2	0.00E+0	2.79E-2	1.12E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.04E-2
POCP	Kg Ethene Equiv.	1.79E+1	1.14E+2	0.00E+0	1.14E+2	6.61E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.13E+2
AP	Kg SO2 Equiv.	1.47E+2	1.39E+3	0.00E+0	1.39E+3	4.89E+2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.42E+3
EP	Kg PO43- Equiv.	3.34E+1	3.12E+2	0.00E+0	3.12E+2	1.11E+2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.69E+2
HTP	kg 1.4 DB	1.46E+4	4.72E+4	0.00E+0	4.72E+4	2.40E+4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.33E+5
FAETP	kg 1.4 DB	1.91E+2	1.18E+3	0.00E+0	1.18E+3	3.34E+2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.89E+3
MAETP	kg 1.4 DB	6.37E+5	3.73E+6	0.00E+0	3.73E+6	1.16E+6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.27E+6
TETP	kg 1.4 DB	1.95E+2	2.31E+2	0.00E+0	2.31E+2	3.95E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.97E+2

ADPE=Depletion of abiotic resources-elements | **ADPF**=Depletion of abiotic resources-fossil fuels | **GWP**=Global warming | **ODP**=Ozone layer depletion | **POCP**=Photochemical oxidants creation | **AP**=Acidification of soil and water | **EP**=Eutrophication | **HTP**=Human toxicity | **FAETP**=Ecotoxicity. fresh water | **MAETP**=Ecotoxicity. marine water (MAETP) | **TETP**=Ecotoxicity. terrestric

7 Results

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B3	C1	C2	C3	C4	D	Total
PERE	MJ	5.26E+4	5.85E+4	0.00E+0	5.85E+4	4.88E+3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.74E+5
PERM	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	MJ	5.26E+4	5.85E+4	0.00E+0	5.85E+4	4.88E+3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.74E+5
PENRE	MJ	5.15E+5	2.63E+6	0.00E+0	2.63E+6	9.58E+5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.74E+6
PENRM	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRT	MJ	5.15E+5	2.63E+6	0.00E+0	2.63E+6	9.58E+5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.74E+6
SM	Kg	6.44E+7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.44E+7
RSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	M3	3.20E+2	4.75E+2	0.00E+0	4.75E+2	4.65E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.32E+3
HWD	Kg	3.24E+0	6.47E+0	0.00E+0	6.47E+0	2.46E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.86E+1
NHWD	Kg	3.50E+3	1.17E+4	0.00E+0	1.17E+4	1.07E+3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.80E+4
RWD	Kg	0.00E+0	1.61E+1	0.00E+0	1.61E+1	6.27E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.84E+1
CRU	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MER	Kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EE	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EEE	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

PERE=renewable primary energy ex. raw materials | **PERM**=renewable primary energy used as raw materials | **PERT**=renewable primary energy total | **PENRE**=non-renewable primary energy ex. raw materials | **PENRM**=non-renewable primary energy used as raw materials | **PENRT**=non-renewable primary energy total | **SM**=use of secondary material | **RSF**=use of renewable secondary fuels | **NRSF**=use of non-renewable secondary fuels | **FW**=use of net fresh water | **HWD**=hazardous waste disposed | **NHWD**=non hazardous waste disposed | **RWD**=radioactive waste disposed | **CRU**=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EE**=Exported energy | **EET**=Exported Energy Thermic | **EEE**=Exported Energy Electric

7 Results

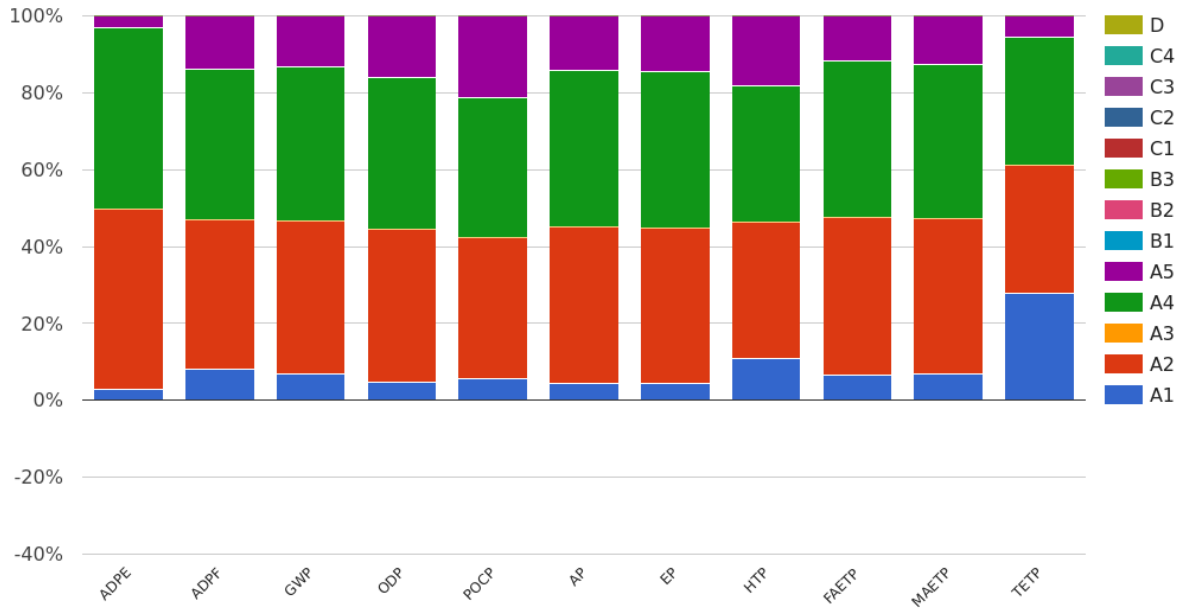
7.2 ENVIRONMENTAL COST INDICATOR PER PIECE (P)

Using the shadow price method, which is presented in the SBK Determination Method (2020), the results are aggregated to the single-point score. The ECI is a relevant valuation method, especially in the Dutch construction sector. In the Netherlands, it is a prerequisite for public tenders. The aim of the indicator is to show the shadow price for environmental impacts of a product or project. The application of single-point scores is an additional assessment tool for eco-balance results. However, it must be pointed out that weightings are always based on a value maintenance and not on a scientific basis (EN 14040). The ECI results are shown in the following table.

Modules EN15804	ECI	Share in total (%)
A1 Raw Materials Supply	s€ 4.030,91	6.8 %
A2 Transport	s€ 23.199,56	39.2 %
A3 Manufacturing	s€ 0,00	0.0 %
A4 Transport from the gate to the site	s€ 23.199,56	39.2 %
A5 Assembly	s€ 8.692,25	14.7 %
B1 Use	s€ 0,00	0.0 %
B2 Maintenance	s€ 0,00	0.0 %
B3 Replacements	s€ 0,00	0.0 %
C1 Demolition	s€ 0,00	0.0 %
C2 Transport	s€ 0,00	0.0 %
C3 Waste processing	s€ 0,00	0.0 %
C4 Final disposal	s€ 0,00	0.0 %
D Reuse/Reovery/Recycling potential	s€ 0,00	0.0 %
ECI per functional unit	**s€ 59.122,28**	

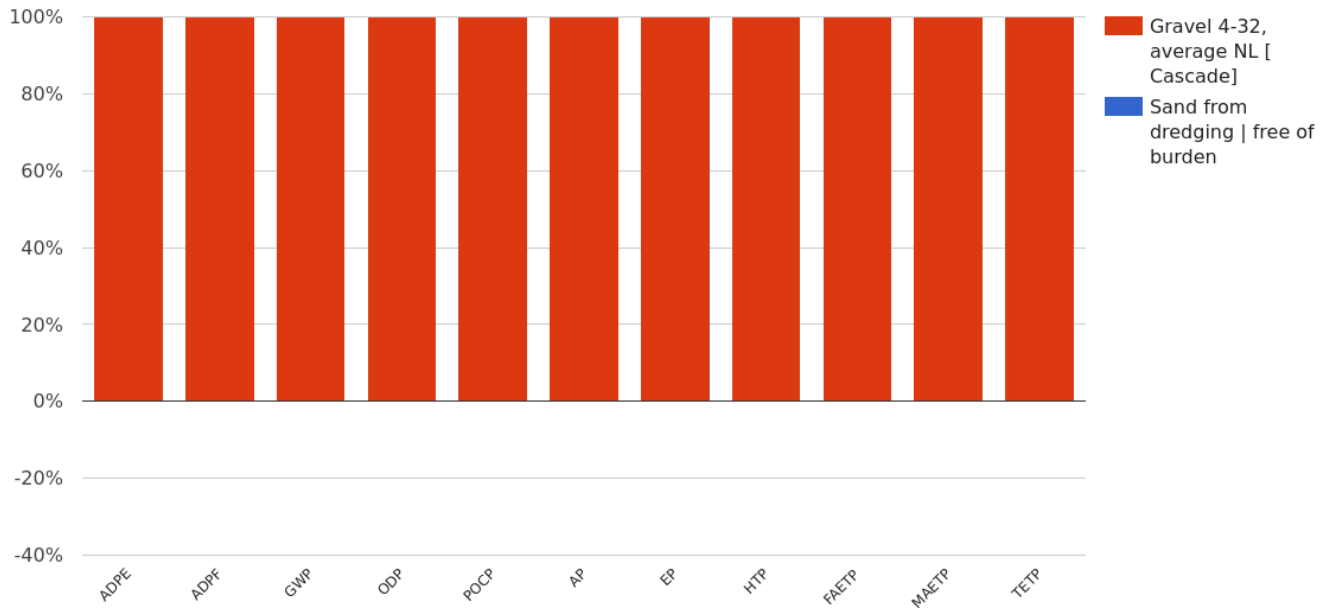
8 Interpretation

8.1 CONTRIBUTION ANALYSIS OF THE MODULES



8 Interpretation

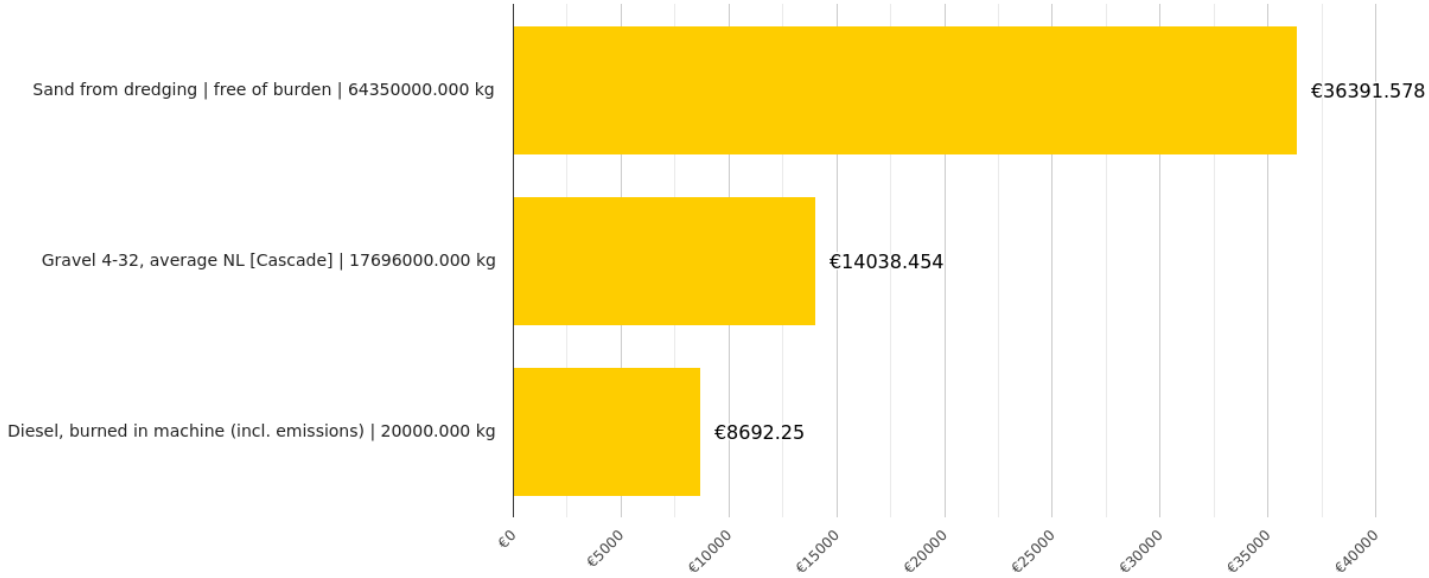
8.2 CONTRIBUTION ANALYSIS OF THE RAW MATERIALS (A1)



8 Interpretation

8.3 CONTRIBUTION ANALYSIS OF THE INPUTS

The following diagram shows the contribution of the inputs, expressed in the Environmental cost indicator. The results per input are the sum of all declared modules.



9 Sensitive analysis

Voor het brandstofverbruik van varend materieel in de bouwfase is als representatief milieuprofiel gehanteerd “Diesel, burned in machine (incl. emissions)". Hoewel het de voorkeur verdient om hier een milieuprofiel voor MDO te hanteren, is daar geen milieuprofiel voor beschikbaar in het systeem.

10 Data Quality

10.1 DATA QUALITY OF THE LIFECYCLE INVENTORY DATA

Description	Determination matter	Data source
Raw material(s)		
Zand	average product	RETHiNK
Grind	average product	RETHiNK
Construction stage		
Brandstofverbruik varend werkmaterieel	average product	RETHiNK

10.2 APPROACH OF SUPPLIERS FOR LCA DATA

Supplier	supplier approached for company-specific environmental data?	manner in which the supplier is approached	Received document type
Leverancier	no		

10.3 USED PROCESSES

Description	Shortened name in application	Processes used	Source	Third-party verified	Comments
Raw material(s)					
Zand	Sand from dredging | free of burden	Empty process, free of burden	n.a.	no	
Grind	Gravel 4-32, average NL [Cascade]	Grind 4-32, in en nabij Nederland geproduceerd door Cascade-leden (A1-A3), c2	Cascade	yes	
Construction stage					
Brandstofverbruik varend werkmaterieel	Diesel, burned in machine (incl. emissions)	0095-pro&Diesel, gasolie, gebruik, liter (o.b.v. 35,8 MJ Diesel, burned in building machine {GLO}| processing | Cut-off, U)	NMD/EcoInvent 3.6 (2019)	no	The combustion emissions of diesel are included in the environmental profile.

11 References

ISO 14040
ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006

ISO 14044
ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14040:2006

ISO 14025
ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804
EN 15804:2012-04+A1 2013: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

SBK-verification protocol
SBK-verification protocol – inclusion data in the Dutch environmental database, Final Version 3.0, January 2019, SBK

NMD Determination method
NMD Determination method Environmental performance Construction works v1.0 July 2020, foundation NMD