Strukton Group
Chain analysis of circular concrete overhead line poles

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Chain analysis of circular concrete overhead line poles

Strukton Group

Reporting in the context of the CO2 Performance Ladder

March 2025

Progress 2025 in collaboration with M.Vos of MVos Advies

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1 Introduction

In order to gain more insight into the CO_2 emissions associated with the production of concrete poles for the overhead line and as part of the CO_2 performance ladder, Strukton Groep N.V. is conducting an analysis of a GHG (Green House Gas) generating chain. This document describes the chain analysis of the production, transport, use and removal of concrete overhead line poles by Strukton Groep N.V. and its chain partners. This chain analysis was drawn up on behalf of MVos Advies on behalf of Strukton Groep N.V.

1.1 Reading guide

In this report, Strukton presents the chain analysis of circular concrete overhead line poles. The structure of the report is as follows:

Chapter 1	Describes what a chain analysis is, the activities and positioning of Strukton Group in the field of corporate social responsibility.
Chapter 2	Justifies the choice of the chosen product category and also describes the scope
Chapter 3	Describes the chain of concrete, names the chain partners and provides background information about the various production locations
Chapter 4	Quantifies CO_2 emissions in the chain
Chapter 5	Contains the objectives and measures for further reduction of CO_2 emissions in the chain of circular concrete overhead line poles
Chapter 6	Describes progress in 2023
Chapter 7	Displays the resources used

1.2 Activities Strukton Groep N.V.

Strukton is active in the design, construction and maintenance of a sustainable infrastructure, both above and below ground, using high-quality technology. Strukton's strength lies in the combination of civil engineering and rail fields. With more than 4,300 employees in Europe, Strukton achieved a turnover of 1.3 billion euros in 2022.

Strukton's activities are housed in various operating companies, namely:

Strukton Rail	Maintenance, management, renewal and construction of track, integration with other public transport systems
Strukton Infra Specials	Design, construction, management and maintenance of civil infrastructure (e.g. civil engineering structures: bridges, tunnels, locks and viaducts)
Strukton Roads & Concrete	Design, construction, management and maintenance of civil infrastructure (roads, civil engineering works, concrete construction
Portfolio companies	Various specializations

In addition, Strukton has rail activities in Italy, Belgium, Sweden and Denmark.

1.3 What is a chain analysis

A chain analysis is created by considering the business process and the value chain, with the aim of mapping the CO_2 emissions in the process. This concerns the CO_2 emissions that are the result of, for example, the purchased materials or the costs of use of the product by the customer. In short, emissions that are not directly caused by their own company, but by suppliers or customers. The *entire chain* refers to the entire life cycle of the product: from extraction of the raw material to the end of its life.

1.4 Purpose of the chain analysis

The main objective for conducting this chain analysis is to identify CO_2 reduction opportunities, define reduction targets and monitor progress.
Based on the insight into the scope 3 emissions and the chain analysis, a reduction target is formulated. Within the energy management system that has been introduced, there is an active focus on reducing scope 3 emissions.

Providing information to partners within the own chain and industry peers who are part of a similar chain of activities is an explicit part of this. Based on this chain analysis, Strukton will take steps to involve partners within its own chain in achieving the reduction targets.

1.5 Strukton's sustainability policy and its place in CO_2

Strukton does business in a socially responsible way. Strukton is actively contributing to the reduction of CO_2 emissions, for example by reducing the use of fossil fuels and generating its own energy on the projects.

Strukton Group's sustainability policy is based on the Sustainable Development Goals, drawn up by the UN. Specifically, we focus on the SDGs in which we can make a difference, namely: 7, 8, 9, 12, 13, 15 and 17. The company's own operations must therefore meet strict sustainability requirements. We see this reflected in projects, innovations and collaborations with customers and suppliers in which we look for sustainable solutions. Since 2010, Strukton has been certified as a company on step 5 of the CO_2 performance ladder, the highest possible level. Part of level 5 is actively managing CO_2 reduction in scope 3 emissions by means of a chain analysis.

1.6 What are portals

Catenary gantries ensure that the catenary remains suspended above rails at the correct height. Nowadays the portals are usually made of steel, but portals of reinforced concrete are also common. There are different types of gantries that differ from each other in construction, dimensions and material depending on the situation. Along single track there are generally loose overhead line poles with a steel or aluminium arm, the overhead line poles described in this chain analysis. There are steel or concrete portals over double track, which are made up of two erecting poles and a beam.

1.7 Professional support

The chain analysis in this report was drawn up with the support of Arthur Kok of Coning Adviesgroep. The update in September 2024 was drawn up with the support of Martin Vos of MVos Advies.
This professional external support meets requirement 4.A.3 of the CO_2 Performance Ladder.

2 Scope 3 emissions & choice chain analyses

The business activities of the Strukton Group are part of a chain of activities. For example, materials that are purchased must first be produced (upstream) and the transport, use and processing of delivered "products" or "works" goes hand in hand with energy consumption and emissions (downstream).

2.1 Selection of chains for analysis

In accordance with the requirements of the CO2 Performance Ladder, Strukton must draw up two chain analyses from the emission categories with the highest CO2 emissions. Strukton has previously carried out a chain analysis of ballast material. This is a body of crushed stone (ballast material) in which the sleepers of a railway are embedded. The roadbed provides stability, dampens vibrations and drains excess rainwater. For the second chain analysis, circular concrete overhead line poles for the overhead line were chosen, hereinafter referred to as: Circular concrete overhead line poles.

An important criterion for certification on step 5 is to provide insight into Strukton's Scope 3 emissions. In the document "Quantitative scope 3 analysis" the most material Scope 3 emission categories have already been mapped. In this analysis, concrete only comes in 8th place. Nevertheless, Strukton is of the opinion that the choice for circular concrete overhead line poles is justified. This choice is substantiated as follows:

1. Extension poles are usually made of steel. In addition, there are also concrete poles. Circular concrete overhead line poles will reduce the number of steel overhead line poles. This directly affects the category with the highest scope 3 emissions, namely "*Purchased goods and services: Steel*". While circular concrete erect piles will replace the older concrete erect piles, Strukton also expects to achieve a reduction in CO2 emissions in the chain due to circularity.
2. In the past, chain analyses have been made on rails and cables. Due to a lack of space within the regulations, no significant reduction could be achieved here.
3. Several parties within Strukton are involved in the chain of circular concrete overhead line poles. Therefore, it is expected that this choice will increase employees' awareness of sustainability. The parties involved within Strukton are: Strukton Rail, Strukton Prefab Beton and GBN Group.
4. In (circular) concrete overhead line poles, steel is (for the time being) an important part of the structure, namely the reinforcement of the concrete.

Strukton will actively collaborate with its chain partners and offer them sustainable alternatives in the field of catenary gantries. In addition to the parties involved (Strukton Rail, Strukton Prefab Beton and GBN Group), ProRail is the most important external chain partner.

2.2 Scope chain analysis

In order to determine the CO2 emissions in the value chain of the circular concrete overhead line poles, it must first be determined which chain steps this value chain consists of and which of these steps are part of the analysis.

The scope of the chain analysis in this report covers the production phase, construction phase, use phase, demolition and processing phase and reuse and/or recovery of materials from circular concrete overhead line poles.

In this chain analysis, the CO_2 emissions for both the steel erect piles and the reinforced concrete erect piles are mapped out. These results are then compared with the CO_2 emissions of circular concrete overhead line poles with fiberglass reinforcement.

In order to determine what this influence is and how much CO_2 emissions are caused in the life cycle of a circular concrete erecting pile, the analysis will partly focus on a pilot project that has already been carried out on circular concrete overhead line poles in Steenwijk.

2.3 Primary and secondary data

This chain analysis uses both primary data provided by Strukton and ProRail, as well as secondary data from scientific research. The primary data consists mainly of data on the different types of overhead line poles, including reports and LCA calculations.
The secondary data mainly consist of the calculations for the various chain steps and the estimation of the transport distances.

2.4 Allocation data

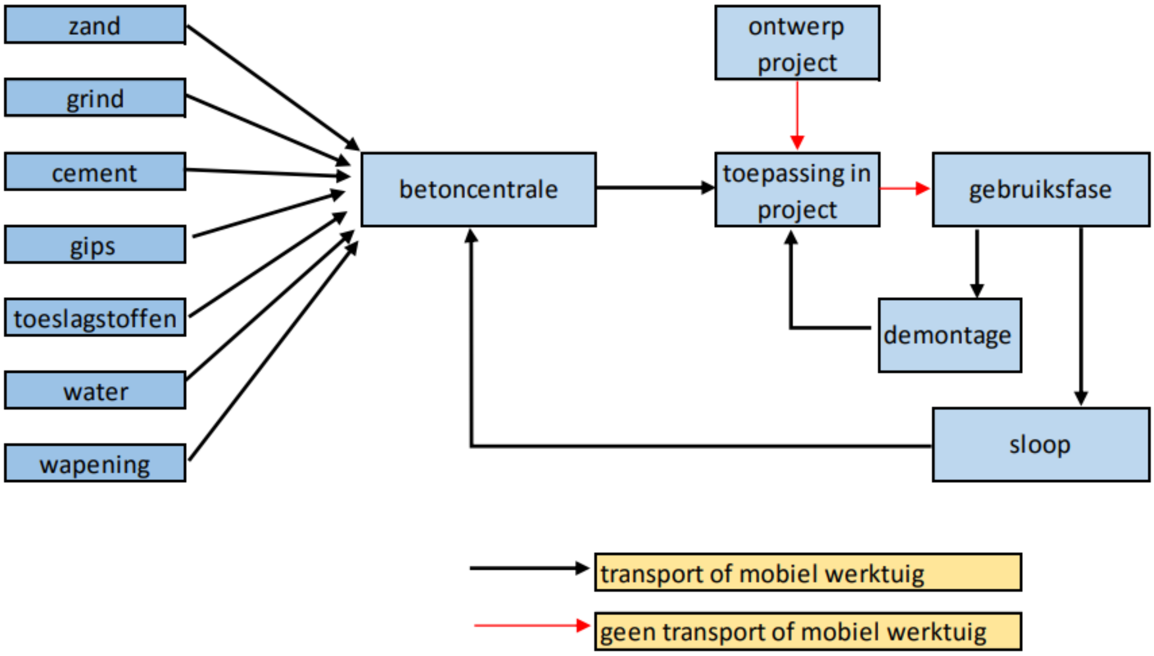
No use is made of data allocation.

3 Value chain

3.1 Description of the chain of the concrete erecting pile

The life cycle of concrete is shown schematically below.

Figure 1 – Schematic representation of the life cycle of concrete



The first step in the chain is the design phase. Because we cannot exert much influence in this phase, it is not taken into account. The following chain steps do fall within the scope:

Extraction of raw materials	Concrete consists mainly of gravel, sand, cement and reinforcing steel. In addition, various additives can be added. Reinforcement steel requires iron ore and carbon. All these raw materials must first be extracted. The fiberglass reinforcement consists of several components.
Transport of raw materials to production location	The raw materials are transported to the production location. Transport can be done by ship, train or truck.
Production	The primary raw materials are made into basic or end products. End products are, for example, precast concrete elements.
Transport of basic or finished products to project location	Transport to the project site is usually done by truck.
Application in the project	In the case of prefabricated elements, the product is assembled at the project site. In other cases, the end product will be produced on site from basic products.

Use	The lifespan of a concrete erecting pile is at least 80 years (as requested in ProRail's OHD). Little to no maintenance is required during the use phase.
Dismantling and demolition	At the end of the life of the concrete pile, the pile is dismantled. The concrete can be used as granulate in various applications. Reinforcing steel is fully recycled. The concrete with fiberglass reinforcement can be recycled as granulate after removing the fiberglass reinforcement (by means of crushing).

3.2 Chain steps steel erect pile

The chain steps are largely the same as those of concrete overhead line poles.

Extraction of raw materials	Primary steel requires iron ore and carbon. The mining of iron ore takes place both in Europe and in other continents (such as South America). Because iron and steel are recycled on a large scale, we can also name iron scrap as a raw material.
Transport of raw materials to production location	The raw materials are transported to the production location. This can be Tata Steel or another steel producer. Transport can be done by ship, train or truck.
Production	The primary raw materials are used to make products from steel.
Transport of basic or finished products to project location	Transport to the project site is usually done by truck.
Application in the project	Finally, the end product is assembled at the project site.
Use	The lifespan of a steel erector is at least 80 years (as requested in ProRail's OHD). During the use phase, no maintenance is required if piles are used without conservation. If posts with conservation are used, they are painted every 20 or 25 years (i.e. 3 to 4 times during their lifetime).
Dismantling and demolition	At the end of the service life of the steel extension post, the post is disassembled. Steel components that are still reusable can be given a second life. The rest is recycled.

4 Quantifying emissions

Based on the description of the chain as shown in chapter 3, it was determined for each chain step how much CO2 is emitted during the various phases of the life cycle of concrete and steel overhead line poles.

4.1 Steel extension poles

The following LCA report was drawn up in 2020 on behalf of ProRail: *LCA Report category 3 data National Environmental Database – Overhead Line Rail*. In this report, environmental profiles have been drawn up for different variants of steel overhead line poles.

Table 1 – System boundaries (X: Module included in LCA study, ND: module not declared)

Production phase			Construction phase		Usage phase					Demolition and processing phase				Next production system
A1	A2	A3	A4	A5	B1	B2	B3	B4	B7	C1	C2	C3	C4	D
Extraction of raw materials	Transport	Production	Transport	Construction and installation	Use	Maintenance	Repair	Replacements	Alterations	Demolition	Transport	Waste management	Final waste processing	Reuse, recovery and recycling options
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

In the LCA report, the LCA is calculated for the following 5 variants of the steel erector with base plate.

Table 2 - LCA Report category 3 data National Environmental Database – Overhead Line Rail

Variant of the extension pole	GWP	Kg CO2 / m	Kg CO2 / pile
Extension pole 220A with base plate 003 per meter	1.64E+02	164	1.361
Extension pole 240A with base plate 003 per meter	1.88E+02	188	1.560
Extension post 240B with base plate 003 per meter	2,45E+02	245	2.034
Extension post 300B with base plate 003 per meter	3.27E+02	327	2.714
Extension post 300B with base plate 004 per meter	3.32E+02	332	2.756

For this chain analysis, we will assume *erect pile 240B with base plate 003*, because the CO2 emissions of this pile are closest to the average value of the 5 piles. To quantify CO2 emissions, we use the data from the aforementioned LCA report.

Figure 2 – Environmental profile set 1 Extension post 240B with base plate 003 per metre

Opzetpaal 240B met voetplaat 3
Tabel 24 Milieuprofiel set 1 Opzetpaal 240B met voetplaat 003 per meter

Impact category	Eenheid	Totaal	A1	A2	A3	A4	A5	B	C1	C2	C3	C4	D
1 abiotic depletion, non fuel (AD)	kg Sb eq	2,08E-02	2,64E-02	3,52E-05	8,39E-05	4,06E-06	7,97E-04	0,00E+00	2,55E-06	1,78E-06	0,00E+00	1,23E-08	-6,52E-03
2 abiotic depletion, fuel (AD)	kg Sb eq	1,84E+00	1,65E+00	9,26E-02	6,53E-01	2,67E-02	1,08E-01	0,00E+00	5,24E-02	4,68E-03	0,00E+00	1,06E-04	-7,52E-01
4 global warming (GWP)	kg CO2 eq	2,45E+02	2,40E+02	1,24E+01	8,79E+01	3,79E+00	1,54E+01	0,00E+00	7,57E+00	6,25E-01	0,00E+00	8,52E-03	-1,23E+02

An average erecting pole is 8 to 8.6 meters high. We assume the average height of 8.3 meters.
Per metre of erecting pile, the 'global warming' is 2.45E+02 kg CO2 eq (see figure 2). This corresponds to 245 kg of CO2 per metre. Total per erector pole this is 8.3 * 245 kg = 2033.5 kg CO2. The lifespan of the steel erector is 50 years.

4.2 Concrete piles

Most concrete overhead line poles are decades old and a large part of them will have to be replaced in the coming years. Nowadays, the old concrete poles are usually replaced by poles made of steel.

With the help of the Green Concrete design tool, Strukton has made a calculation of traditional concrete overhead line poles. The results of the calculation are shown below.

	A1	A2	A3	Production	C2	C3	C4	D	Total
ECI	60,65	2,28	0,105	63,04	1,74	0,353	0,0021	- 5,34	59,81
GWP	561,5	19,34	0,849	581,69	14,45	3,414	0,1519	-42,58	557,2

Source: Appendix 1

In addition to the calculation for the traditional erecting pile, a calculation was also made of a concrete erecting pile with circular gravel.

	A1	A2	A3	Production	C2	C3	C4	D	Total
ECI	33,74	4,59	0,226	38,56	3,74	0,755	0,0035	- 3,57	39,52
GWP	373,8	38,56	1,485	413,85	31,01	7,310	0,247	-28,04	424,2

Source: Appendix 2

In addition to the calculation for the traditional erecting pile, a calculation was also made of a concrete erecting pile with circular concrete granulate.

	A1	A2	A3	Production	C2	C3	C4	D	Total
ECI	51,31	2,26	0,104	53,67	1,74	0,35	0,0021	- 5,33	56,4
GWP	422,2	37,94	0,838	460,98	14,45	3,41	0,152	-42,58	416,3

Source: Appendix 3

Finally, a calculation was also made for a concrete erecting pile with circular raw material and fiberglass reinforcement.

	A1	A2	A3	Production	C2	C3	C4	D	Total
ECI	45,76	2,1	0,105	47,96	1,556	0,318	0,0014	-0,99	48,86
GWP	355,5	17,6	0,849	373,9	12,92	3,075	0,0099	-7,73	382,3

Source: Appendix 4

Summary

The table below summarises the values of the various variants. This shows that the concrete sustainable variants have lower emissions over the entire lifespan.

	Global Warming Potential (GWP in kg)	Reduction Compared to steel	Reduction compared to traditional concrete
Steel extension pole	2.033		
Concrete pile (traditional)	557	72,6%	
Concrete pile (circular gravel)	424	79,1%	23,9%
Concrete pile 100% concrete granulate	416	79,5%	25,3%
Concrete pile (circular + fiberglass reinforcement)	382	81,2%	31,4%

5 Strukton's objectives

5.1 Reduction targets for 2023-2030

Strukton has two objectives. A target on downstream CO2 emissions, accompanied by the sale of products; and a target on upstream CO2 emissions, coupled with the emissions in the chain of the circular concrete overhead line poles.

Downstream CO2 *emissions target:*
In total, about 5000 erecting poles need to be replaced in a short time. This is not specified, so we assume 5 years. Strukton Rail's objective is to construct all 5000 overhead line poles in circular concrete. Strukton Rail has a market share of approximately 20%, and we expect to be able to replace 1000 concrete/steel overhead line poles ourselves with circular concrete overhead line poles, approximately 200 overhead line poles per year. This allows us to make an impact of a total of 1282 tonnes of CO2 in total or 256.4 tonnes of CO2 per year.

Target upstream CO2 *emissions:*
Within the value chain regarding the production and commissioning of circular concrete overhead line poles, we will reduce CO2 emissions by 55% in 2030 compared to 2023.

5.2 Reduction measures 2023 - 2030

In order to reduce CO2 emissions in the chain, Strukton will implement CO2 reduction measures in the various phases within the chain in the years up to and including 2030. Below are the measures listed with the intended reduction potential. Table 3 shows the planning of the reduction measures and their effect.

A1 Current emissions: 422.3kg CO2

- Replacing cement with low-CO2 cement substitutes. We replace 20% of the cement for Circument: 23% of CO2 emissions come from CEMIII and we can reduce that by 20%. Pilots are now being done with replacement up to 50%. Intended effect: 7.5% reduction in the chain.
- Replacing reinforcing steel with glass weasel reinforcement. Reinforcing steel accounts for about 50% of the CO2 emissions in phase A1. Replacement for alternative reinforcement reduces approximately 33%. This is already being used in other products. Intended effect: 10.8% reduction in the chain.

A2 Current emissions: 19.4kg CO2 (74km – 2 tonnes)

- We can do the transport by rail to Utrecht, but with a transshipment in between. This means that part of it still has to be transported by axle. Intended effect: 0.6% reduction in the chain.
- We expect to be able to do the transport by rail to Roosendaal in a few years. This can be done entirely by rail, without a transshipment. Intended effect: 2.1% reduction in the chain.
- Transport by axle electric. Intended effect: 0.2% reduction in the chain.

A3 Current emissions: 0.8kg CO2

- By making the production halls more sustainable, we can completely reduce CO2 emissions in this phase. Intended effect: 0.1% reduction in the chain.

A4 Current emissions: 10.5kg CO2 (50km - 2 tonnes weight)

- Transport by rail instead of by axle. Intended effect: 1.5% reduction in the chain.
- Transport by axle electric, transhipment also electric. Intended effect: 0.3% reduction in the chain.

A5 Current emissions: 107.25kg CO2

Current machines needed for construction run on diesel as standard. This will first be replaced by HVO50 and then switched to electric equipment (battery-electric or hydrogen-electric).

- HVO50 biofuel. Intended effect: 6.75% reduction in the chain.
- Electrical (green) equipment. Intended effect: 3.3% reduction in the chain compared to reduction as a result of the use of HVO100.

C1 Current emissions: 107.25kg CO2

Current machines needed for construction run on diesel as standard. This will first be replaced by HVO50 and then switched to electric equipment (battery-electric or hydrogen-electric).

- HVO50 biofuel. Intended effect: 6.75% reduction in the chain.
- Electrical (green) equipment. Intended effect: 3.3% reduction in the chain compared to reduction as a result of the use of HVO100.

C2 Current emissions: 14.5kg CO2

Transport by axle electric. Intended effect: 2.3% reduction in the chain.

C3 Current emissions: 3.4kg CO2

A HAS machine is used to separate materials. We want to electrify these when they are replaced. Intended effect: 0.5% reduction in the chain.

No reduction measures have been identified for phase C4 and phase D.

5.3 Planning reduction measures

Table 3 below shows a breakdown of all reduction measures per phase and their intended reduction. The planning of the reduction measures in the chain of circular concrete overhead line poles will be carried out in the years up to and including 2030. Table 3 gives an indication of the years in which (parts of) the measures will be implemented and the calculated reduction.

Table 3 – Planning of CO_2 reduction measures and their effect up to and including the year 2030

Phase	Measure	2023	2024	2025	2026	2027	2028	2029	2030	*Sub*	Total
A1	Apply Circument			1%	2%	2%	2,5%			*7,5%*	**18,3%**
	Research innovative reinforcement						*n.a.*	*n.a.*	*t.b.a.*	*0,0%*	
	Alternative reinforcement				3,6%	3,6%	3,6%			*10,8%*	
A2	By rail to Utrecht	0,2%	0,2%	0,2%						*0,6%*	**3,0%**
	By rail to Roosendaal					0,7%	0,7%	0,7%		*2,1%*	
	Transport elec. per axle					0,1%	0,1%	0,1%		*0,3%*	
A3	Making production halls more sustainable					0,1%				*0,1%*	**0,1%**
A4	Transport by rail	0,5%	0,5%	0,5%						*1,5%*	**1,8%**
	Transport elec. per axle				0,1%	0,1%	0,1%			*0,3%*	
A5	Apply HVO50	2,25%	2,25%	2,25%						*6,75%*	**13,35%**
	Electrical equipment			2,2%	2,2%	2,2%				*6,6%*	
C1	Apply HVO50	2,25%	2,25%	2,25%						*6,75%*	**13,35%**
	Electrical equipment			2,2%	2,2%	2,2%				*6,6%*	
C2	Transport elec. per axle				0,8%	0,8%	0,8%			*2,4%*	**2,4%**
C3	Electrical recycling system				0,5%					*0,5%*	**0,5%**
Total		**5,2%**	**5,2%%**	**10,6%**	**11,4%**	**11,8%**	**7,8%**	**0,8%**	**0,0%**		

6 Progress 2024

6.1 Alterations

- In 2024, we will have improved the chain analysis with data from the Green Concrete design tool. This makes traditional concrete more comparable with the various alternatives. We have therefore adjusted the figures where necessary, so that a better picture emerges of emissions and possible reductions.
- The objectives have not changed, but with the adjustments in the calculation, they have been better substantiated.
- The Strukton Prefab part where the development is taking place has been sold. An agreement has been concluded with the buying party as part of a permanent collaboration for circular concrete.

6.2 Reductions achieved

Strukton has drawn up this chain analysis based on the ambition to install approximately 200 circular concrete overhead line poles per year. Strukton Rail is ready for this; however, this product is not yet included in ProRail's SPC. This means that the product may not yet be used in projects. However, six circular concrete overhead line poles were installed as a trial in 2023 with the permission of ProRail.

Of course, not being allowed to use the circular concrete overhead line poles in projects has a major impact on the progress of this chain analysis. Strukton is therefore undertaking various activities to include ProRail in the development of circular concrete. For example, in March 2024, Strukton, in collaboration with ProRail, took samples from the previously installed erect piles (and circular foundations) to test them 'destructively' and thus map out the quality. This led to the conclusion that the circular concrete has a lifespan of at least 80 years; similar to steel.
ProRail is also subjecting the elements to various tests. In addition, in April 2024, Strukton invited a delegation from ProRail (with a background in sustainability, tender management and system specialists) to the workshop in Zutphen, where Strukton also installed a circular concrete erecting pile.
Strukton is testing glass weasel reinforcement as a sustainable alternative to steel reinforcement. An initial shredder test has also been carried out to see how the fibreglass reinforcement can best be removed. This test gives rise to follow-up tests to optimally remove the fiber optics and remove health risks.
As a result of the various tests, Strukton held several discussions with ProRail (see presentation of the meeting in Zutphen in April and the report of the online meeting in December). In the last meeting, ProRail promised to take circular concrete to the system managers' meeting, with a list of preconditions and tests as the desired output. Catenary products are also part of ProRail's sustainable annual plan for 2025 and concrete and catenary products have been identified as spearheads for ProRail in the context of the transition paths 'Rail' and 'Artworks'. Circular concrete was also one of the topics in the Week of the Circular Economy, in which Strukton colleagues and external parties thought together about how to get the client on board.
Strukton hopes that such activities will contribute to the eventual inclusion of circular concrete overhead line poles (and other elements) in ProRail's SPC. Then a large number of circular concrete overhead line poles can still be installed in the future.

Below we describe the progress achieved per phase:

Phase A1 In 2024, the investment in the new concrete recycling facility was obtained. Construction has started on the new plant for recycling old concrete elements. With the new installations, various replacement raw materials are extracted from the old concrete; namely gravel, sand and cement substitutes. The latter in particular provides a great saving when making new concrete. It is already possible to use 20% cement substitute. Work is now underway on concrete with a cement replacement of up to 50%. It is expected that the planned reduction will be achieved and possibly greater by 50% cement replacement.

In 2025, the development of a circular concrete top beam will also start. This can be used to make a fully circular concrete portal.

Phase A2

- In 2024, 80% of transport to the production site in Utrecht was done by truck and 20% by rail
- With 200 circular erecting poles per year and 100% transport by rail, 0.7% CO2 in the chain would be reduced

Phase A3 *For 2024, no progress in CO2 reduction can be reported for this phase.*

Phase A4

- In 2024, 80% of the transport from the production site in Utrecht to the project site was done by truck and 20% by rail.
- With 200 circular overhead line poles per year and 100% transport by rail, 1.7% CO2 in the chain would be reduced.

Phase A5 The goal was to reduce CO2 emissions in the chain by 4.5% by 2024 by switching to HVO100 for the equipment used for construction. In 2024, HVO50 was used within Strukton Rail for the use of the rollers and HVO100 for the hybrid aggrega(s). The CO2 reduction achieved in the chain is 2.25%.

Phase C1 The goal was to reduce CO2 in the chain by 4.5% by 2024 by switching to HVO100 for the equipment used for the removal of old overhead line poles. In 2024, HVO50 was used within Strukton Rail for the use of the rollers and HVO100 for the hybrid aggrega(s). The CO2 reduction achieved in the chain is 2.25%.

Phase C2 *For 2024, no progress in CO2 reduction can be reported for this phase.*

Phase C3 In 2024, it was announced that the full electrification of the recycling process has been started, according to plan. At the moment, the entire installation has been running on HVO100 for a number of years and the CO2 emissions are captured so that they can be used. The planned reduction is expected to be achieved in 2026.

6.3 Summary

Strukton has drawn up this chain analysis with the aim of replacing a large number of old erect piles with circular concrete erect piles with significantly lower CO2 emissions in the chain.

Unfortunately, circular concrete erect piles have not yet been included in ProRail's SPC, which meant that the product could not be used in the 2024 projects. In 2023, only six circular concrete overhead line poles were installed as a trial. This trial is being monitored and so far the results are good. In practice, the concrete erector works the same as the steel erect pile.

Strukton has also not yet switched to the use of HVO100 in phases A5 and C1, because this will void the warranty on the equipment. For the long term, it has been decided not to make the switch to HVO100.

The reduction has been adjusted on the basis of this. However, it is expected that switching to electric equipment will result in more savings as planned. This will be better evaluated next year.

The causes mentioned above will lead to a 4.5% reduction in CO_2 by 2024. This is slightly less than the 5.2% planned for 2024.

Strukton is therefore focusing on continuing discussions with ProRail to include the circular concrete overhead line poles in the SPC. It can then become clear when and at what pace a large number of circular concrete overhead line poles can still be installed. This is a long process, given that it is an innovative product. For ProRail, certainty about the quality, safety and lifespan of the product is of great importance. Strukton is therefore focusing on making this demonstrable. However, if this is successful and the product is allowed to be used once, the reduction in the chain can be very large. This means that we see sufficient potential to continue this chain analysis and cooperation.

In addition, Strukton is investigating the possibilities of producing other concrete elements around the track with circular concrete. We are thinking explicitly of foundation blocks, but also of retaining walls and concrete plugs. Strukton has also increased the ambition for the application of Circument from 20% to 50%. This also results in an increase in CO_2 reduction. In 2025, the top beams of the portals will also be added to this development. The goal is to be able to install a fully circular concrete portal in the future.

Strukton's own calculations show that CO_2 can also be reduced in this way. That is why we want to expand this chain analysis with these circular concrete elements in 2025. We also hope to be able to make progress in making our equipment more sustainable by 2025. By raising the ambition in certain areas, we believe that we are on the right track to achieving the reduction target.

7 Sources

1) Dominance analysis ProRail 2021
2) LCA Report category 3 data – Overhead Line Track; National Environmental Database
3) Mast for catenary (concrete) S6; Strukton Precast concrete
4) Paul Ewalds: "Concrete has enormous potential in the circular economy."; Concrete house

The structure of this document is based on the Corporate Value Chain (Scope 3) Standard. In addition, the methodology of the Product Accounting & Reporting Standard has been used where necessary (see Table 4).

Table 4 – Overview of the application of standards in chain analysis

Corporate Value Chain (Scope 3) Standard	**Product Accounting & Reporting Standard**	**Chain analysis**
H3. Business goals & Inventory design	H3. Business Goals	Chapter 1
H4. Overview of Scope 3 emissions	*N/a.*	Chapter 2
H5. Setting the Boundary	H7. Boundary Setting	Chapter 3
H6. Collecting Data	H9. Collecting Data & Assessing Data Quality	Chapter 4
H7. Allocating Emissions	H8. Allocation	Chapter 2
H8. Accounting for Supplier Emissions	*N/a.*	Part of the implementation of the CO2 Performance Ladder level 5
H9. Setting a reduction target	*N/a.*	Chapter 5

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