

Arup  
**CO2-Performance Ladder**  
Downstream Scope 3 emissions

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Dit rapport is opgesteld met inachtneming van de specifieke instructies en eisen van de opdrachtgever. Gebruik van (delen van) dit rapport door derden, zoals bijvoorbeeld (maar niet beperkt tot) openbaarmaking, vermenigvuldiging en verspreiding is verboden. Arup aanvaardt geen enkele aansprakelijkheid jegens derden voor de inhoud van het rapport, noch kan een derde aan de inhoud van het rapport enig recht ontleen.

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**ARUP**

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# 1 Introduction

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This document describes an analysis of the most important emissions related our the design and consultancy projects. These emissions are classified as downstream scope 3. **Downstream scope 3 emissions:** emissions arising from the use of the project, service or delivery offered / sold by the organization. The objective of this analysis is to identify the opportunities for CO<sub>2</sub>-reduction and serve as a basis for our reduction strategy.

The most important emissions are assessed for the two main design disciplines within Arup design and consultancy service, which are Buildings and Infrastructure.

## 2 Assessment buildings

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Buildings are the greatest source of CO<sub>2</sub> emissions in the Netherlands, accounting for almost 40% of the total emissions.

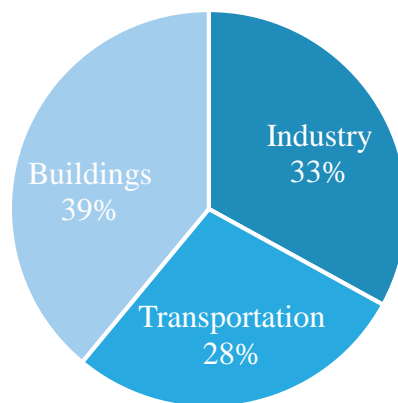


Figure 1: U.S. Department of Energy (DOE), 2008 Buildings Energy Data Book, Section 1.1.1, 2008.

### 2.1 Services

The activities of the Arup Buildings department in Amsterdam consist of engineering consultancy in the areas:

- Sustainability consulting
- Façade design
- Installation, mechanical
- Fire engineering
- Structural engineering and structural upgrading

- Lighting
- Acoustics

## 2.2 Identification of chain partners

The partners in the building chain are:

- Clients. Example: Rijksvastgoed bedrijf, Volker Wessels, Municipality of Tilburg, G&S Vastgoed
- Municipalities
- Architects. Example: OMA, IAA, Paul de Ruiter
- Contractors. Example: Volker Wessels, BAM, Heijmans
- Manufacturers
- End users of buildings
- Building Certification Schemes operators. (LEED, BREEAM, etc.)

## 2.3 Footprint data of partners

### Rijksgebouwendienst

2014 data;

Total RGD carbon footprint in-use = 0,2Mton/yr

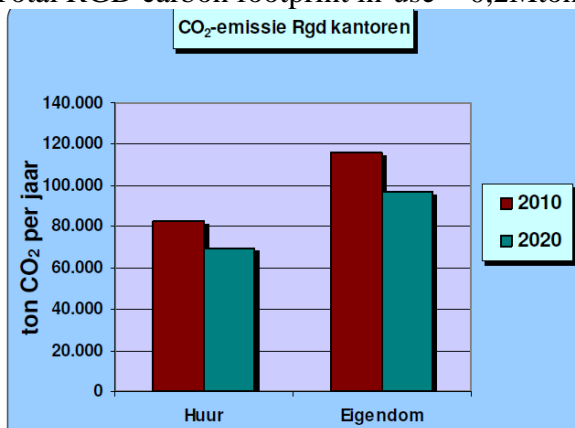


Figure 2 Footprint RGD

## 2.4 Footprint distribution of buildings

Over the life-time of a building, most CO<sub>2</sub>-emissions (>80%) are produced when the building is in use. A significant proportion of 17% is embedded into the construction phase.

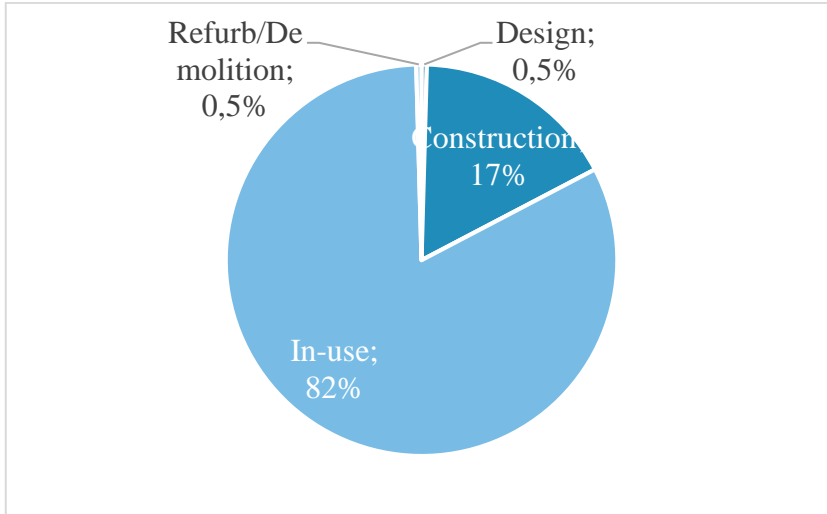
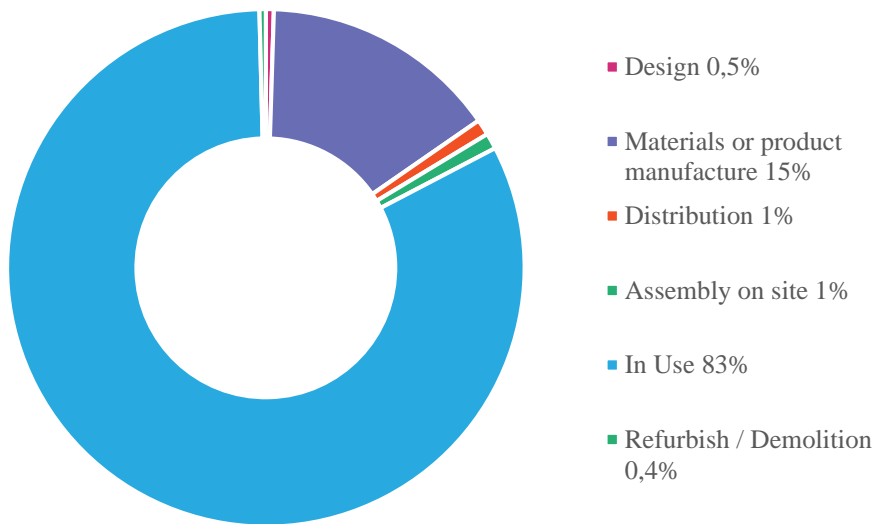


Figure 3 Energy use during life cycle of a building (Source: Department business innovation & skills<sup>1</sup>)



<sup>1</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/31737/10-1316-estimating-co2-emissions-supporting-low-carbon-igt-report.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/31737/10-1316-estimating-co2-emissions-supporting-low-carbon-igt-report.pdf)

### During construction phase

The CO2 emitted in the construction stage is subdivided into three categories. Of these categories, the actual manufacture accounts for the greatest emissions, and it is most directly influenced by Arup design. Concrete, stone and metal products are the greatest carbon producers.

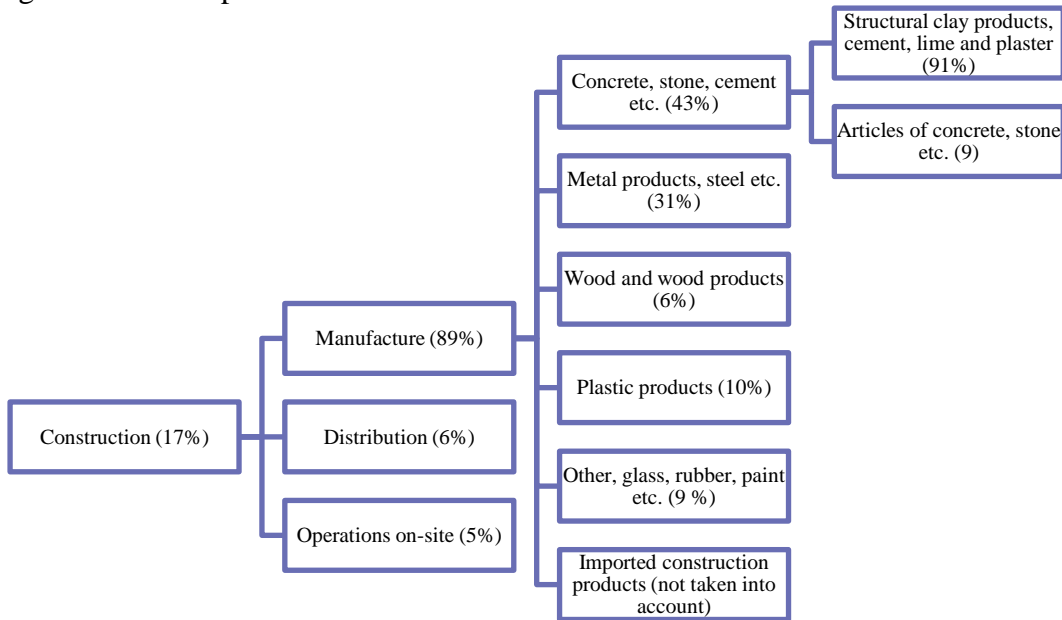


Figure 1: Relative emissions as a result of building construction, based on BIS data (2009)

### During use of building

The main possibilities for reduction within the design lie in energy for heating, cooling and lighting.

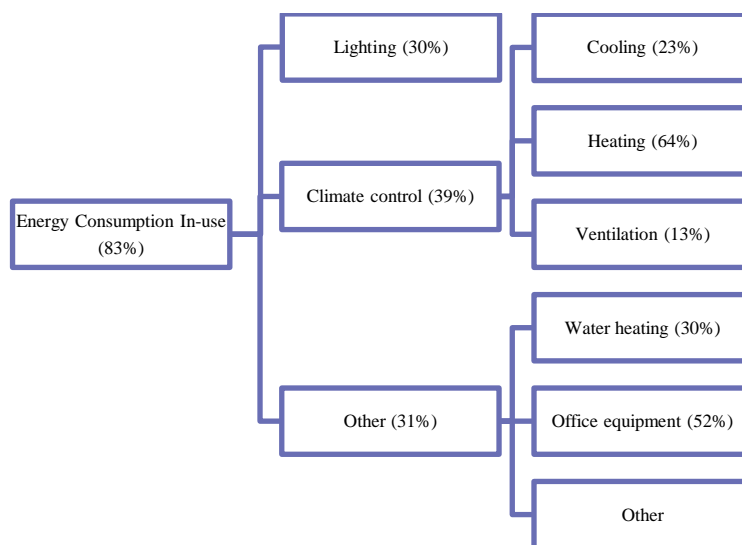


Figure 2: Relative energy consumption office building, based on bouwen met staal (2015)

### 3 Assessment infrastructure & transport

Transport is responsible for a quarter of EU greenhouse gas emissions, making it the biggest greenhouse gas emitting sector after energy [1].

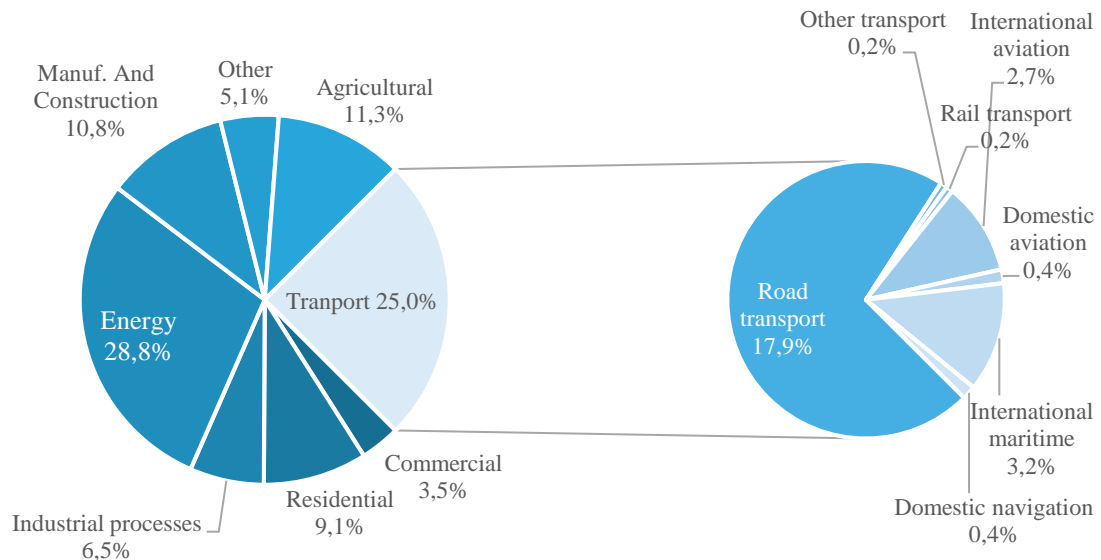


Figure 4 EU27 greenhouse gas emissions by sector and mode of transport, 2009 [1]

#### 3.1 Services

The following are standard **transport planning** services of Arup in the Netherlands:

- Strategic modelling (static);
- Traffic modelling / assessment (static & dynamic);
- Road design (including extensive cycling infrastructure);
- Municipal and provincial transport plans.

Main activities of the **infrastructure** department include:

- Highways
- Urban infrastructure (pedestrian and cyclist bridge)
- Structural assessment of bridges
- Renovation of steel bridges

The infrastructure services are concentrated around large scale bridge renovations.

Figure 6 presents the chain activities of Arup in relation to road transport CO<sub>2</sub> emissions. The colored boxes indicate the fields/activities where Arup has the most influence.

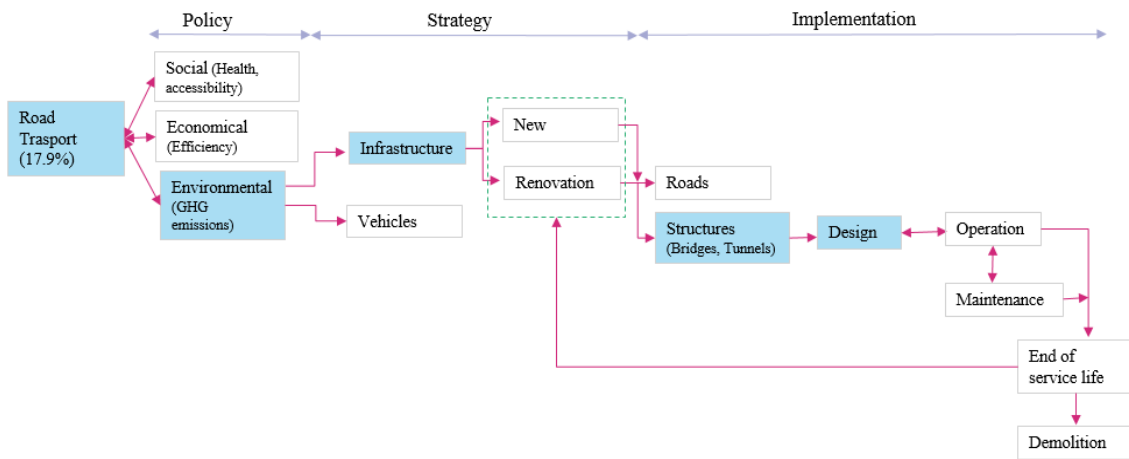


Figure 5 Chain analysis of infrastructure in relation to road transport emissions

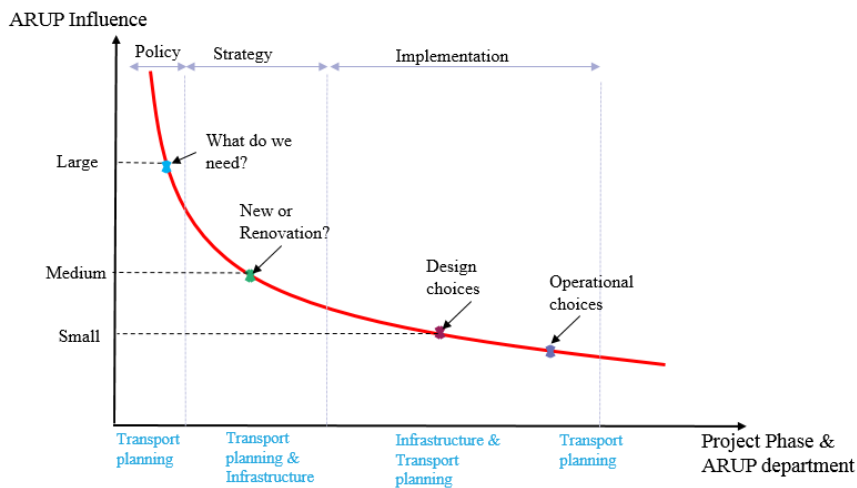


Figure 6 Arup’s influence per project phase and activity

### 3.2 Identification of chain partners.

In order to investigate the CO2-footprint of our chain partners, first the most important partners are identified:

- National governmental bodies (Rijkswaterstaat)
- Prorail (partner)
- Municipalities / Waterschappen
- Project developers
- Architects / designers
- Contractors
- Suppliers



### 3.3 Footprint data of partners

We have identified the emission data of our most relevant partners and suppliers.

#### Rijkswaterstaat

According to ‘Duurzaamheidsrapportage Rijkswaterstaat 2015’ [5] the following footprint data is available;

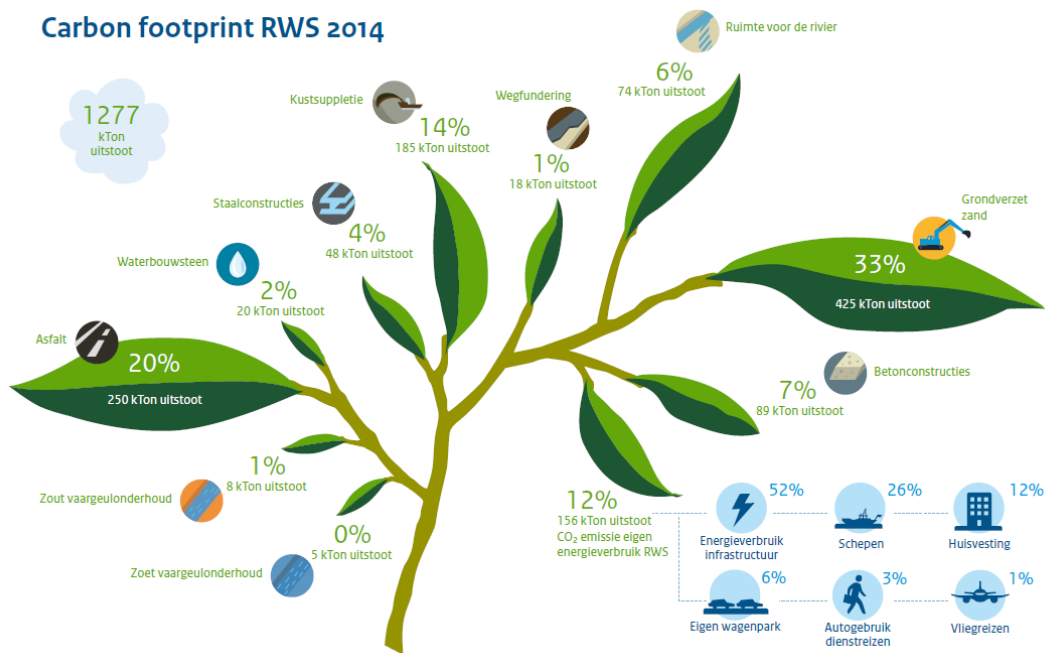
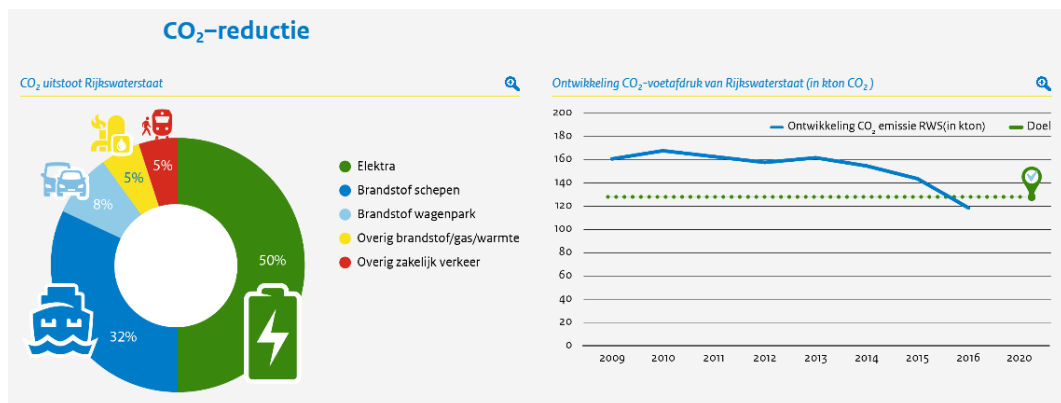
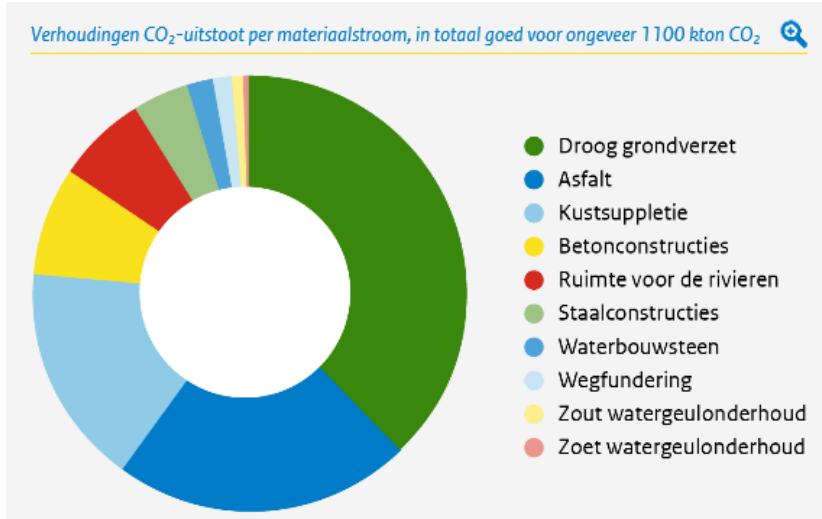


Figure 7 RWS footprint 2014





Figuur 3 Uitstoot RWS 2016 (bron; <https://www.ienmduurzaamheidsverslag.nl/rws.html>)

### Prorail

According to [https://www.prorail.nl/sites/default/files/co2-emissie\\_inventaris\\_2017-def.pdf](https://www.prorail.nl/sites/default/files/co2-emissie_inventaris_2017-def.pdf) the following footprint data is available;

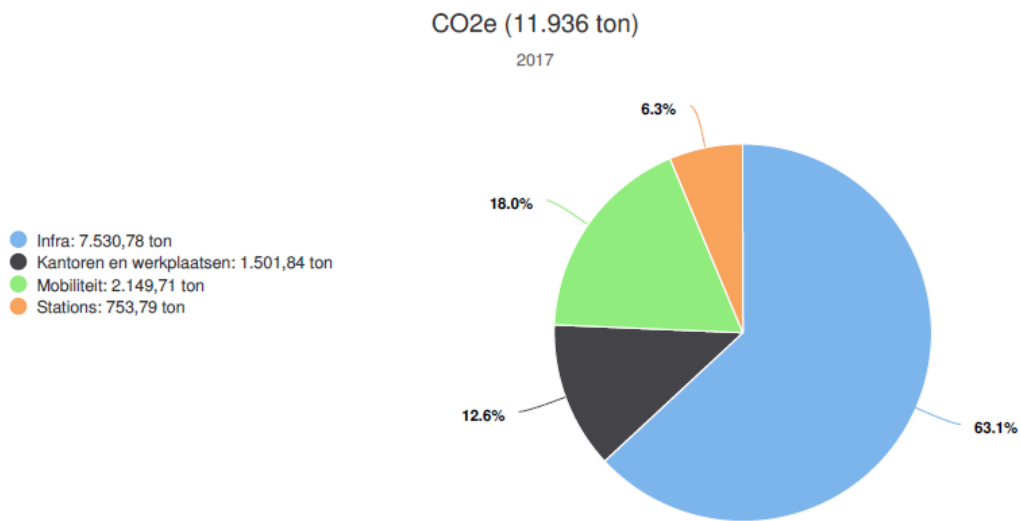
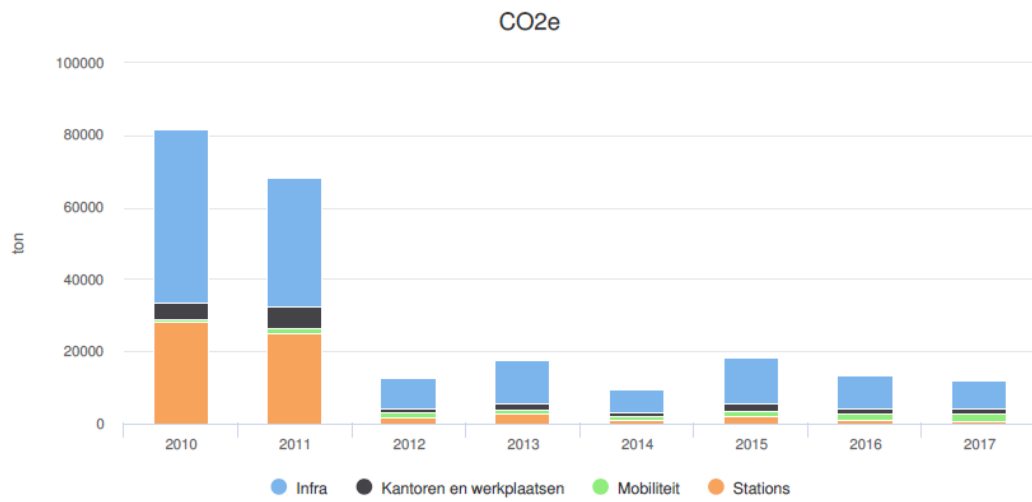


Figure 8 ProRail footprint 2017



Figuur 4 Footprint ProRail over the years