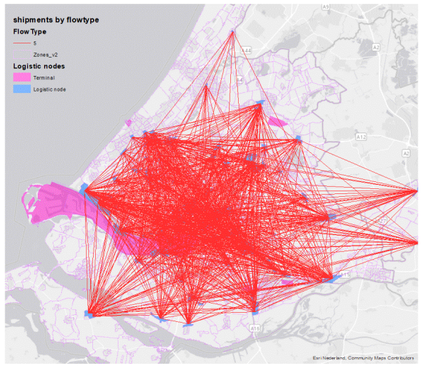
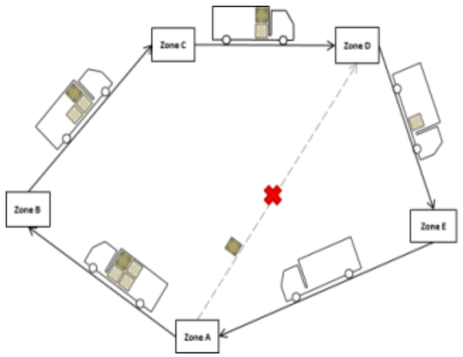
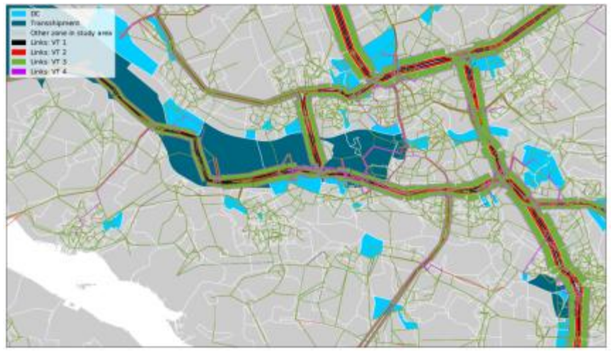


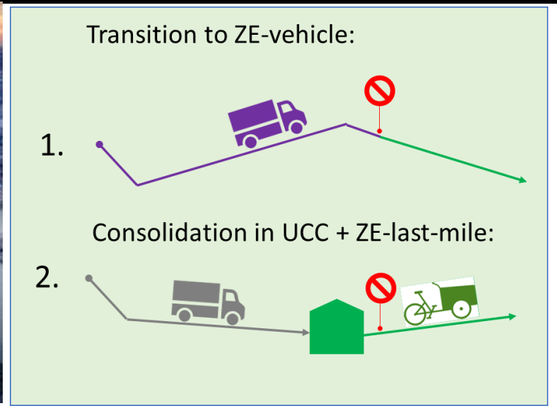



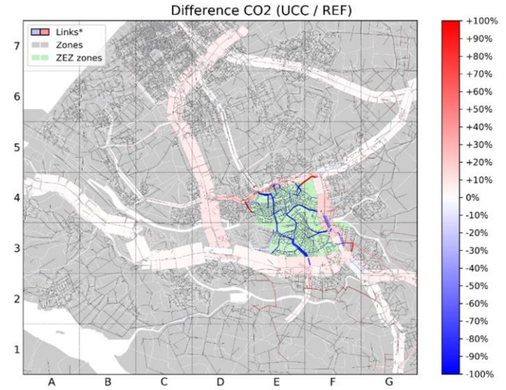

# Can we reach the climate goals to reduce GHG emissions? A comprehensive impact assessment of policies to decarbonize road freight transport.

Michiel de Bok(*,θ), Lórant Tavasszy(*), Ioanna Kourounioti (*), Sebastiaan Thoen(θ), Larissa Eggers(θ)

(*) Delft University of Technology, (θ) Significance Quantitative Research

3-12-2021



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II. Tactical Freight Simulator
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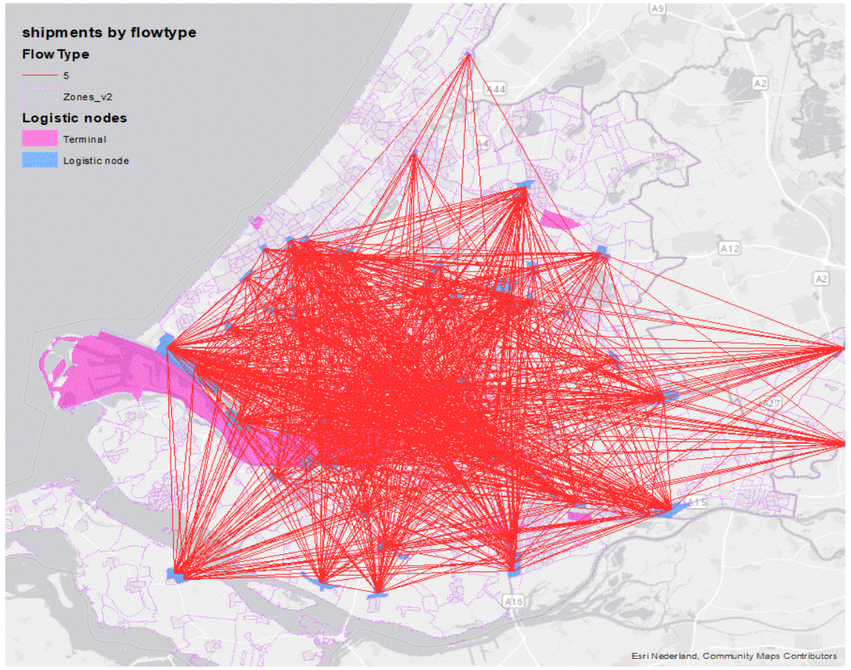
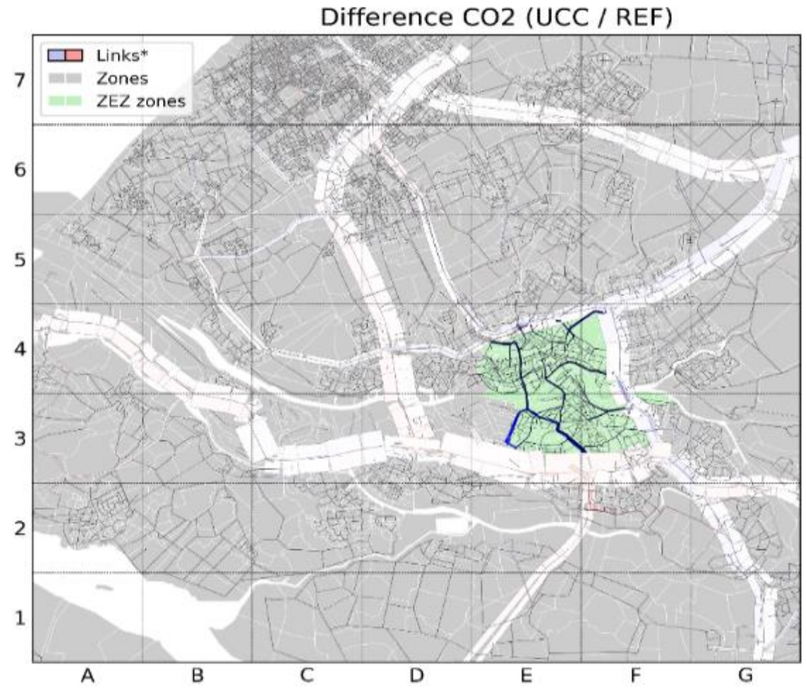
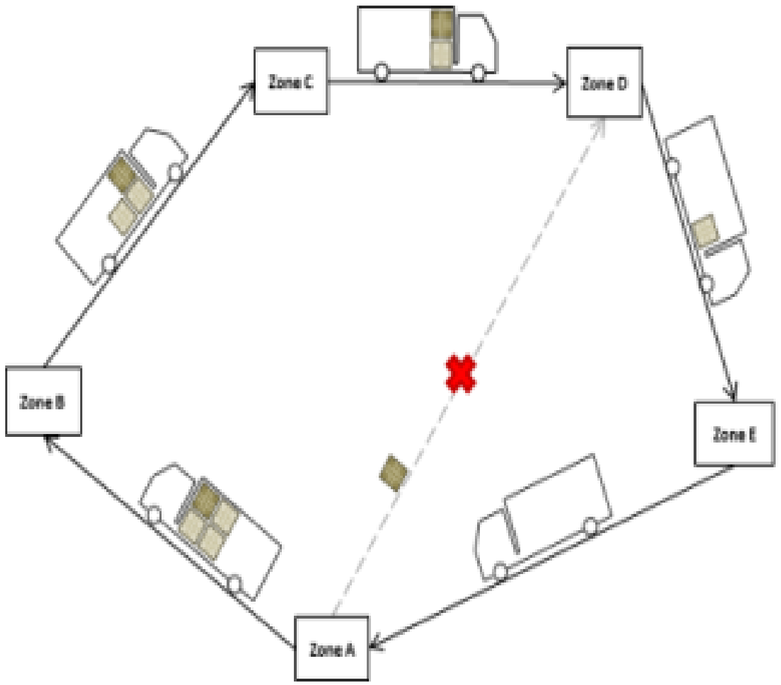


# Motivation and background

Policy context:

- The European White Paper on transport (2011) has put an ambitious decarbonization goal for 2050: a reduction of freight related emissions by 60%.
- Green Deal (2019): growth strategy and climate neutral Europe by 2050
- Fit for 55 Package (2021): aim is a reduction of freight related GHG emissions by 55% in 2030

❖ Ambitious climate goals are translated into specific measures and plans for action: pricing, emission standards (ICE phase out), supporting measures (funds).

❖ This calls for comprehensive impact assessment. However, policy support tools are scarce.

# Objective of the study

**Aim:**
To simulate the impact of a comprehensive set of decarbonisation measures to reduce GHG emissions of road freight transport to explore if climate targets are achievable

**Methodology:**

- Multi-agent simulation of urban freight, with logistic decision making
- Geography: urban agglomeration (Zuid-Holland)
- Macro scenario 2030: High growth scenario for The Netherlands
- First exploration: optimistic scenario
- Emission calculation: tank-to-wheel
- Broad inventory of policy measures
- Scenario-based and step wise simulation of impacts of each measure

# The HARMONY Tactical Freight SImulator

- Overview
- Shipment synthesis
- Tourformation
- In six figures

# Overview of the TFS

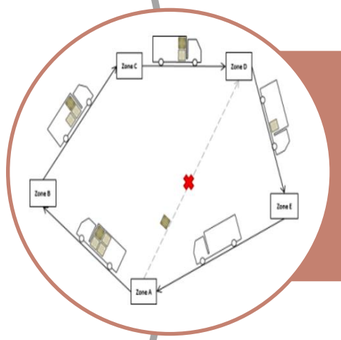
## Simulation of logistic decision making behind urban freight transport demand

Key design principles:

- ❖ Evidence based (extensive road freight data)
- ❖ Agent-based: to represent the heterogeneity in city logistics: producers, consumers, carriers, public administrators
- ❖ Shipment-based: more behavioural realism
- ❖ Long-term and daily logistic decisions are simulated separately

**Shipment & parcel demand**

- Producer/supplier choice
- Shipment size & vehicle type



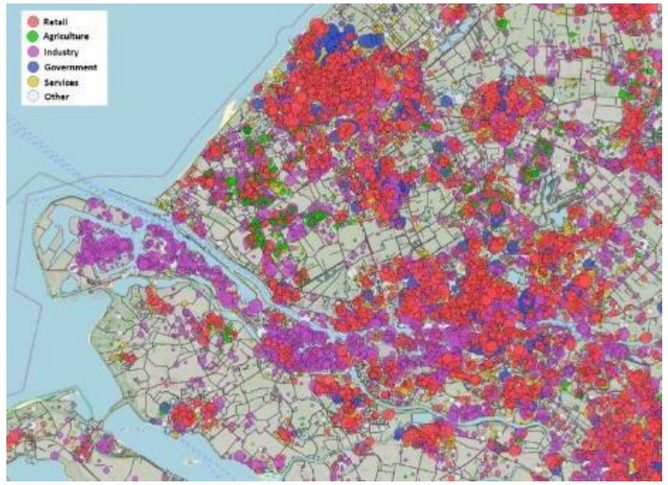

**Scheduling**

- Tourformation
- Time-of-delivery choice

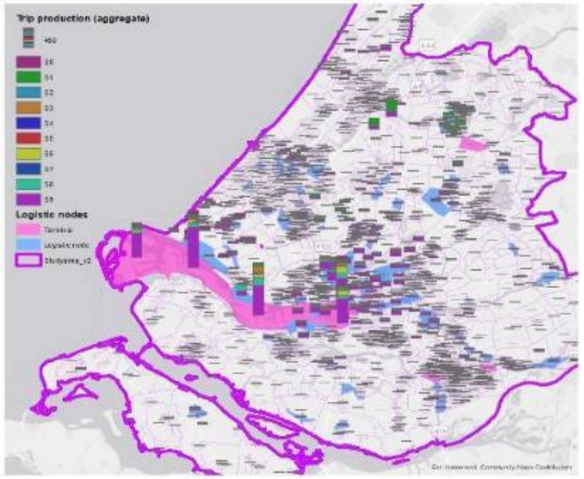
**Networkmodule**

- Routechoice
- Emissions

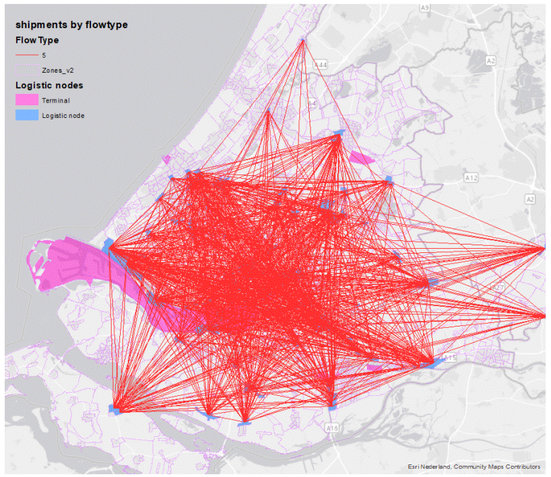
# HARMONY Tactical Freight Simulator in 6 figures



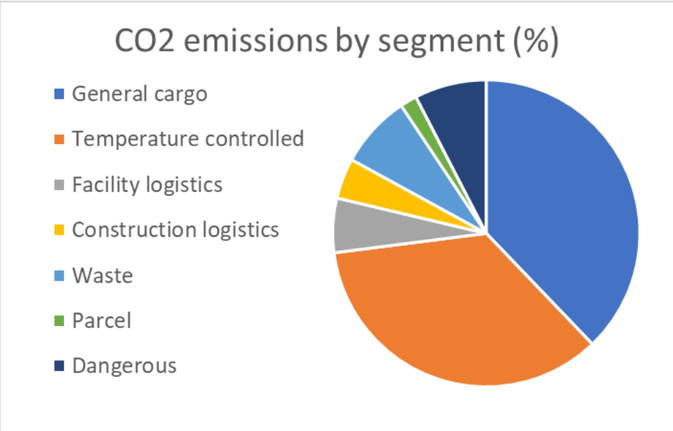

Firms (Synthetic)



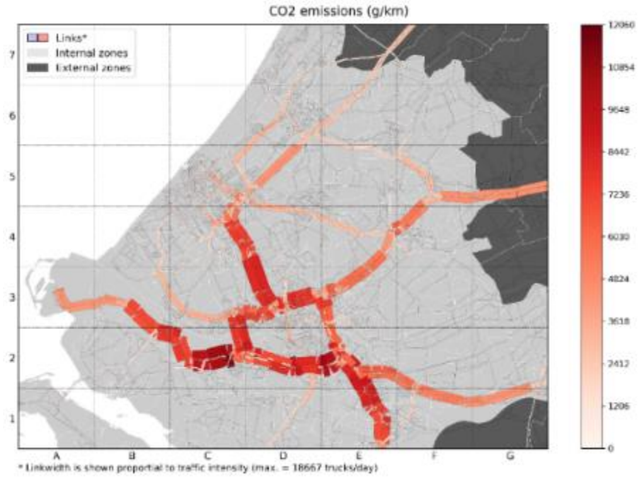

Shipment demand



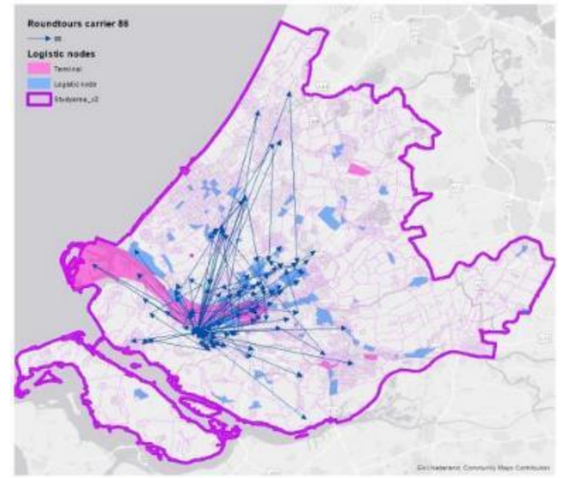

Logistic flow through distribution channels




Aggregated output indicators (KPI's)




Emissions




Logistic planning of roundtours

# Decarbonisation scenarios for road freight transport

# Inventory of decarbonisation measures

Inventory of measures from recent studies:

- “Fit for 55”, EC, (2021)
- “Roadmap Logistiek Laadinfrastructuur”, NAL (2021)
- “Decarbonising transport in Europe: non urban freight modelling”, ITF (2021)
- “The roadmap of the PI”, Alice (2020)
- “Roadmap Zero Emissie Stadslogistiek”, Rotterdam (2019)
- “Roadmap towards zero emissions logistics 2050”, Alice/SFC (2019)
- "Decarbonizing Logistics: distributing goods in a low carbon world", McKinnon (2018)

| Measure: | Labe |
|---|---|
| **Demand Reduction (DR):** | |
| Distance charging | DR1 |
| Productpackaging<br>Dematerialisation<br>Waste reduction | DR2 |
| **Clean Energy (CE):** | |
| Electrification of trucks | CE1 |
| Electrification of vans | CE2 |
| Zero emission zones | CE3 |
| Clean fuels | CE4 |
| **Energy Efficiency (EE):** | |
| Fuel efficiency | EE1 |
| Driving behaviour | EE2 |
| **Logistic Efficiency (LE):** | |
| New last mile solutions: CS + microhubs | LE1 |
| Modular loading units<br>Tour optimisation | LE2 |
| Asset sharing | LE3 |

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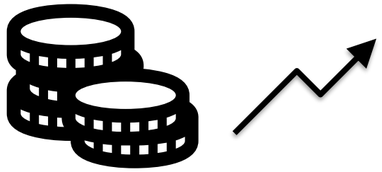
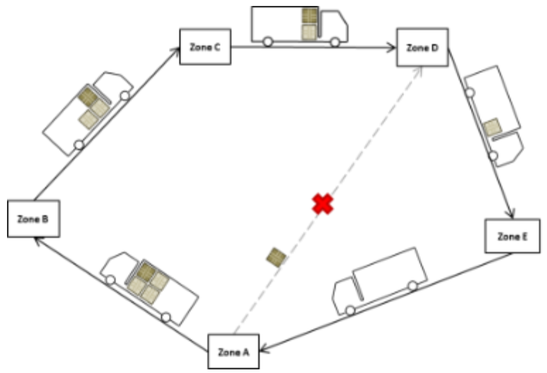
# Implementation of the measures in the model (1/2)

- Unit prices,
  - HGV charge

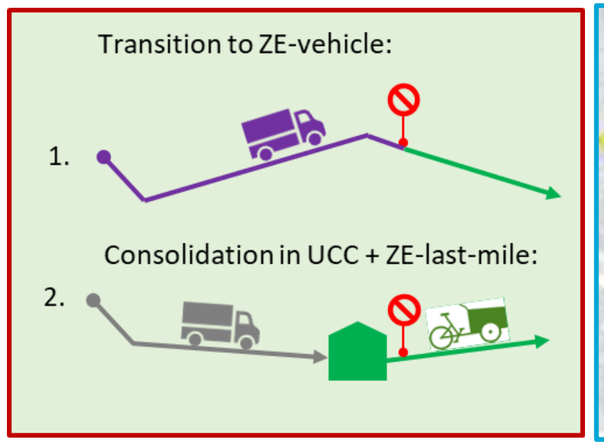


- Emission factors:
  - Fuel efficiency gains
  - Driving behaviour

- Logistic choice parameters:
  - More efficient planning




- Transition scenario's:
  - Zero emission zones




  - Vehicle market shares, e.g. for penetration new vehicle technology
  - Transition scenario new services (e.g. crowdshipping, microhub)

- Commodity demand (external scenario):
  - Modal shift and demand

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# Implementation of the measures in the model (2/2)

| | | | |
|---|---|---|---|
| Demand reduction | Distance charging | DR1 | Demand Matrix from Basgoed<br>Charge: flat 15ct/km, whole network or ASW?<br>Parameters: sourcing, vehicle type choice |
| | Productpackaging | DR2 | Increase load factor of vehicles: +5% |
| | Dematerialisation | DR2 | Global demand reduction (-1% per jaar) |
| | Waste reduction | DR2 | Reduction of Waste segment by -10% |
| Clean energy: | Electrification of trucks | CE1 | Transition scenario HGV to electric: 20% (no emissions) |
| | Electrification of vans | CE2 | Transition scenario vans to electric: 50% (no emissions) |
| | Zero emission zones | CE3 | ZE scenario for South Holland |
| | Clean fuels (hydrogen for trucks) | CE4 | Transition scenario to other clean vehicles: 30 % of HGV |
| Energy efficiency: | Fuel efficiency | EE1 | Reduce emission factors: 30 % |
| | Driving behaviour | EE2 | Reduce emission factors: 20 % |
| Logistic efficiency: | *New last mile solutions* | *LE1* | *Use scenario CS + microhubs* |
| | Modular loading units | LE2 | Increase TF parameters: target+5% shipments/tour |
| | Tour opt. (ICT, Pi) | LE2 | Increase TF parameters: target+5% shipments/tour |
| | Asset sharing: DC's + fleet sharing + optimising tour | LE3 | Reroute shipments directly to nearest DC’s.<br>Tourformation for shipments per DC |

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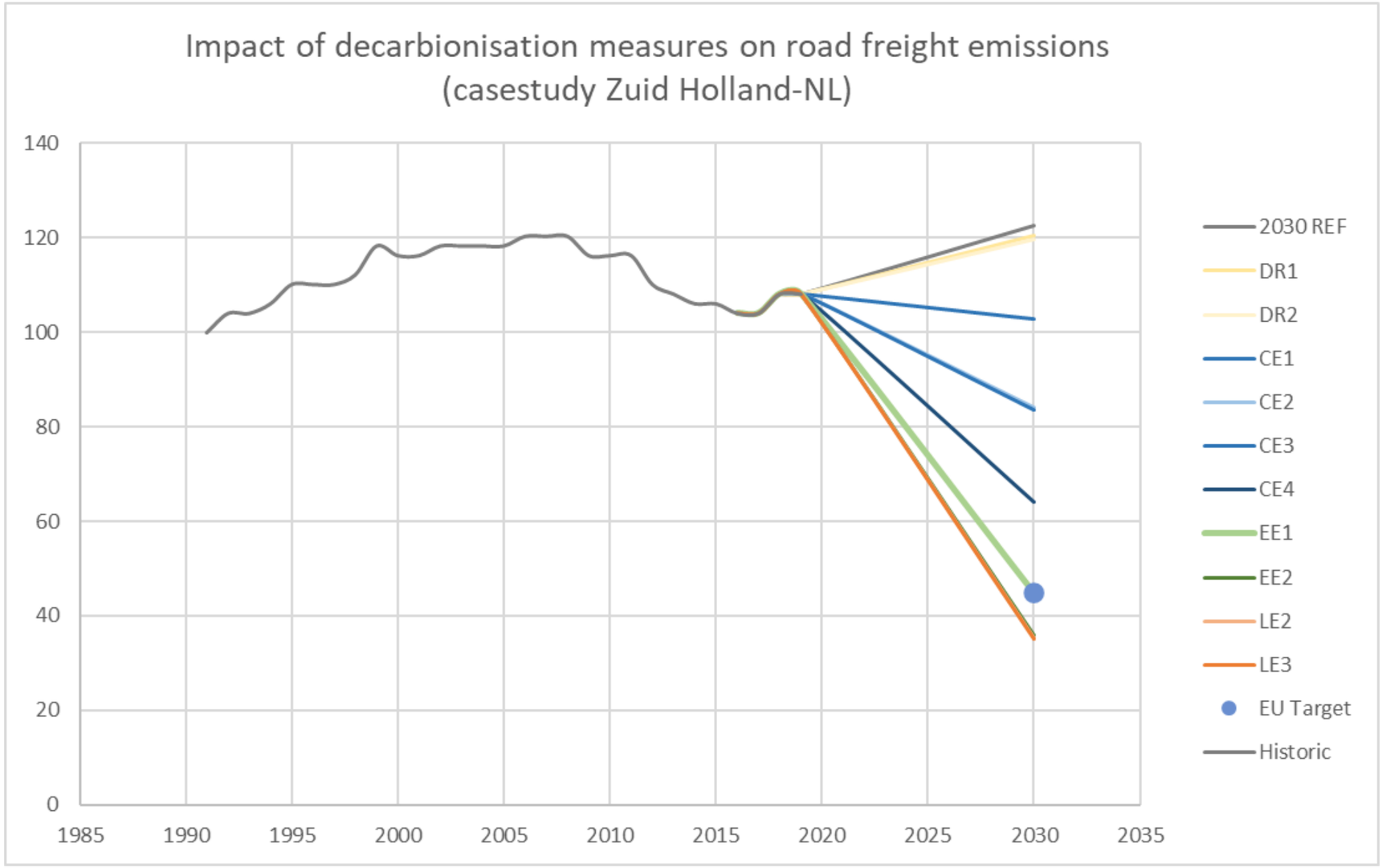
# Impact measures on CO2 emissions




| **Demand Reduction (DR):** | |
|---|---|
| Distance charging | DR1 |
| Productpackaging<br>Dematerialisation<br>Waste reduction | DR2 |
| **Clean Energy (CE):** | |
| Electrification of trucks | CE1 |
| Electrification of vans | CE2 |
| Zero emission zones | CE3 |
| Clean fuels | CE4 |
| **Energy Efficiency (EE):** | |
| Fuel efficiency | EE1 |
| Driving behaviour | EE2 |
| **Logistic Efficiency (LE):** | |
| New last mile solutions: CS + microhubs | LE1 |
| Modular loading units<br>Tour optimisation | LE2 |
| Asset sharing | LE3 |

in this optimistic scenario the climate goal is within reach

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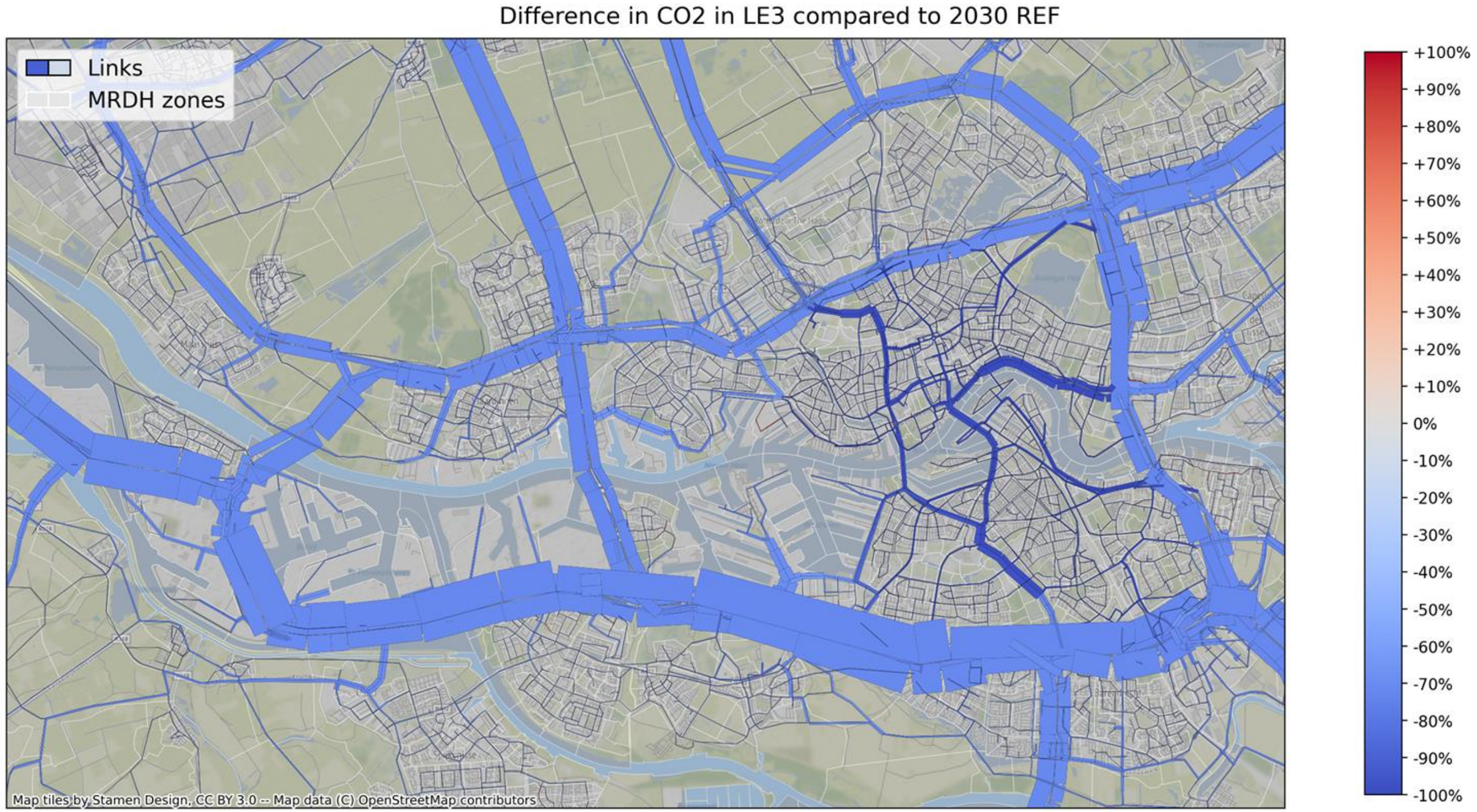
# Local impact on CO2 emissions




Local measures -> local variatio of impacts

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# Conclusions and outlook

Goals Fit for 55 seems feasible with rigorous measures

This assessment is based on optimistic assumptions

Impact assessment can also be used to track the progress to achieve decarbonisation goals

Impacts are locally very diverse: urban simulation models are needed to make a more reliable impact assessment

In future work alternative assumptions will be testes for realistic / pessimistic scenarios

# Questions and answers?

Thank you for your interest!

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