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FREIGHT TRANSPORT DECARBONISATION

TRANSITION PATHWAYS FOR LAST MILE LOGISTICS

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RISE FOR DECARBONISING LAST MILE ROAD FREIGHT

AIMS

To create a tool to assess the impact of last mile deliveries across all supply chains, the relationship between urban and rural freight and how last mile deliveries contributes to carbon emissions

Background

- Domestic transport carbon dioxide emissions have fallen by **19.6% against 2019 levels for 2020,** associated with reduced transport usage due to restrictions introduced in response to the COVID 19 pandemic
- Contribution from vans to UK's total emissions in 2020 has reached 19% (from 17% in 2019) and is equivalent to the contributions of Heavy Goods Vehicles
- New cars and vans to be 100% zero emissions at the tailpipe by 2035

Barriers

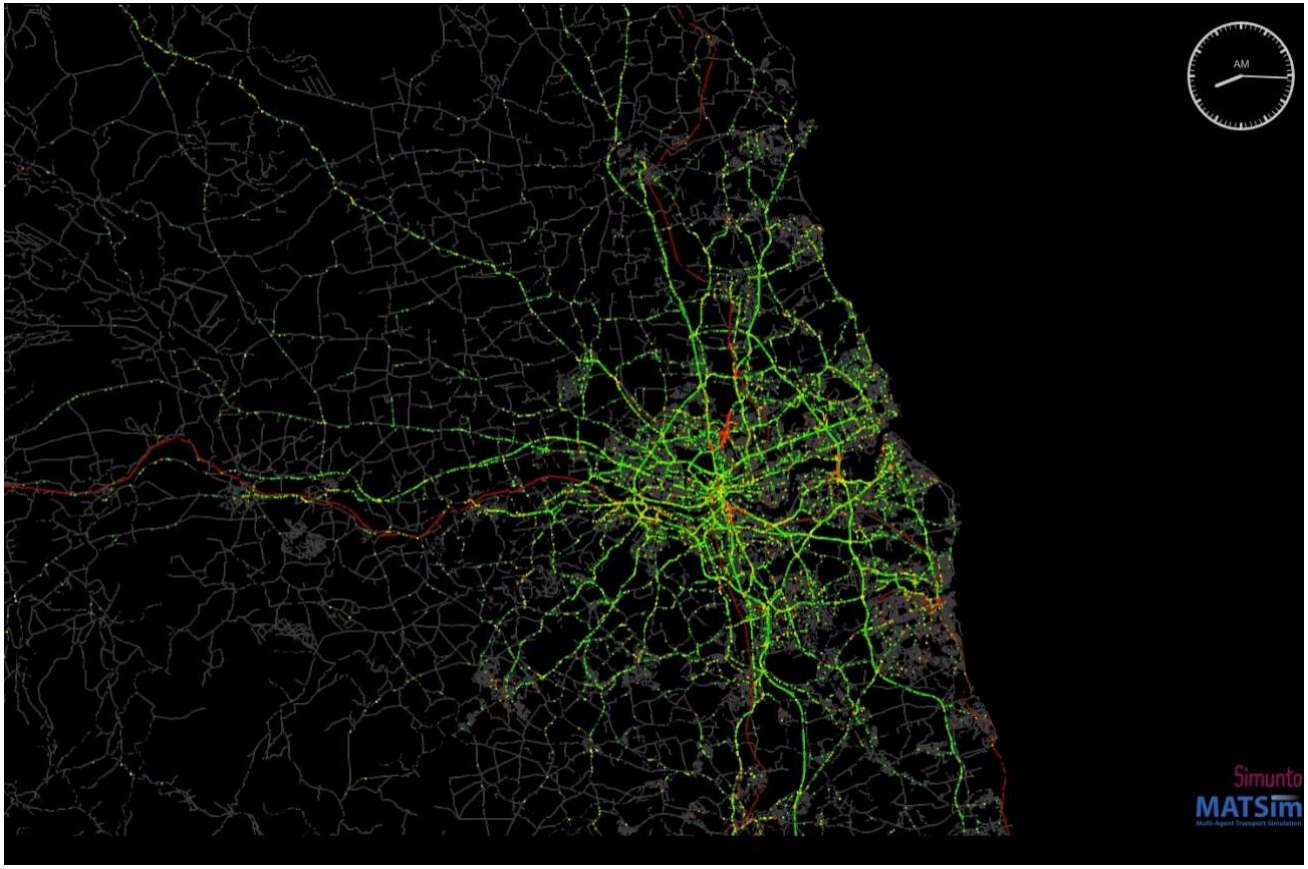
- Benchmarking the effectiveness of policy interventions requires relevant data on emissions generated through last mile deliveries, including rural areas, during the transition from ICE to net zero vehicles
- Lack of data sharing across wider freight industry, usually limited to one supply chain and one operator

Output

The RISE model uses integrated agent-based and emissions modelling **to assess the impact fleet electrification, demand consolidation and modal shift** could have on reducing the emissions generated from last mile deliveries in rural areas.

RURAL INNOVATION FOR SUSTAINABLE ENVIRONMENTS (RISE) FRAMEWORK

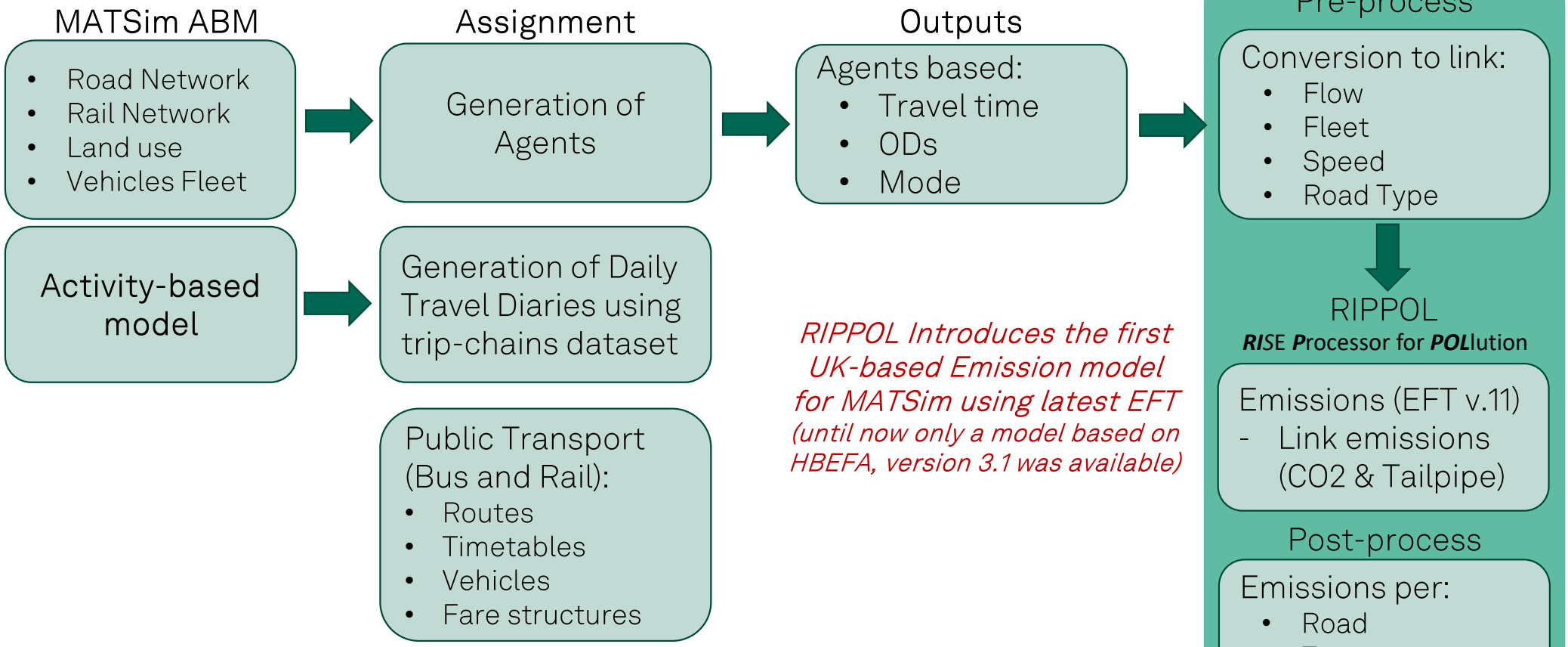
- Multimodal Network
- Public Transport and New Mobility services for passengers and goods
- Urban and rural areas
- Travel patterns and behaviours derived from Trip-chains MND dataset provided by Telefonica
- Average weekday April 2021, 24 hours distribution
- Multimodal door-to-door movements (passenger and goods)
- RIPPOL - the first UK-based Emission model for MATSim using latest DEFRA EFT (2021)



962,262 agents of which 57,000 traveling for last mile deliveries

RISE framework

ABM with Activity-based approach coupled with Emissions modelling

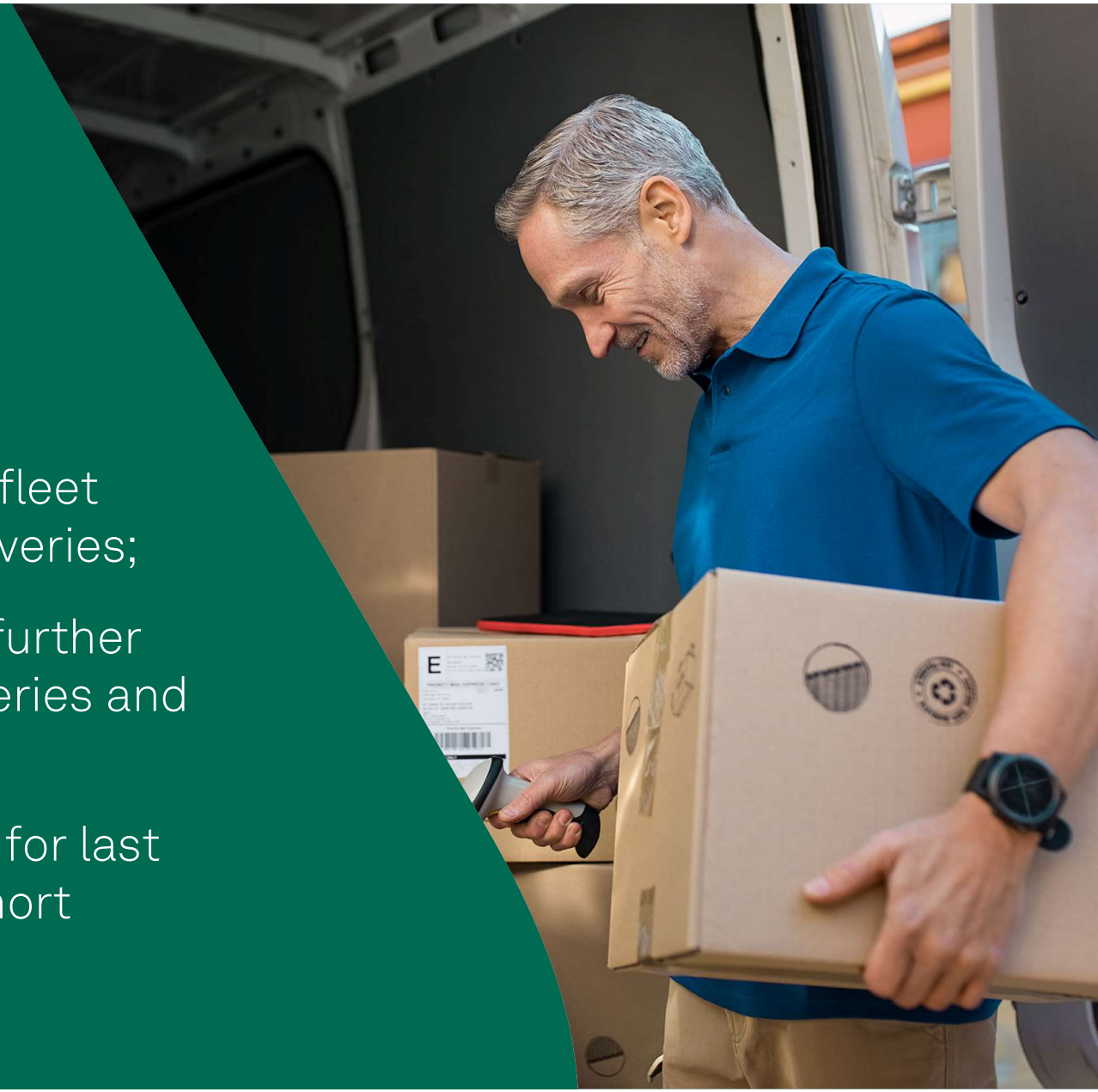


RIPPOL Introduces the first UK-based Emission model for MATSim using latest EFT (until now only a model based on HBEFA, version 3.1 was available)

Large-scale ABM at higher granularity allows to better understand travel behaviour
Activities and trip-chaining allow to set up mobility door-to-door schemes
Modular, scalable and transferable

SIMULATED LAST MILE DELIVERIES SCENARIOS

- Electrification of vehicles fleet deployed for last mile deliveries;
- Consolidation Centres to further breakdown last mile deliveries and introduce new modes;
- Mode shift to light modes for last mile deliveries covering short distances.



ELECTRIFICATION OF FLEETS

To estimate the reduction in CO2 emissions that could potentially be achieved by the electrification of last-mile delivery vehicles, the 2021 MATSim agent activity and network data were run through the RIPPOL (RISE Processor for POLlution) emissions model for the following three scenarios:

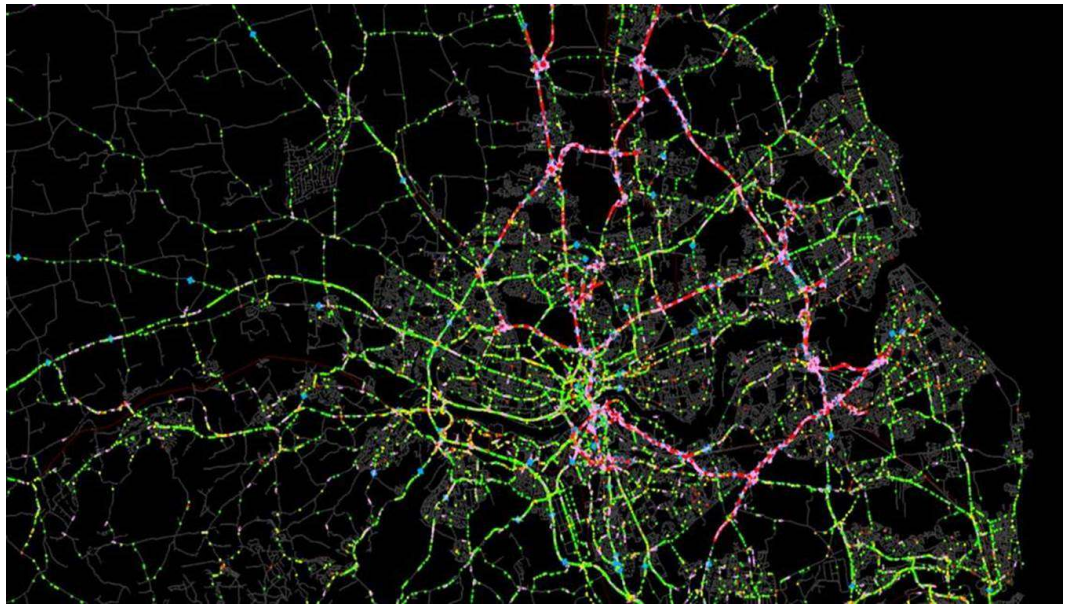
- 2021 base case: assuming all vans were ICE LGVs with less of 0.3% being BEV;
- 2031: assuming 20% of all vans were battery electric LGVs (i.e. no tailpipe emissions) and 80% were conventional ICE LGVs; and
- 2035: 40% of all vans were battery electric LGVs and 60% were conventional ICE LGVs

Assumptions

- The values of 20% electric van penetration in 2031 and 40% in 2035 are based on DfT's adoption trend assumptions (July 2021)
- Current level of demand remains unaltered until 2035
- Adoption trends are applied only to vans

Findings

- For vans, CO_2 emissions are estimated to fall by approximately 50%
- Further interventions are required to reduce emissions from last mile deliveries, in addition to technology uptake of ZE vehicles



MatSim Simulation for Base case scenario 2021 – above in pink LGV and in blue HGVs)

CONSOLIDATION AND MODE SHIFT

The analysis of MATSim output allowed to create an initial set of six consolidation centres to break down longer travel patterns, and create an initial assumptions on shift to e-vans or e-bikes.

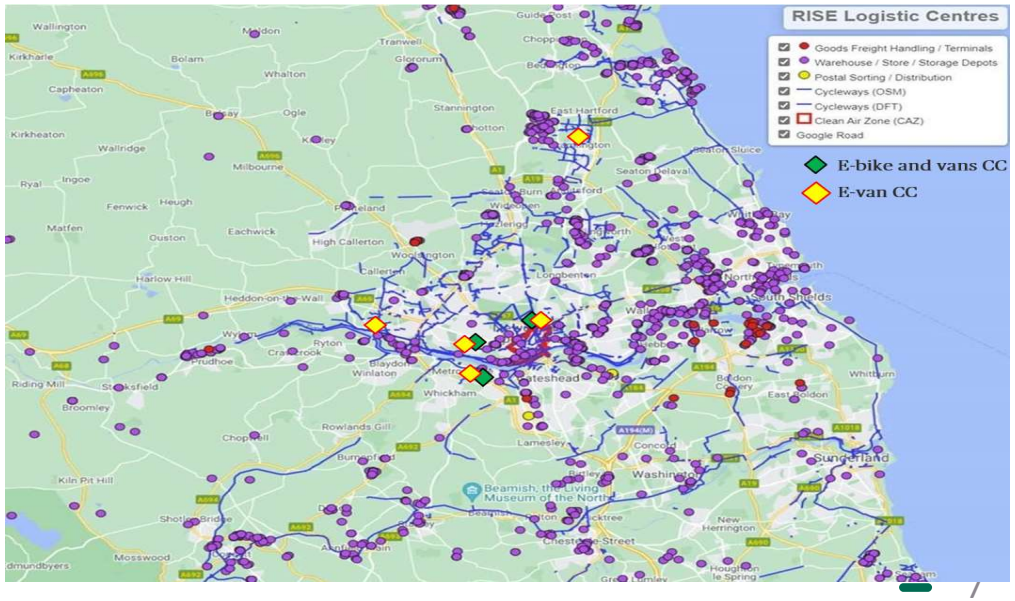
Assumptions

- Analysed current travel patterns, assuming that current level of demand would stay the same until 2035
- Adopted **average e-vans and e-cargo bikes characteristics currently available** on the market or near the market across multiple manufacturer models

Findings

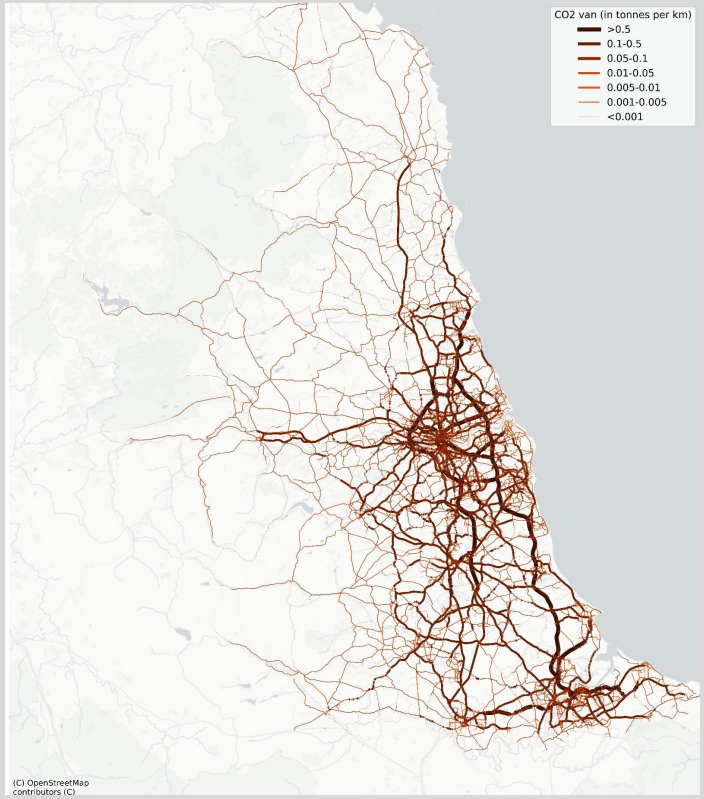
- Majority of trips that can be shifted to e-vans or e-bikes high specification (HS) are located in County Durham and Northumberland
- For vans, CO_2 emissions are estimated to fall by approximately 96%
- At present, Northumberland and Durham can't completely electrify the vans fleet. This is due to the large and less densely populated areas but also to trips that are connecting places in the east/ west corridors

Distance Band	No. of Van	Percentage	Potential mode shift
0-50 km	12154	21.1%	e-bikes
50-100 km	27315	47.4%	e-bikes High Spec/ e-vans
100-250 km	17417	30.2%	e-vans
250-350 km	622	1.1%	e-vans HS
>350 km	94	0.2%	ICE vans
Total	57602		

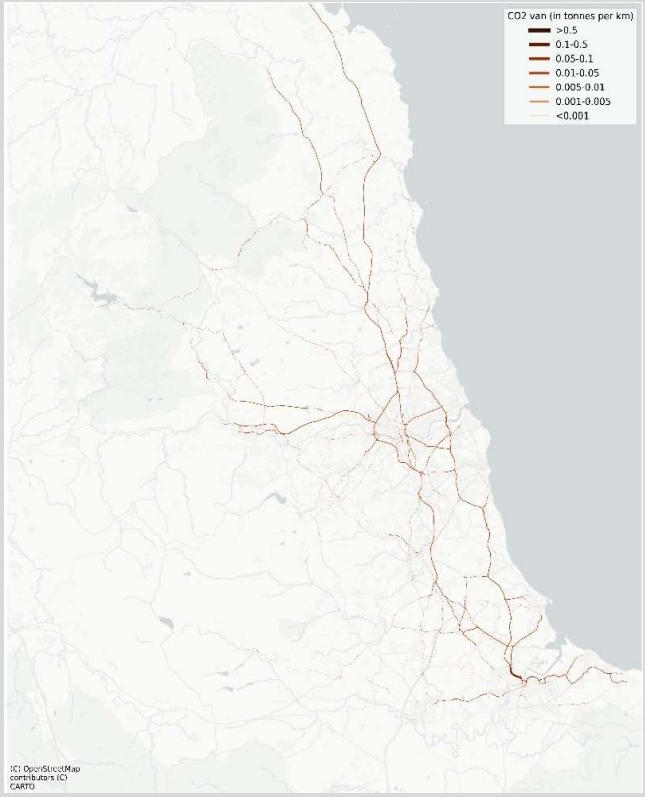


VANS' EMISSIONS PER DISTANCE TRAVELLED
CONSOLIDATION CENTRE SCENARIO

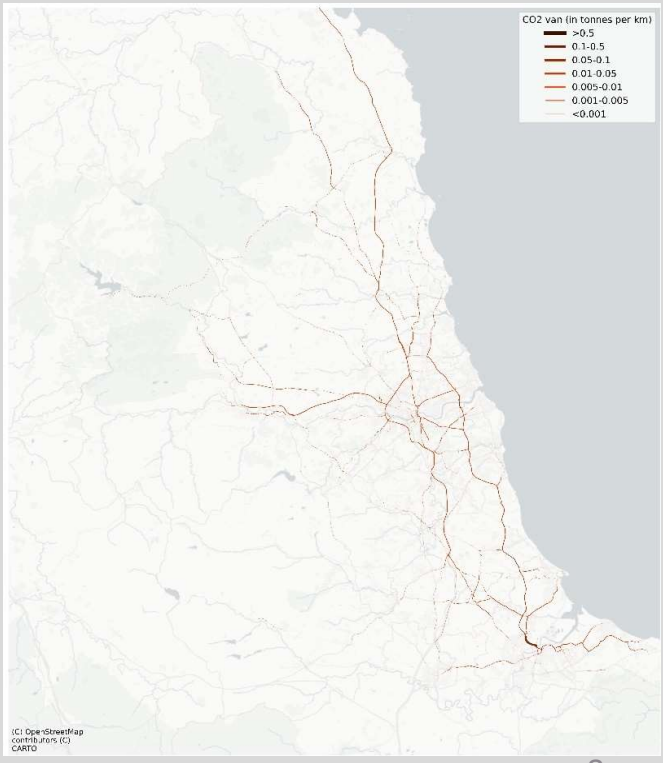
Emissions from vans only in 2021



Vans' emissions in 2031



Vans' emissions in 2035



RESULTS

Electrifications scenario

if 40% of commercial fleets switch to e-vans by 2035, this will only achieve a 50% reduction (against 2021 levels) in emissions from last mile deliveries.

Combining Electrification and consolidation

Enables a shift to zero emission transport modes, the model shows a 96% reduction in carbon emissions from last mile deliveries in 2035

Mode shift

- Majority of trips can be shifted to e-vans or e-bikes with current technology
- Increasing the shift towards net zero vehicles requires behavioural change and an higher adoption of new technologies

CONCLUSIONS

- Rural areas needs to be part of the solution, as there is a risk to be left behind in technology adoption (and are driving up emissions in urban areas)
- Emissions from last mile deliveries can be substantially reduced by 2035 if, alongside the natural shift towards electrification, a strategic network of consolidation centres is developed which supports the current level of demand for last mile deliveries and potential future increase in demand.
- Co-creation with industry to facilitate behavioural change and travel reduction
- Consolidation centres could provide last mile delivery operators with access to:
  - Dedicated charging network for commercial fleets
  - The possibility to consolidate demand into smaller deliveries, allowing the shift from larger operators to smaller ones.
  - Initial support to kickstart behavioural change in the last mile delivery sector

THANK YOU

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Executive Summary for RISE project available on https://cp.catapult.org.uk/

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