



Ministry of Infrastructure
and Water Management

Urban distribution with cargo bikes and other LEFVs

An initial study

KiM | Netherlands Institute for Transport Policy Analysis
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Summary

Electric cargo bikes and other light electric freight vehicles (LEFVs) are becoming increasingly common on Dutch roads. They are here to stay and their numbers are in fact expected to rise over the coming years because LEFVs offer clear benefits for their users. For example, users of LEFV are able to travel quickly, easily and efficiently through our cities.

Electric cargo bikes have yet another social advantage; they are more sustainable in terms of CO₂ emissions than diesel-powered delivery vans. LEFVs will certainly not be able to replace all delivery vans, because they are not suitable for all distances and payloads. These obstacles can partly be overcome by deploying more LEFVs, although this is not necessarily attractive in terms of costs. However, even if the cargo to be carried out and the distance to be travelled are suitable for a LEFV, businesses can still be cautious about replacing their delivery van with a LEFV. Switching to LEFVs, for example often requires changes to operations, such as the introduction of (transfer) hubs. There are also user groups who prefer to keep a delivery van for reasons of ease and comfort, for example service engineers.

It is important to realise that LEFVs cannot only be used to replace journeys by delivery vans, but can also generate new services such as fast grocery deliveries. All in all, it is difficult to say with any certainty whether LEFVs make a positive contribution to improving the accessibility and safety of our cities. To answer these questions, we must continue to carefully monitor the use of LEFVs over the next few years.





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ACKNOWLEDGEMENTS

1 What are LEFVs?

LEFV is an umbrella term

Light electric freight vehicles (LEFVs) come in many shapes and forms, and as a consequence the term LEFV does not mean the same thing for everyone. Our definition is as follows:

- Vehicles with electric pedal assist or electric drive;
- designed for the distribution of goods on public roads;
- smaller than a delivery van and with a maximum payload of 750 kg; and
- with a maximum vehicle speed of 45 km/h.

In this study, we concentrate on LEFVs used for goods transport (post, parcels and other goods), service provision (plumbers, gardeners, etc.), meal and grocery deliveries and construction and waste logistics. The focus is on electric cargo bikes, because these are the types of vehicle about which most information is available.

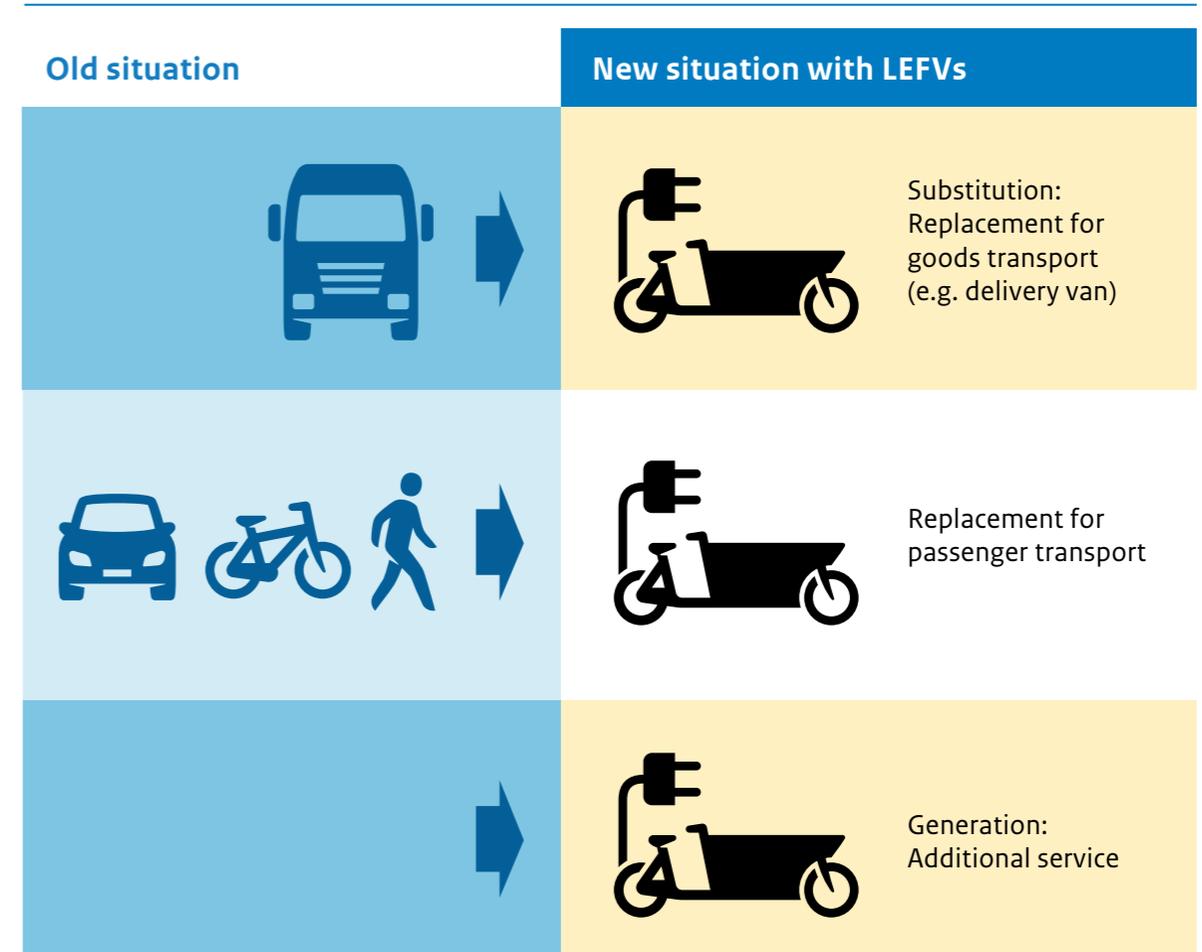
This study will not consider LEFVs that travel over water or through the air (drones). Nor will we be looking at autonomous robots. Also beyond the scope of this study are light electric vehicles (LEVs) used for passenger transport, including passenger-adapted cargo bikes and electric scooters.



LEFV category	Subcategories	Short description
1 Electric cargo bike	A cargo bike with a maximum speed of 25 km/h 	No compulsory inspection or registration. Net payload: 50-350 kg. Mass in running order: 20-170 kg. Electric motor power output: max 0.25 kW. Range: up to approx. 20 km.
2 Electric scooter	A moped, max. speed 25 km/h or less 	Just like all other scooters and mopeds, this vehicle is subject to EU Regulation 168/2013. The moped is not an official EU category; for the EU, this is a scooter with a maximum speed of 25 km/h.
	B scooter, max. speed 45 km/h 	Net payload: 100-500 kg. Mass in running order: 50-600 kg. Range: approx. 20-100 km.
3 Compact electric delivery vehicles	A vehicle with a maximum speed of 25 or 45 km/h 	L category of vehicles. European approval and registration required. Net payload: 200-750 kg. Mass in running order: 300-1000 kg. Range: up to more than approx. 100 km.

LEFVs as an alternative for what?

LEFVs are often seen as an alternative for a (diesel) delivery van. In some cases, however, they are also used to transport passengers. Instead of a person collecting their own groceries or products, they have them delivered to their door. The shift from passenger transport to cargo transport has been gradually taking place for some time, but the advent of the LEFV may accelerate the process. Supermarkets and shops are generally supplied by trucks, while the home delivery of groceries and other articles can also be performed by smaller vehicles such as cargo bikes and compact delivery vehicles.



There may be other additional LEFV transfers. For example, people will not visit the shops less regularly, but may purchase fewer products on each visit. It is also possible that LEFVs will encourage the provision of new services that were not (as easily) possible using delivery vans or other vehicle types. LEFVs are for example ideal when delivery timeslots are restricted. Offering specific delivery timeslots can be seen as an additional customer service, even if it does result in lower groupage efficiency and, as an indirect consequence, more goods transport movements.



Fast grocery delivery services made possible thanks to LEFVs

Fast grocery delivery services is the term for the online ordering of (a few) grocery items that are delivered to your door within 10-20 minutes by couriers on electric (cargo) bikes or electric scooters. Fast grocery delivery companies usually work from small branches in urban centre areas, often also referred to as dark stores.

Fast grocery delivery services have grown rapidly but their growth is stagnating

In mid-2022 four fast grocery delivery companies are operating in the Netherlands, although one provider has recently announced its intention to halt its services in the near future. The market for fast grocery delivery services doubled between August 2021 and January 2022. In January 2022, 2.8% of all Dutch people reported having made use of a fast grocery delivery service in the past three months. More recently, however, the growth in the number and size of orders has been stagnating.

Road safety is a key issue for fast grocery delivery companies

According to the fast grocery delivery companies themselves, they pay considerable attention to road safety, for example by making the wearing of helmets compulsory and by introducing a minimum age for their couriers of 18 years. The riders are also paid an hourly rate, as a means of discouraging speeding. Enforcing the compulsory wearing of helmets has proved difficult; 40% of delivery riders say they never wear a helmet as compared with 37% who say they always do. In addition, almost 27% of riders report 'always to often' having their mobile telephone in their hand, while making their deliveries.

Literature from abroad has identified a number of risk factors for meal and grocery deliveries. These are not wearing a helmet, young age, lack of experience, committing traffic violations and (perceived) pressure of time. The first two factors are also clearly present in fast grocery delivery services in the Netherlands. The extent to which the other factors also apply is unknown.

Impact on sustainability unclear

The impact of fast grocery delivery services on sustainability is difficult to estimate as it depends heavily on what the fast grocery delivery replaces. The riders exclusively use LEFVs for delivering the groceries, which is a relatively sustainable choice. However, a



sustainability gain is only achieved if the fast grocery delivery replaces one or several trips by car, or other motorised vehicle. The sustainability gain is lower, if the groceries ordered via a fast grocery delivery service would otherwise be collected on foot or not at all.



2 Current situation

Numbers of LEFVs

On the basis of vehicle registration data, there were around 1,000 compact delivery vehicles on the road in the Netherlands at the start of 2022. The sector association for logistic service providers TLN estimates that there were also around 3,500 cargo bikes on the road in the Netherlands, carrying out logistic activities. These numbers are rising.

No data are available for the number of cargo delivery scooters, but (at present) these are less common on the road in the Netherlands than cargo bikes and compact delivery vehicles. There are also e-bike delivery riders with a rucksack (such as meal couriers and fast grocery delivery riders), but these are not separately registered.

To place these numbers in perspective, at the start of 2022 there were around 1 million delivery vans registered in the Netherlands, of which almost 10,000 are electric powered. In other words, there are more electric delivery vans on the road, than there are compact delivery vehicles.



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LE(F)V framework

For vehicles such as mopeds and speed pedelecs, there are European rules that impose requirements. As yet there are no European rules for the approval of other types of electric light (freight) vehicles. For that reason, at present every Member State decides for itself whether a particular type of LEFV is permitted on its roads. In the Netherlands, an LE(F)V must comply with the rules for a 'special scooter' but the Dutch Safety Board has indicated that a more detailed framework is required. The Ministry of Infrastructure and Water Management is currently drafting such an LE(F)V framework, outlining the requirements for the admission method (including vehicle registration), requirements on the vehicle itself (including dimensions and speed), the user (age and driving licence) and the environment (for example its position on the road).



Policy within municipalities

A number of (large) Dutch municipalities are introducing zero emission zones. This process is accelerating the electrification of urban distribution. Large municipalities recognise (social) benefits in LEFVs, as a sustainable and efficient form of urban logistics. Municipalities with fewer than 100,000 residents barely mention (types of) LEFV in their policy or policy vision, if at all. Many larger municipalities also see LEFVs as a potential risk for road safety especially on cycle paths. In particular at municipal level, there are many questions and uncertainties about LEFVs.

- There is little knowledge of the numbers of LEFVs. Municipalities believe they are observing a rise in numbers but there is no monitoring of the number of LEFVs and the number of incidents involving them.
- Hubs are seen as a prerequisite for the success of LEFVs. There are however many questions about where those hubs should be established, within the municipality (in the centre, at the periphery, neighbourhood hubs).



3 User perspective



Advantages of LEFVs

Sustainable: Sustainability is a key motivator for parties already using LEFVs. Sustainability in that sense relates not only to lower emissions but also quality of life in the city.

Image: A LEFV is a marketing tool that ties in well with corporate social responsibility. A cargo bike also generates more positive reactions than a delivery van. A LEFV is narrower than a delivery van and as a consequence is expected to cause less irritation during loading and unloading, because people are able to circumvent the parked LEFV.

Fast, easy and efficient: Riders can manoeuvre smoothly, rapidly and easily through busy city streets, on a cargo bike. With a cargo bike, they are not forced to look for a parking space, suffer less disruption from traffic congestion and reach their destination faster because they are not forced to return to the outer city ring, but can take one-way streets.

Cost saving: Cost saving is one of the considerations for choosing a LEFV. Anyone who is required to regularly visit the city centre can move more rapidly using a cargo bike. This time saving results in cost savings. This advantage is however lost if the LEFV is unable to carry the necessary volume.

More potential employees: A cargo bike rider does not require a car driving licence. The potential pool of cargo bike riders is therefore larger than that of van drivers. This offers advantages for staff recruitment.

Healthy: Health is mentioned as an additional benefit of using a cargo bike. Employees feel fitter after riding a cargo bike than sitting behind the wheel of a delivery van.

Disadvantages of LEFVs

Limited volume or mass: The most commonly heard reason for business owners to not make the switch relates to the limited volume and mass that can be transported in a LEFV as compared with a delivery van.

Limited operating radius: The operating radius (in combination with a longer charging time) is a barrier for many businesses in switching to a LEFV. A requirement for switching to a LEFV is that the business must mainly operate locally; after all, LEFVs are not permitted to use the motorway.

Flexibility is important: Even if the entire volume or total operating radius of the delivery van is only needed sporadically, businesses want the flexibility to transport large volumes of goods or equipment, or to visit a far-off client. These may still be achievable if they alter their business operations, but the question is whether they are open to this option, since any change requires time and staff.

It is a large, complex step: It is not possible for many businesses to transfer their entire operations to LEFVs, which means that delivery vans remain necessary. This combination makes the system more complex. In addition, a LEFV must be reloaded at a hub. This has consequences for the overall logistics. In particular for smaller companies, this makes the switch to LEFVs a major change. Many of them do not have the time or resources to extensively test the use of LEFVs.

Van as an employment benefit: Some employees (in particular service engineers) see a delivery van as part of their secondary employment benefits. Many employees do not wish to surrender their delivery van and employers are not keen to make this compulsory, out of fear that their employees may switch loyalty to another employer.

Weather conditions: In a delivery van, both the driver and the cargo are protected against wind and rain, while with a number of types of LEFV, this is not or less the case.

E-van a more attractive alternative: The development of electric delivery vans in the small segment is moving rapidly and these vehicles are becoming increasingly affordable. When making the switch to an electric delivery van, the business owner is not required to make any major changes to his business operations, if any.

High depreciation and maintenance costs: One party interviewed suggested that a LEFV generates little or no cost savings. This was due to the high maintenance costs and the limited service life of LEFVs. As a result, businesses must write off their LEFVs relatively quickly.

Lack of funds: A number of businesses are unable to make the switch to electric transport because of a lack of funds.





Costs of LEFVs compared with delivery vans

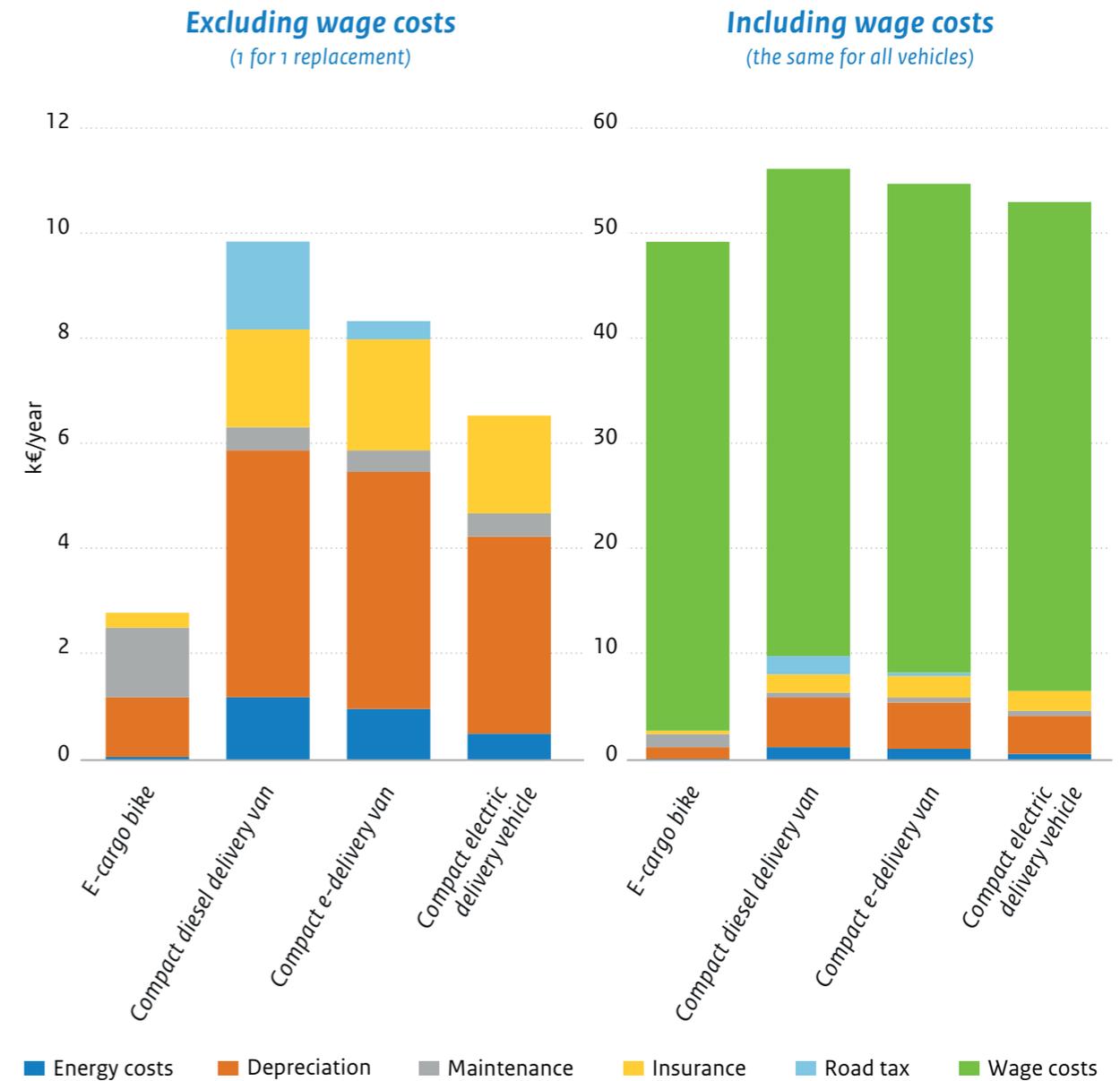
We compared the costs of a new electric cargo bike, a new diesel delivery van, an electric delivery van and a new compact electric delivery vehicle. The costs for the latter vehicle type are however very uncertain. We did not include cargo scooters in the comparison, due to the unavailability of cost data for that vehicle type. In this cost comparison, we assume that all vehicles achieve the same annual mileage, namely 15,000 kilometres.

Wage costs are the dominant factor

In assessing the cost breakdown, it is noticeable that wage costs are a very important cost item for all vehicle types, followed by depreciation costs. Maintenance costs for an e-cargo bike are relatively high, because when used intensively, they require maintenance every two weeks. If more robust LEFVs make their way onto the market, these costs may fall in the future.

LEFVs cheaper than delivery vans if replaced one for one

If replaced one for one, both the cargo bike and the compact delivery vehicle are cheaper than an electric or diesel delivery van. The cost benefit of a cargo bike is 10% to 15% and of a compact delivery vehicle around 5%, as compared with the delivery van option.



If a cargo bike rider receives wages that are 10% lower, the cost benefit increases to approximately 25%. A lower wage is perfectly conceivable, since cargo bike riders need no driving licence, unlike drivers of a delivery van.



LEFVs more expensive if more LEFVs are needed to replace one delivery van

The volume of capacity of a cargo bike is around 4 times less than of a delivery van. However, the average payload of a delivery van is often well below the maximum payload. Nonetheless, it is likely that more LEFVs will be needed to replace a single delivery van for post and parcel deliveries or for delivering other goods.

If 1.5 cargo bikes are needed to replace 1 delivery van, the price benefit of the cargo bike quickly evaporates. In this case, the cargo bike option is 25% more expensive than the delivery van option. Even with a 10% lower wage for the cargo bike rider as compared with the delivery van driver, the cargo bike option remains 10% more expensive than the delivery van option. The compact delivery vehicle also offers no cost benefit if 3 compact delivery vehicles are needed to replace 2 delivery vans.

Other factors that generate cost benefits for LEFVs

In the previous calculation, we assumed that all vehicles clock up the same annual mileage and deliver the same transport performance (with 1 or 1.5 LEFVs per delivery van). This need not necessarily be the case in practice. The profitability of parcel delivery with an (electric) cargo bike as compared with delivery with a delivery van is also positively influenced by the following factors:

- Short distance between destinations and depot or hub
- Small service area, so stops are closer together, so relatively much time is spent parking and delivering the parcel
- Very busy roads so low average speed for delivery vans
- Subject to restricted delivery timeslots
- Small parcel sizes per stop so numerous stops can be made before the cargo bike returns to the depot to reload with parcels
- Shorter delivery time for a parcel if delivery by cargo bike instead of delivery van. The delivery time is influenced among others by the searching time for a parking space and the walking time from the parked vehicle to the delivery address.



4 Social consequences of LEFVs

The social effects of compact delivery vehicles and cargo scooters are broadly unknown. A number of studies have been carried out into cargo bikes.

Effects on traffic performance and congestion

To assess the contribution of LEFVs to improving the accessibility of city centres, we have considered the consequences of LEFVs on the distance travelled and traffic congestion.

Consequences for distance travelled vary

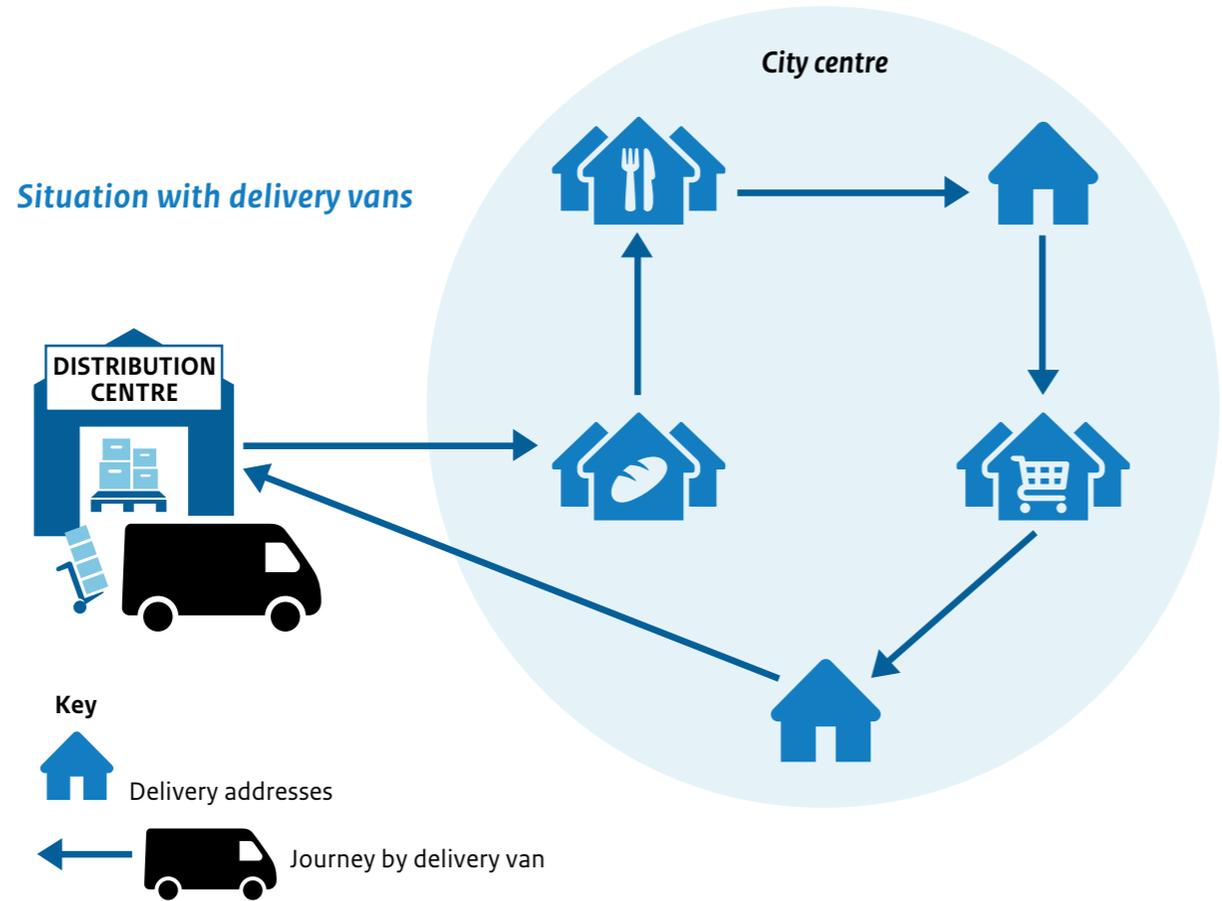
The distance travelled by cargo bike to deliver parcels, to supply goods or to provide services can be higher or lower compared to the distance travelled by a delivery van. The consequences for the distance travelled depend on the scale of the study (only within the city centre or inside and outside the city centre), the distance between the city and the main distribution centre, the positioning of the (micro) hubs, the capacity of the cargo bikes and the extent to which cargo bikes are able to follow shorter routes than delivery vans.

Impact on congestion also depends on the position on the road

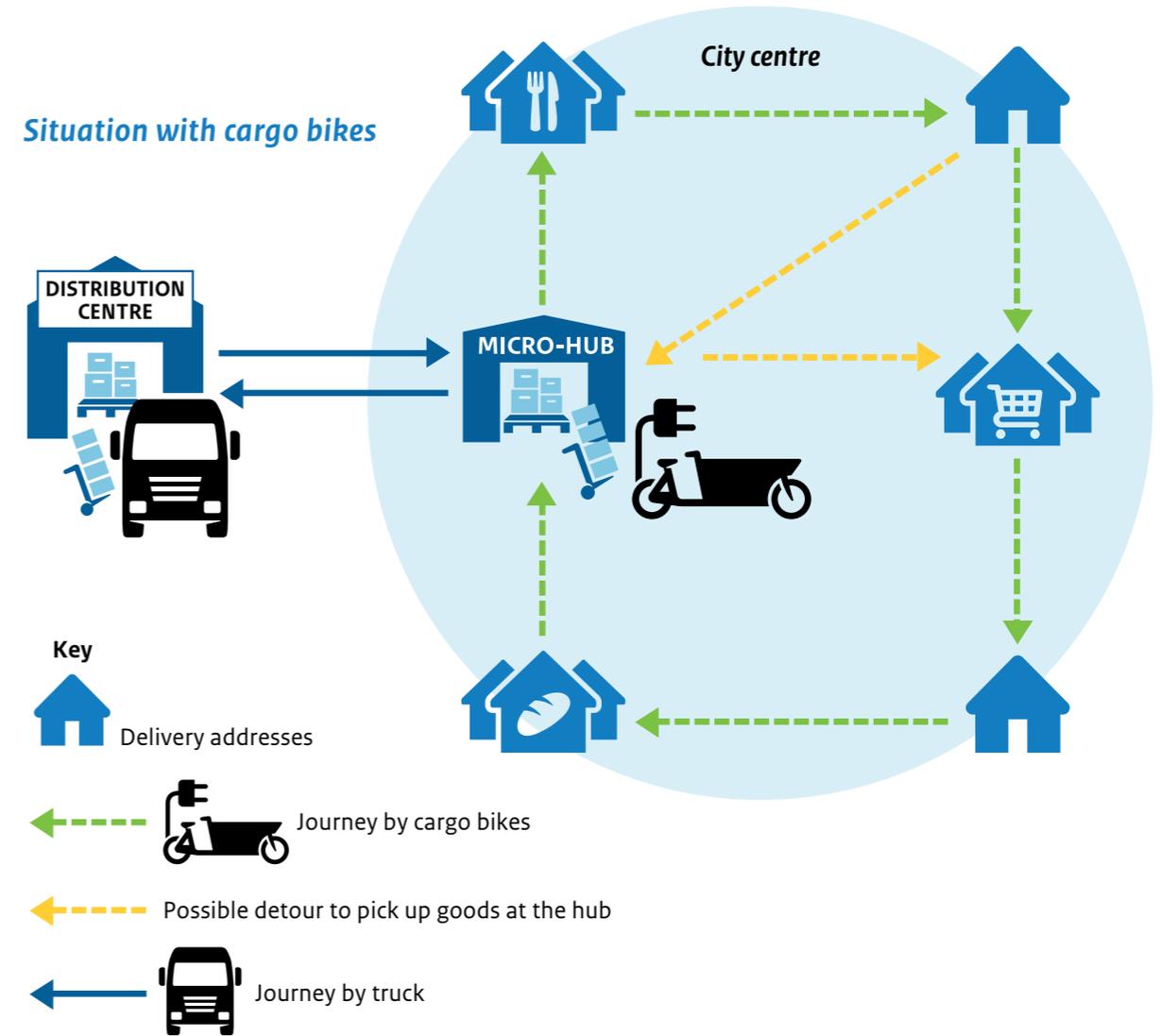
The majority of traffic congestion on Dutch roads is caused by passenger cars and not delivery vans. Nonetheless, replacing delivery vans with cargo bikes can result in less congestion. On the other hand, it can result in heavy traffic on cycle paths and bicycle congestion, mainly in the large cities. This point has been underrepresented in (scientific) literature. If in the future cargo bikes are permitted to ride on the road and are not restricted to cycle paths, the question arises about the extent to which they will contribute to reducing the amount of congestion.



Situation with delivery vans



Situation with cargo bikes



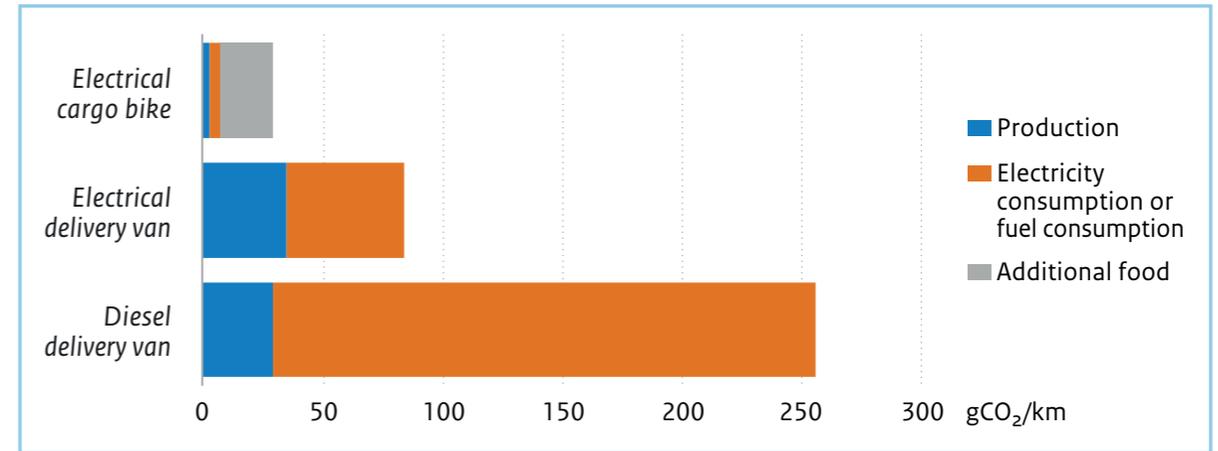
On the one hand, a cargo bike takes up far less space (65%) than a delivery van, but on the other, buses and cars can be hindered in overtaking slow-moving cargo bikes. This will result in more congestion than delivery vans that move at the same pace as other traffic.



Sustainability

Per distance travelled, cargo bikes emit less CO₂ than a delivery van

An e-cargo bike emits 88% and 65% less CO₂ per unit of distance travelled than a diesel or electric delivery van, respectively. In this calculation, account has been taken of the emission released during the production of the vehicle and the generation of (non-renewable) electricity. For other LEFVs such as compact delivery vehicles and electric cargo scooters, no sources are available.



Per delivered parcel there is also a CO₂ saving, although precisely how much is uncertain

A comparison on the basis of the distance travelled takes no account of the fact that delivery vans can transport more than an electric cargo bike. For that reason, a number of studies have investigated the CO₂ saving per delivered parcel (instead of per unit of distance travelled). However, these studies only consider operational emissions of (fossil) energy consumption and not the emissions relating to the production (and disposal) of the vehicle. All sources report a sustainability benefit, but the scale of this benefit varies widely from 10% to 73% CO₂ reduction per delivered parcel. This variation is due to different assumptions relating among others to:

- The electricity mix used for the electric cargo bike;
- The efficiency of the truck or delivery van that is replaced;
- The efficiency of the cargo bike;
- The additional kilometres travelled by the cargo bike as compared with the delivery van.



Road safety

Road safety effects of LEFVs are unknown

The road safety of LEFVs in terms of the number of registered victims is not known in the Netherlands. This is because LEFVs are not identified as a separate category in the road death statistics. In addition, details about the distance travelled by LEFVs are also unknown.

Estimate: safer with an e-cargo bike on the cycle path

Rijkswaterstaat (2022) estimates that admitting e-cargo bikes on the cycle path is beneficial for road safety, understandability of the road situation and enforceability. At speeds of up to approximately 30 km/h, vehicles with large mass differences can be safely mixed. The speed difference between an e-cargo bike and motorised traffic on a 50 km/h carriageway is too great to permit cycling on the road safely.

A complicating factor in estimating the road safety effects of cargo bikes is that the location on the road is different (cycle path surrounded by vulnerable traffic participants) compared with transport by delivery van. It is therefore meaningful to monitor the effects.

Smaller units are not by definition safer

It could be assumed that smaller units are always positive in terms of road safety. On the basis of an analysis between trucks and delivery vans, however, this has been shown to not always be the case. Replacing a truck within a built-up area with more than one delivery van is expected to result in an increase in the number of serious traffic injuries (traffic deaths and hospital admissions). It should be noted in this connection that delivery vans and trucks may follow other routes, which will have consequences for the number of interactions with specific types of road users.

It is not possible to predict the effect on road safety if for example delivery vans are replaced by LEFVs, that also partly make use of cycle paths. This should be further investigated.

Monitoring is important

By more systematically gathering knowledge about the potential risks of LEFVs in the future, the effects of LEFVs on road safety can be better monitored and estimated. This could be achieved by:

- Monitoring to what extent LEFVs are used and ‘at the cost of’ which other modes of transport (modal shift);
- Conducting in-depth empirical studies into accidents involving LEFVs.



5 Projected future developments

Interesting subareas for LEFVs

The interviewees above all identified inner city areas as interesting for LEFVs, and in particular for post and parcel deliveries and goods deliveries. The interviewees also mentioned the medical and health sector (for example GPs, physiotherapists), small and medium-sized enterprises (such as bakeries and wine merchants) and service logistics (engineers) as interesting sectors for LEFVs.

Possible role for LEFVs in urban distribution

Based on a survey among Dutch manufacturers of LEFVs, the expectation is that the number of LEFVs on the road in the Netherlands will triple between 2021 and 2025. A study of the available literature reveals that between 10% and 40% of current goods transport journeys in urban areas could be carried out using electric cargo bikes or other types of LEFVs, if micro hubs are established. The highest potential of 40% is based on a number of simple parameters. As a consequence, the researchers failed to consider that volume or refrigerated transport could be limiting factors for transport with a LEFV, or that multiple LEFVs could be deployed to deliver goods. On the other hand, the role of other logistic concepts could perhaps increase the potential of the often referred to 10-15%.

Policy influences potential

The future expectations for LEFVs also depend on policy choices. If (regional, national and European) policy comes out in favour of LEFVs as compared with alternatives such as electric delivery vans, more LEFVs can be expected. The reverse also applies; if policy favours the electric delivery van, this could have consequences for the popularity of LEFVs.

No consensus on which LEFV is most promising

Literature is unclear about which types of LEFV are specifically most interesting for replacing journeys by delivery van. There is no consensus among the stakeholders spoken to about which LEFV concept (normal cargo bike, large cargo bike, compact delivery vehicle or a brand-new type of LEFV based for example on a cargo scooter) offers the most promise in the future.

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Acknowledgements

Method

This brochure is based on insights from a literature study into LEFVs and ten interviews held with various stakeholders and experts.

Background report

For more information on the data, methodology, results and sources, consult the background report (only available in Dutch) that can be downloaded via the website www.kimnet.nl



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