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Potential to shift goods transport from cars to bicycles in European cities

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cyclelogistics
moving Europe forward

D7.1 A set of updated IEE Common performance indicators including their baseline and assumptions for extrapolation

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www.cyclelogistics.eu

Baseline and assumptions for the calculation of energy and CO_2 savings related to Cycle*logistics*

General introduction

The definition of Logistics is the transport of goods from A to B. Currently no commonly accepted definition of urban logistics exists. Some studies define it as the movement of freight vehicles with the main purpose of goods transport in urban areas. For Cycle Logistics a broader definition of goods transport in urban areas is used, independent of the vehicle type.

Logistics can be further distinguished by the type of goods that are transported and by the purpose of the trip:

1) Transport services of professional carriers like freighters, haulage firms, postal companies and international delivery services like DHL or TNT. In urban context, trips often concern the first or last mile delivery within a longer transport chain.
2) Freight transport carried out by the producers or traders themselves. The main activity of these companies is therefore located in a different field and the delivery transport only supports their business activity. An example for that would be Pizza delivery services.
3) A special form of goods transport is generated by transport trips where no freight is picked up or delivered, but goods or tools are transported to carry out certain services. An example would be craftsmen, but also communal services like park maintenance.
4) Private trips associated with the transport of goods are often not considered as logistics but are nevertheless part of this category. Both types of trips are associated with the transport of goods whether goods are transported home by a delivery service or by private individuals themselves. Shopping is the most common form of private logistics, but often goods are also transported in the area of leisure traffic.


Take-away Food


Sushi Bike


Cold Water Bike


Berlin Poster Bike


Amsterdam Cargo


Corn on the Cob


Stereo Bike


Carpenter Bike

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Characteristics of cargo cycling

The field of moving goods by bicycle is related to professional activities as well as to transport activities by private persons.

The project deals with trips in urban areas and the fact that the bicycle has many advantages over the car/lorry, in urban areas.

- It can use a denser road network (e.g. one-way roads in both directions, bus lanes – if allowed, cycle lanes, etc.)
- It needs less parking space and there are no access restrictions e.g. to deliver in pedestrian zones
- It is faster on short distances routes (up to 4 km) and especially at peak hours

For that reasons cycle*logistics* is dealing with urban trips and not with long-distance trips. Long-distance trips are only concerned if they are part of an intermodal trip. These long-distance trips will be done by train and only the last mile by bicycle.

Definition/demarcation by weight/volume

The second definition concerns the weight and volume of the transported goods. The weight of the transported goods is defined through the maximal load allowance for bicycles. For commercial bikes it amounts to 80 – 200 kg, in exceptional cases up to 400kg. But the weight also is an important factor with regard to determining whether a bike is a suitable means of transport, especially on hilly terrain.

The transport volume is predefined by the design type of the bicycle and varies between 400 – 800 litres depending on the bike.

Definition of used terms

Personal Transport: refers to commuter (work/education) travel, shopping trips, leisure trips and business trips. These trip purposes are usually established within household surveys and lead to modal split results by means of transport and trip purposes (TEMS database[i]).

Freight & Service Transport: refers to both freight trips for supply and demand transport within a city (like delivery or waste collection) and service trips done by business providers associated for the transport of goods and tools for the execution of their business (e.g. plumber, road maintenance etc.). These data usually result from business surveys.

Private Transport: Private transport refers to refers to commuter (work/education) travel, shopping trips and leisure trips. These are all personal trips, without business trips.

Commercial Transport: includes Freight & Service Transport including business trips.

Motorised Trips: all trips done by lorry, van, personal car and motorised 2-wheeler.

Eco-friendly Trips: all trips done by walking, cycling or public transport

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Definition distance and area

In the various surveys used as a basis for this document the term urban is used in a different context. Sometimes urban refers to an agglomeration and in other surveys urban refers to a city itself. In this study we use the term urban with regard to a city. Especially the transport behaviour of individuals that is described here has been based on surveys done in cities (TEMS database).

For cargo bikes, e-bikes and bicycle a distance of 7 km was defined as acceptable and therefore used within the calculation of the shift potential in this document.

Statistics about urban freight & service transport

High quality statistics are available for long-distance freight transport and for passenger transport also in urban context. For short-distance freight transport very few data are available. Regarding the share of urban good trips as part of overall trips, conflicting data exist. This may also be caused by the different definitions of cargo transport.

In the BESTUFS report[ii] (2006), a share (of urban good trips as part of overall trips) of 9-15% was reported for urban areas in France. The "Study on Urban Freight Transport"[iii] reports that 8-15% of all trips are done by freight vehicles. The share for Switzerland was 15%[iv]. For Berlin[v] and for Graz the reported share was 20%. An analysis for the City of Stuttgart[vi] reports commercially motivated trips in their city amount to 25 – 30% (service trips, business trips and cargo trips). This relates well to the 15% of cargo trips that is stated within the BESTUF analysis.

Taking into account the different sources an average share for urban freight trips of 15% (10-20%) has been assumed for the Cyclelogistics Baseline Study. The other 85% of trips are related to personal transport (business, commuter, shopping, etc).

In the freight category, BESTUFS reported that 1/3 of the trips are related to heavy freight transport (>3,5t) and 2/3 of the trips are urban freight trips with vehicles weighing less than 3,5 tons. However, a comprehensive study on motorised transport in Germany[vii] states that 60% of all motorised commercial freight trips (cargo trips, service trips, business trips) are carried out by regular passenger cars or estates. 25 % are related to vehicles with less than 3,5 t and only 8 % of all commercial motorized are related to vehicles >3,5 t (and 7% are allocated to vehicles that are not relevant for the urban context). This means according to this study that less than 1/5 of all cargo trips are related to heave vehicles (>3,5 t).

In relationship to the overall share of trips in cities this means 12% of all urban trips are deliveries of light goods. Whereby, in light goods delivery there is a lower degree of capacity utilization (28%). Out of these 12% of light goods transport there is a big potential for logistics by bicycles, especially because the vans carry much less load than they are constructed for. Also, goods transport is often done with vehicles the size of passenger vehicles. Very often these cars are used for deliveries attached to another core business, like pizza delivery services, or something similar.

Taking the results of existing data into account the urban trips for professional goods transport can be divided in three categories (1/5 heavy goods with >3,5t vehicles, 1/3 trips with lorries/vans of less than 3,5t weight that means a load of 0,8-1,5t, and slightly less than every second trip within urban freight transport is related to very light goods done in small vans, estate cars etc.). It is evident that the very light urban cargo trips are of great importance for the cycle logistic potential. But also to some extent the cargo trips in lorries and vans below 3,5 tons (0,8-1,5t load capacity)

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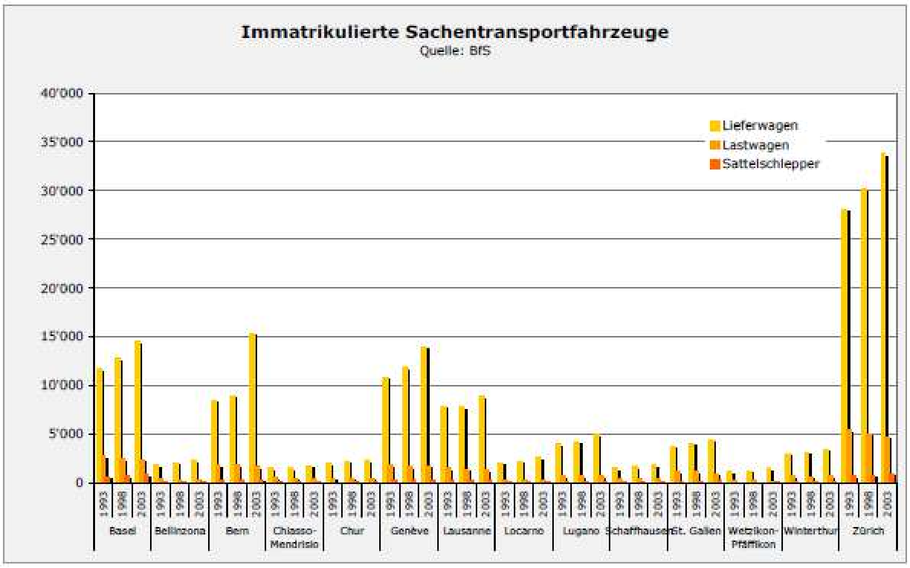
are of interest for the cycle logistics potential because of the low average load factor in urban delivery transport.

Vehicles by weight	Share within all urban trips
Share of heavy freight vehicle trips >3,5t	**3%**
Share of trips freight vehicles < 3,5 tons (vans)	5%
Share of logistic trips done by cars, small vans, estate car	7%
Share of urban freight & service transport in relation to all urban trips	**15% (10-20%)**

Goods transport by bike is mainly suited for short distances and light goods. Therefore, this form of transportation can play an appropriate role in urban areas and especially in city centres. Within the general professional urban logistic there seems to be a trend for an increased use of smaller delivery vehicles. Research in Swiss[viii] cities found out that the number of small delivery vehicles is remarkably increasing while the number of heavy vehicles is more or less constant.



This can be used as good indicator for the potential of cycle logistics applications. One explanation for this might be that e-commerce is increasing and more light goods have to be transported that were purchased directly in shops in the past. On the other hand logistics companies might have realized that small vehicles are more appropriate for deliveries in cities.

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Urban delivery trips, environmental impact and energy use

While the share of goods delivery trips sumps up to 15% of all urban trips the share of energy use is 30% of all urban transport energy consumption.

The reason is that urban freight transport is almost exclusively done with vehicles that rely on fossil fuels (diesel and petrol).

According to BESTUFS 20-30% of urban emissions from the transport sector are attributed to goods transport. In Switzerland[ix] it is even 40%. This means that urban freight transport also has a very high share with regard to environmental impact and energy consumption. Delivery by bicycle already exists in urban areas e.g. for postal services. I can be assumed that the share of these trips will be less than 1% of all delivery trips so we calculated with 99% motorised trips for this trip category.

Urban goods delivery in context with the overall urban transport

Share of trips of urban freight transport	15% (10-20%)
Share of km of urban freight transport	20% (15-25%)
Share of energy use and emissions of urban freight transport	30% (20-40%)

Urban personal mobility

With regard to how people travel and transport their personal goods in urban areas it is possible to distinguish the following transport purposes:

- Business trips related to the transport of goods – these are people pursuing their business, e.g. craftsmen or service providers
- Shopping transport
- Leisure transport
- Commuter transport to work and school

There exist various good data for personal transport in urban areas. For this report the results from Social Data[x] and from MiD 2008[xi] for German cities were used, also data from the National Travel Survey in Finland[xii], mobility data from the EPOMM database TEMS[xiii] and from the allinx web platform[xiv], as well as the mobility survey from Graz.[xv]

Taking the different sources into account following proportions arise:

Share of trips	All passenger trips
Business trips	8%
Shopping trips	24%
Leisure trips	27%
Commuter trips (work and school)	26%
Total	85%

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The TEMS data of 322 European cities show an average amount of motorised passenger trips of 45% (out of 85%) of all passenger trips. There are plenty of data available concerning the modal split for the number of trips in European cities. But the methods on how these data are collected and analysed differ remarkably. No uniform standard method on carrying out surveys on mobility behaviour in cities /urban areas exists. In 2010 a country wide survey, in 27 EU-countries[xvi], analysed the main mode of transport. It resulted in a 3 % higher share of motorisation that the average of the TEMS cities. This can be used as a plausibility check for our calculations, because the motorisation in cities is usually lower than the country average.

Share of all trips in an average European city

Trips done by car and lorry

The share of motorized transport that is involved in trips associated with the transport of goods is calculated for each trip purpose. To calculate the rate of motorisation per trip purpose surveys were considered that are close to the mean value of the 322 European cities taken from the TEMS database[xvii],[xviii].

Motorisation by trip purpose[xix],[xx]	%
Level of motorization in urban freight and services	99%
Level of motorization in business transport	73%
Level of motorization in shopping transport	56%
Level of motorization in leisure transport	53%
Level of motorization in commuter transport	46%

The average number of all trips done by car, weighted against the share of trips that can be shifted results in an average factor for the choice for motorized means of transport. This factor, 0.6, was used for the calculation of the long term outcomes.

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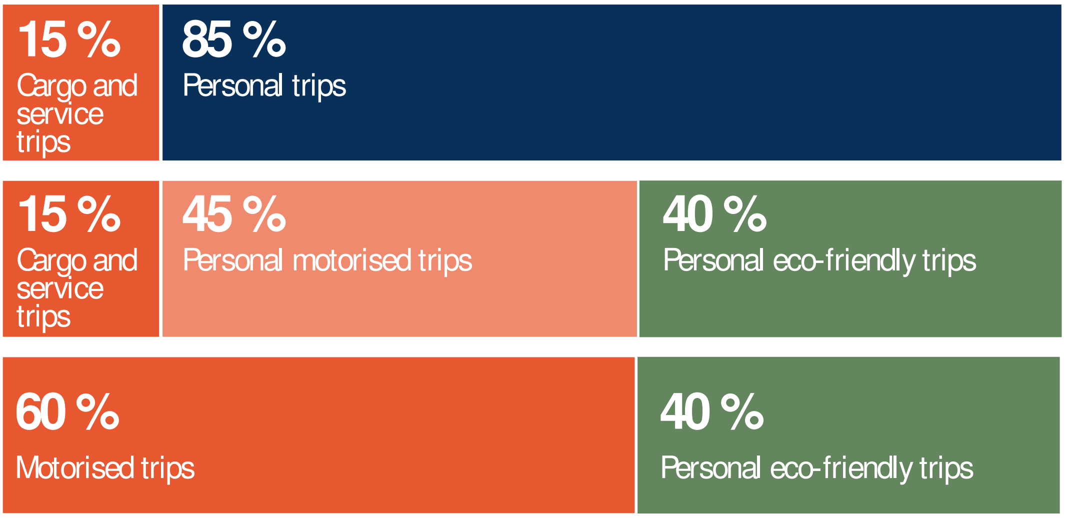
Composition of trips in European cities



Share of trips by mode

Freight or goods transport is not only relevant for supply and disposal transport but also for personal transport connected with the transport of goods.

15% of trips in European cities are related to goods transport done by professional carriers (supply and disposal) and on average 85% are related to private transport (business, commuter, shopping, etc.). The private trips are partly also related to transport of goods. The fact that they are carrying cargo or goods is obvious in the business sector and for shopping trips. But it it important to note that also leisure trips and commuter trips include a certain share of light goods transport.

For a shift to cycle logistics only motorised trips are of interest for further calculation.

Taking all motorised trips as the basis (60% =100%) of the trips the following split into trip purposes can be calculated for an average European city.

Share of trips	Motorised trips
Business trips	10%
Shopping trips	22%
Leisure trips	23%
Commuter trips (work and school)	20%
Freight/Delivery/Cargo trips	25%
Total of motorised trips	**100%**

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Personal trips in cities involving the transport of goods and their potential for cycling

Shopping transport

Shopping transport has a share of 22% of all urban motorised trips, and thus represents a high share of the trips related to light goods transport in a city. While1/5 of all shopping trips result in no purchase[xxi], nevertheless, the possibility of a purchase exists for all shopping trips. So even trips result in no purchase they need to be taken into consideration also for these cases.

Research[xxii] shows that a car is only required for 6% of all shopping trips. This survey, carried out in Graz in 2009, had surprising results. Out of 1600 purchases from shopping trips 80% could have been transported by cycle. Some (14%) the volumes were big they would have required a bicycle trailer. But only in 6% of the cases was a car necessary to transport the purchases home. Despite that 77% of all these shopping trips were done by car.

	Shopping goods could be carried in a bike basket / panniers	Shopping goods could be carried in a bicycle trailer	A car is necessary to carry the shopping goods
Shopping in hardware stores and supermarkets related to the required means of transport	80%	14%	6%
Shopping in Supermarkets related to the required means of transport	87%	12%	1%

The majority of all shopping trips involve the transport of daily goods (food and toiletries)[xxiii]. In fact, 9 out of 10 shopping trips are done for daily supplies, available in supermarkets. In urban areas supermarkets are usually located within the catchment area of bicycle traffic. Therefore, the existing data demonstrate a high potential for shopping transport, both, with regard to transport volumes and the trip distance. About 1/6 of the shopping trips for daily supplies are done as part of trip chains and cannot easily be shifted and are therefore not taken into consideration. Shopping trips that are connected to commuter trips would also require a change of the transport mode used for the trip to work. These complex shifts are part of the overall potential but not easy to realise.

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Leisure and commuter trips

Insufficient data are available on leisure transport connected with the transport of equipment is. Leisure transport consists of many different types. It ranges from holiday trips to day trips to regular leisure activities like sport, culture, meeting friends etc. In total 27% of all urban trips are attributed to leisure transport. Based on all motorised trips the leisure transport represents 23% of all motorised trips of citizens. [xxiv],[xxv]

The need for transport is mainly attributed to the area of sports activities and visits but also to day trips or leisure time activities (e.g. picnic). Based on the data of a Swiss survey[xxvi] it was calculated that 2 out of 3 motorised leisure trips involve the transport of goods. From the 2/3 of trips that involve goods transport every second trip has the potential to be done by bicycle (taking into consideration weight/volume and trip length).

Share of leisure time activities in urban areas			
High relevant to transport of goods		Partly/little relevant to transport of goods	
Visits	19,5%	Restaurant, Pub	23,5%
Active Sports	14,5%	Culture, leisure centres, passive sports	8,3%
Excursions, Holidays, non-paid work etc.	7,4%	Non sport activities in the living environment	7,5%
Combined leisure activities	4,4%	Activities in member associations , religion	4,9%

Commuter trips to work and school represent 26% of all urban trips. Related to the share of motorised trips the number is 20 % (15% trips to work, 5% trips to educational sites, mainly school children as passenger in their parent's car). For the motorised educational trips the school bag was identified as light goods. The other part of the potential is related to the trips to work. There are some target groups that regularly carry work related belongings. For instance, teachers often state the need to use their car for the transport of their teaching materials. Sometimes the use of the car is justified solely by the possibility that working materials might have to be transported, when in reality there is often no need for it, or the materials could easily be transported on a bike. These assumptions were also taken into account when the potential for goods transport related to commuter transport was calculated. So every second motorised commuter trip involves goods transport and every 4th trip can be identified as having the potential to be shifted to the bike.

It would be possible to provide guidance for this target group during the **cycle*logistics*** project with product information about bicycle baskets, panniers, etc.

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Trip lengths as a limiting factor for the shift towards cyclelogistics

Surveys carried out in German and Austrian cities showed that every second trip of private individuals done with motorised vehicles is shorter than 5 km and 70% of all car trips are shorter than 7 km.

So 7 out of 10 private car trips fall within the distance criteria formulated within CycleLogistic.

For **light goods transport** done by professional carriers the trip distance between stops amounts on average to 6 km[xxvii]. Another research result found that most deliveries have trip distances between 2 and 9 kilometres[xxviii]. These delivery trips might or might not involve a trip chain. Therefore, the trip distance is not the only factor that has to be taken into consideration when estimating the potential of goods delivery trips for a shift to cyclelogistics. However, a French analysis determined that only 3 out of 10 deliveries trips are part of delivery round or trip chains[xxix] Therefore, it can be concluded that a high share of motorised cargo trips fall within the bicycle/pedelec distance of 7 km.

The average trip length for business transport in Graz[xxx] is 18km. However, this also includes business trips to other conurbation centres. A survey among businesses in Graz[xxxi] showed that 37% of the trip lengths of the businesses in question are shorter than 5 km long and 47% are less than 7 km long (catchment area for Pedelecs).

S**hopping transport** can be split into 85% relating to trips for daily supplies, 10% relating to goods like clothes, sports equipment etc. Both taken together thus amount to 95%. Only 5% relate to shopping for goods that are only purchased once or twice a year, like furniture, etc. Trips for daily supplies are short trips and are all less than 7 km. This means they all have the potential to be shifted to the bike the same is true for the 10% related to goods like cloths and sports equipment. This means that if we apply the distance criteria 95% of all shopping trips are relevant.

For **leisure time transport** trip distances of the population of Graz[xxxii] are used for the calculation and therefore, it is assumed that every second trip is shorter than 5km. A Swiss study about leisure time transport assumes an average trip length of 11 km[xxxiii], however this includes all leisure time trips and is not restricted to urban leisure trips. Therefore, our calculations are based on the mobility survey done in Graz[xxxiv].

The same is true for the potential with regard to **commuter transport**. Educational trips (including school trips and parent taxi) are identified as trips within the cycle logistics distance criteria (about a quarter of all motorised commuter trips). Commuter trips (to work) on average involve longer distances than the average of all car trips carried out within a city. This is confirmed by surveys from cities within the TEMS database. And data from company transport surveys show that on average 2 out of 3 motorised work trips are shorter than seven kilometres.

To be on the safe side, with regard to the calculations of the specific savings in the area of leisure trips, an average distance of 5 km was assumed for the trips that have the potential to be shifted from the car to the bike.

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Calculation of the potential for Cycle Logistics

The share of motorised trips in European urban areas is on average 60% of all trips. 40% are done by Public transport, cycling or walking.

Taking all motorised trips as basis for the calculation (60% =100%) we find that 42% of all motorised trips could be potentially shifted to bicycle transport. Because these trips are:

- Related to light goods transport (more than a handbag less than 200 kg)
- Are short enough (less than 5 km for bike, less than 7 km for e-bike)
- Are not part of a complex trip chain that involves usage of a car.
-

Taking into consideration all motorised trip purposes the percentages shift. For cargo trips this means that the percentage within this new basis is now 25% because most of them are done with motorised vehicles. The situation is similar for business trips that also have a high share of motorisation.

Motorised trips and potential for shifting (Basis: 60% = 100% motorised trips)				
	Motorised trips purpose	Trips to shift to bike/cargo bike	Trips, no goods involved	Motorized trips; not to shift
Commuting	20%	5%	10%	5%
Leisure	23%	7%	8%	8%
Shopping	22%	17%		5%
Business	10%	5%		5%
Cargo & Service	25%	8%		17%
Total	**100%**	**42%**	**18%**	**40%**

This shift of potential is illustrated below. Moreover, this graph shows in detail the potential of shift from motorized vehicle to bicycle (dark blue) in each of the different trip purpose categories. Trips with no potential for a shift (light orange) are those trips that are excluded due to the weight/volume, trip length or trip chain parameter. Trips that do not involve any transport of goods are represented in gray.

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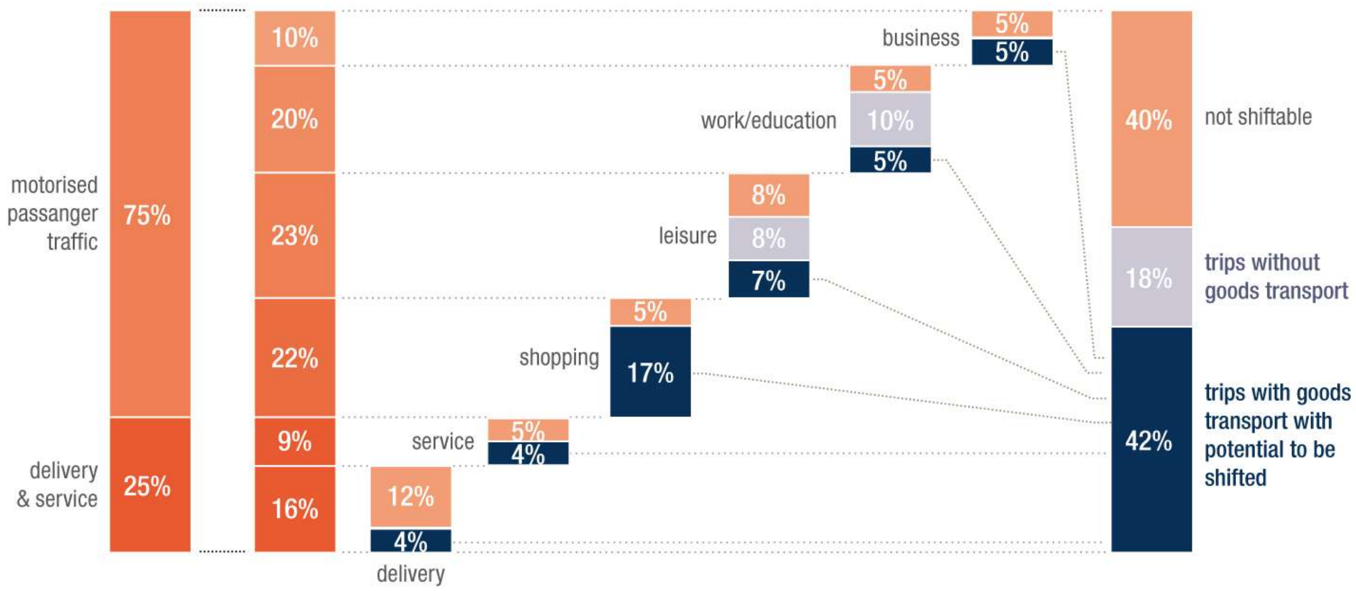
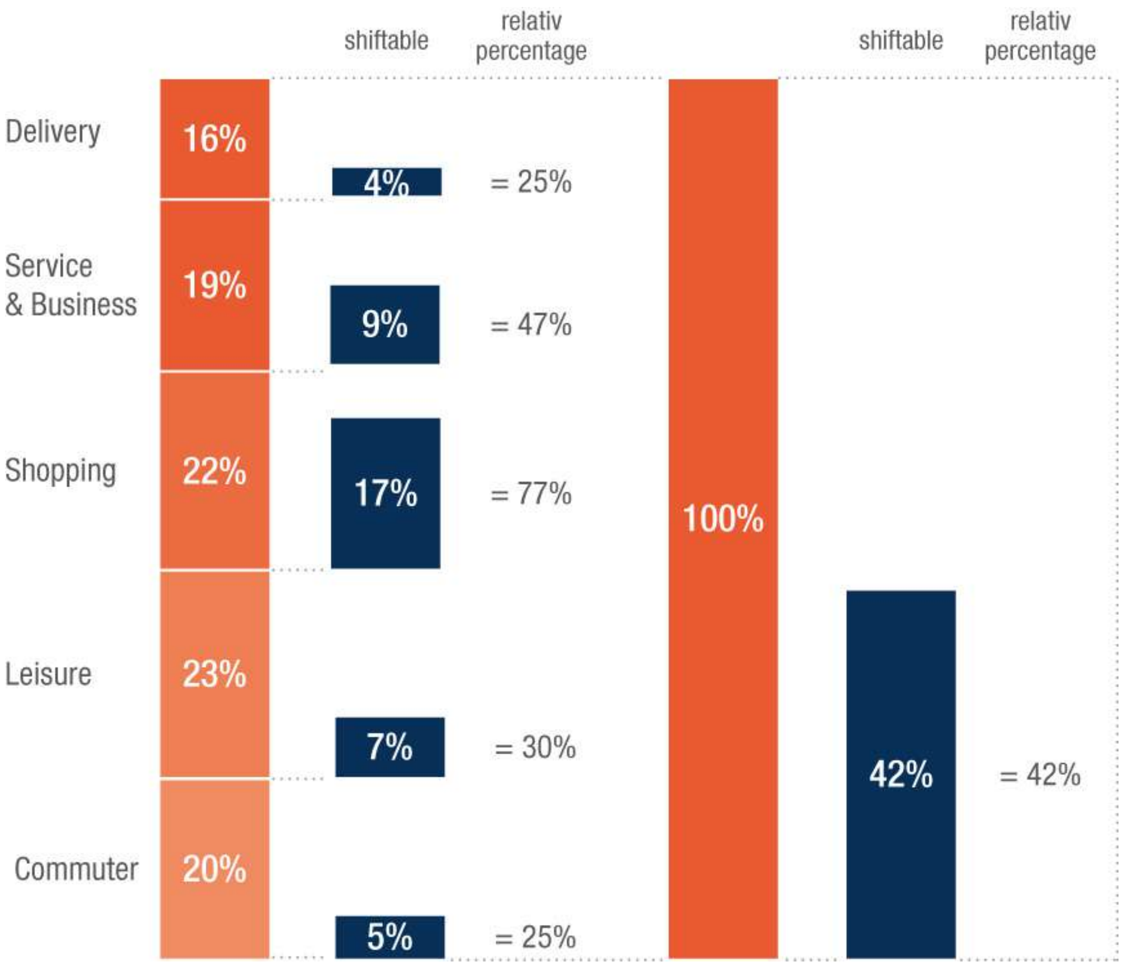


Shift of trips to bike and Cargo bike out of all urban motorised trips



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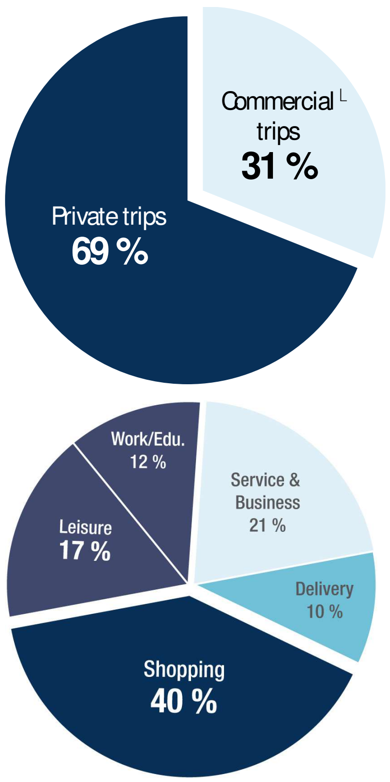
With regard to the potential the amount of logistic trips carried out by private persons is remarkable. Seven out of ten trips are related to private transport like shopping goods or leisure equipment. The biggest potential can be found within shopping trips. Four out of ten trips that have the potential be shifted are related to this trip purpose. This is more than the entire potential for commercial logistics (three out of ten trips).

	Share of potential	Shift able motorised trips within all motorized trips with goods transport	Shift able motorised trips within all motorized trips	Shift able motorised trips within all trips
Shopping trips	40%	21%	17%	10%
Leisure & commuter trips	29%	14%	12%	7%
Private logistics	**69%**	**35%**	**29%**	**17%**
Goods delivery and service trips	19%	10%	8%	5%
Business trips	12%	6%	5%	3%
Professional logistics	**31%**	**16%**	**13%**	**8%**
Total	**100%**	**51%**	**42%**	**25%**

Share between all shift able trips related to trip purpose



Within the potential for Cycle Logistics the private logistic trips amount to over 2/3 (69%) of the potential for a shift towards the bicycle while the professional logistic sector could contribute 1/3 of the potential.

Assessing the overall picture the shopping trips could play a very important role when it comes to measures to achieve the potential.

Within the private trips the shopping trips are of high importance. Shopping trips alone represent a bigger potential for change than all commercial trips together. But with the increase of online shopping this sector is changing and parts of the shopping trips will be replaced by delivery trips of online shopping items.

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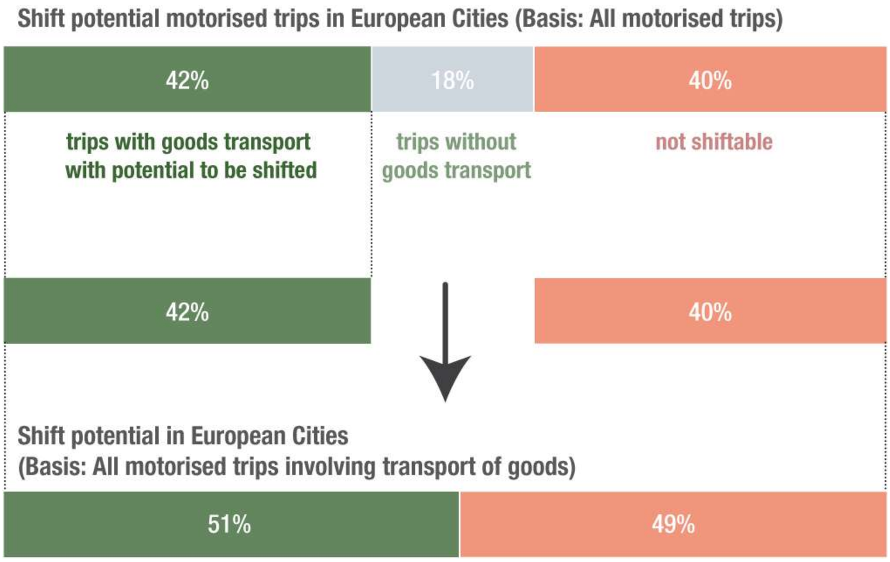
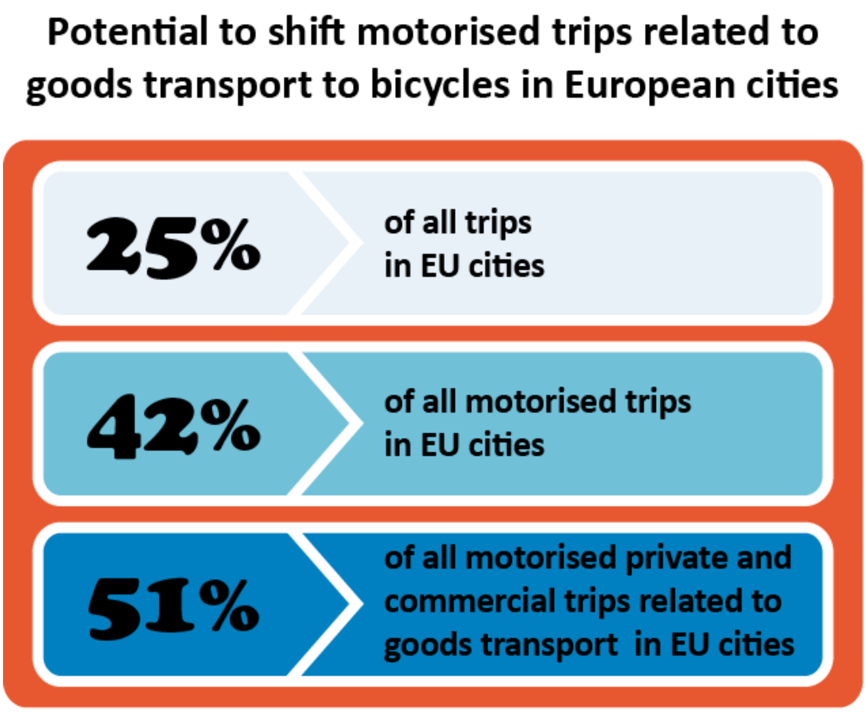
Taking into account trip distance, weight and volume of goods every **second motorized trip** in urban areas that involves goods transport has the **potential to be shifted** to the bicycle!





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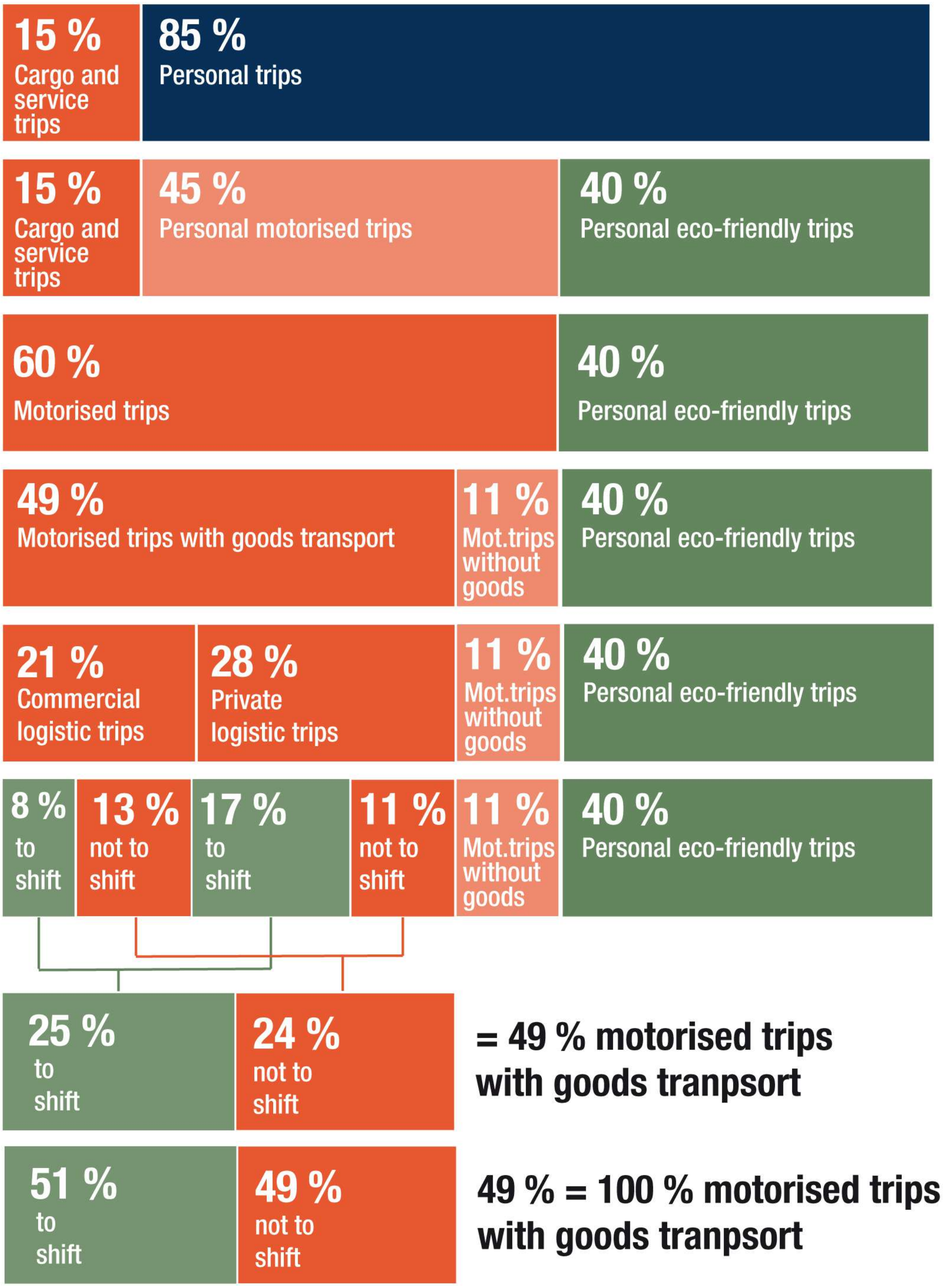
Potential for Shifting Trips to Bike and Cargo Bike

in a step by step diagram view



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Limitations of the analysis of the potential

The potential for the above calculations was generated by applying the following indicators:

- weight/volume of transported goods (everything above 200 kg/m3 was excluded)
- trip lengths (everything above 7 km were excluded)
- trip chains (were partly excluded)

However other limiting factors affecting the use of bicycles (like negative attitude towards cycling, absence of cycling infrastructure, weather conditions, topography, etc.) were not taken into consideration, because these factors vary greatly in different European cities.

On the other hand factors that could have a positive influence on the use of bicycles for goods transport (like the existence of cargo bikes that can transport weights up to 400 kg, the availability of high volume cargo bike trailers and the positive effect of micro-consolidation centres for the distribution of goods by bicycle).

Would these limiting and/or favouring indicators have been applied to the calculations as well the resulting numbers for the potential might vary slightly.

Many data and surveys are available regarding the motorisation or the split of trip purposes in urban areas of private trips. And the present analysis is heavily based on those data.

Few data exist on the number of commercial trips and the trip purpose within commercial trips. In this area the calculations were based on the limited amount of data and logical conclusions and reasoning.

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Breakdown of savings for the strategic savings until 2020

The assumptions on the strategic level were done in a very general way. For this, the proposition made in various EU-publications that states that 70% of all Europeans live in urban areas was used as a basis for the calculations.

It is a well know fact from various surveys done in urban areas that inhabitants of cities make 3-4 trips per day. The number for Graz is e.g. 3,7 trips per day plus a 15% value for goods transport (see baseline chapter in this deliverable) this therefore results in 4,26 trips/day.

This means that the value of 5 trips per day needs to be reduced to the value of 4,3 trips per day.

Share of light good trips

The statements in the baseline study at the beginning of this report demonstrate that the potential for light goods transport is 60% of all trips in urban areas. If restrictions due to distances, trip chains and motorisation are also taken into account the potential is reduced to 25% of all trips (which is equal to 42% of all motorised trips). If electric support for bicycles and cargo cycles will be used in bigger numbers this amount might even rise. However, all further calculations will be done with a value of 0,25 (share of shift).

Average trip distance

The assessment of the average trip length is connected with the chosen shift criterion for reasonable distances for the transport of goods by bike. According to **cycle*logistics*** partner Outspoken delivery and subcontractor Gnewt logistics, 1,9 km is an average distance for light goods transport in the delivery sector. If trips with a distance of up to 5 km for bicycles and 7 km for electric assisted bicycles are considered reasonable, an average trip distance of 2,5 km / 3.5 km has to be used for the calculations. The same is true for the transport of tools and materials in the area of private business transport.

For shopping transport the numbers are lower (1,5 km) due to the fact that the share of trips for daily supplies is high. Where leisure transport is concerned, the trip length is higher (on average 4 km) and the same value has also been used for commuter transport. This results in an average trip distance of 2,3 km for motorized traffic that could be shifted to bicycles and is related to the transport of goods.

Average litres of fuel in light goods transport [xxxv]

The average consumption of fuel was calculated on the basis of the fuel consumption of small lorries and vans (13l/100km) and the consumption of personal cars for short urban distances (9l/100km).

Weighted by trip length and trip purposes this leads to an average fuel consumption of 10,4l/100km of goods related urban transport.

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Litres into tons (www.aral.de)[xxxvi]

Density of diesel: 0,845 kg/l

Density of petrol: 0,747kg/l

Weighted by consumption and the fact that diesel is also used for private transport an average value of 0,796 kg/l fuel is used for the strategic calculations.

Days per year

For goods transport, private business transport and commuter transport the amount of 220 working days/year are used for the calculations. However, for shopping and leisure transport Saturdays have also been considered (280 days) too.

For the strategic calculations a value of 220 days per year has been used.

How many trips can be shifted?

Following is an explanation for why we assume that 1 out of 1000 trips will be shifted form car to cycle transport.

The number 1 of 1000 is already taken form the potential trips – this means trips from an area where change is really possible.

We have made this assumption because we expect only a small change in behaviour in the next few years. The European trend still shows an increase in the energy consumption related to transport. The savings calculated for the **cycle*logistics*** project should be regarded in the light of this trend.

Certainly the numbers can only give an overview and should be considered as one reference point because different areas in Europe show great differences. In Copenhagen (520.000 inhabitants) for example 35.000 cargo bikes are in use already. And during the **cycle*logistics*** kick-off-meeting we were told by Copenhagen logistics experts that even there they see a bigger potential.

Delivery services that utilize cargo bikes have a big effect on the public and on the media. However, the biggest potential for a shift from the car to the bike is attributed to private logistics with regard to shopping transport. Here there are no big investments necessary. The purchase of stable bicycle baskets, panniers or, if necessary, a bicycle trailer, is sufficient. Shopping by bike can be done in all European cities and regions as long as adequate conditions for bicycle traffic are available (safe transport options, bicycle parking facilities, etc.). However, it is important to consider an interaction between the different areas. In Copenhagen, for instance, cargo bikes are used for different purposes: to transport children, goods, or both at the same time.

With regard to **cycle*logistics***, *we note that* forerunner nations like the Netherlands and Denmark will have an influence on the effect throughout Europe. Not only the Netherlands or Denmark are represented as partners within the **cycle*logistics*** consortium but there are also subcontractors from metropolitan centres like Paris and London. Things that happen in these two cities have an influence on the public perception in the rest of Europe. It is difficult to predict if all regions will be motivated by the project activities to the same degree – therefore, the assumptions made in this report are rather conservative. Based on these data and the careful calculations the proposed savings in fuel presented in Annex I of the CycleLogistics project is about **15.000 tons/year** and the reduction on CO_2 emissions is about **37.000 tons/year**.

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Performance indicators and targets of the CycleLogistic project Long-term outcomes and impact

<table>
<tr><th>Strategic objective(s)</th><th colspan="2">Target by 2020</th></tr>
<tr><td>– Stakeholders in the urban environment are aware of the possibility and the advantages of using cargo bikes
– European Metropolitan cities should be the trendsetter for cargo cycling because of the international media recognition</td><td colspan="2">– By 2020 more than 1000 stakeholders in Europe are not only aware of the possibilities created by cyclelogistics but also integrate them into their daily activities and decision making processes.
– cyclelogistics with partners in Paris, Copenhagen and London will be established as trend setters in the field
– Contents applied and promoted within cyclelogistics will applied in more than 200 cities within Europe</td></tr>
<tr><td>– Large scale application of cargo bicycles for delivery services, for communal and business services and integration in the local transport policies
– Raise the number of intermodal deliveries</td><td colspan="2">– 10% of European cities with more than 100.000 inhabitants will take up bicycles for communal and business services or set up new/extension of existing delivery services and integrate their use in the local transport agendas
– 1000 trips a year will be shifted to intermodal deliveries.</td></tr>
<tr><td>– Bicycles will be used more for private goods transport like shopping because more bicycles with e-support will be utilised</td><td colspan="2">– 20% of all shopping trips (= 3% of overall trips), involving goods transport will be shifted from the car to cycling</td></tr>
<tr><td>– To reach a critical mass of sold cargo bikes and bike equipment related to goods transport</td><td colspan="2">– The purchase numbers of cargo bikes and related equipment will increase by 10% per year</td></tr>
<tr><td rowspan="14">– To reduce fuel consumption for trips that are related to goods transportation and to realize the corresponding CO_2 savings</td><td>Energy savings / CO_2 savings</td><td></td></tr>
<tr><td>EU 27 population</td><td>500.000.000</td></tr>
<tr><td>Living in urban areas</td><td>0,7</td></tr>
<tr><td>Trips a day incl. freight/goods</td><td>4,3</td></tr>
<tr><td>Done by car/lorry</td><td>0,6</td></tr>
<tr><td>Share of light goods trips to shift</td><td>0,4</td></tr>
<tr><td>Average trip distance km</td><td>2,3</td></tr>
<tr><td>Average litre fuel/km in urban goods transport</td><td>0,104</td></tr>
<tr><td>litre to tons</td><td>0,000796</td></tr>
<tr><td>(Working)days /year</td><td>220</td></tr>
<tr><td>Theoretic saving potential/t fuel</td><td>15.130.200</td></tr>
<tr><td>1 out of 1000 trips will be shifted</td><td>0,001</td></tr>
<tr><td>Savings until 2020 / t fuel/year</td><td>15.130</td></tr>
<tr><td>Savings until 2020/ t CO_2 per year</td><td>37.370</td></tr>
</table>

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Assumptions for specific savings during the project lifetime of the CycleLogistics project

AA1 – Goods delivery

The savings in AA1 range from the expansion of activities of existing cycle logistic businesses to the initiation of new applications in companies and the initiation of intermodal transports combining bike and rail.

It is assumed that 100 new cargo bikes will be in use thanks to the **cycle*logistics*** project. Both, the number of trips as well as the trip length are extrapolated from information available from already existing delivery services. Thereby already existing services will have a higher number of trips compared with newcomers in the field. This number will also vary depending on the number of businesses that transport their goods themselves (e.g. pizza delivery) will shift from motorized vehicles to the bike.

We assume a low shift for co-modal trips because at the moment it is not yet clear if Outspoken will actually receive all expected commissions in this application area. However, in the case of a positive development the number could be much higher. For the distance of co-modal trips data from the bicycle couriers from Graz have been used for the calculations.

The average fuel consumption of vans was determined by using data from relevant websites that provide real data (www.spritmonitor.de). For urban trips a 15% increase in consumption was assumed. This number coincides with a mean value from test reports[xxxvii]. For vans this results in a real consumption of 13l/100km as a calculation basis. The conversion from tons of fuel to tons CO_2 has been based on the value for diesel. Working days (weekdays) per year were used as a basis for the calculation. According to our calculations 292 tons will be saved in AA1 per year.

AA2 – Municipal services & service providers

AA2 deals with the use of cargo bikes for municipal services and services with the need to transport goods or tools. For municipal services a rather moderate number of 20 cargo bicycles were taken as a basis for calculations. We use this figure despite the fact that this is the number of cargo bikes in use for road maintenance services in Copenhagen alone. (Copenhagen uses many more cargo bikes for other city services.) With regard to cargo bikes in use in private businesses it was estimated that 120 bikes would be in use during the project lifetime with an average trip length of 4km. This mean value is rather small for private business services, however it was chosen in order to guarantee a conservative number for fuel savings. All other parameters were the same as in AA1.

In AA2 savings of **71 tons** are predicted.

AA3 – Private goods transport

It is assumed that during the 2-3 test months (on average 65 days) 3000 people participating in the "Shop-by-bike" campaign will contribute to savings in the area of shopping transport. It is also assumed that every third participant of this test campaign will maintain this shopping behaviour (1000 persons). In addition it is assumed that 300.000 members of NGOs over Europe are reached during the project lifetime and some of them will also change their shopping behaviour. For this a

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careful assumption was made on the basis of discussions with the Austrian NGOs. It was only assumed that every 20th person would change the behaviour and in addition it was also taken into account that about 56% of all shopping transport are currently done by car . This implies that out of 300.000 people reached 9.300 might actually change their behaviour. A further assumption concerns word-of-mouth propaganda between family members and friends. Therefore, it is assumed that every 40th person reached through NGO media will motivate persons in his or her immediate surroundings to switch from the car to the bike. This too, is a very conservative assumption and will be verified during the evaluation of the project.

The calculation of trips was done as follows: number of average trips per day 3,7 x share of shopping transport 0,27[xxxviii] = an average number of shopping trips per day of 0,99. For people induced through NGOs to shift from the car to the bike it was assumed that only 70% of the trips will be substituted. This makes 0,69 trips/day. Where shopping transport is concerned Saturdays were also included in the calculation and this resulted in 280 days/year as a basis for the calculation. The average fuel consumption assumed for short urban shopping trips was 9l/100km and the numbers for petrol were used for the calculations to convert fuel into CO_2.

In total this leads to a prediction of 634tons of savings in the area of shopping transport.

Savings in the area of leisure time transport.

For leisure transport connected with goods transport the cautious assumption was made that every 30th NGO member, reached through **cycle*logistics*** activities, will change his behaviour. Further, it was taken into account that 48% of all leisure trips are currently done by car. This leads to an estimated number of 4800 people who will change their behaviour. In addition it is assumed that there will be a spill-over effect from persons that have changed their shopping behaviour into the area of leisure transport. It was estimated that this spill-over effect will amount to 20%[xxxix] . This means that an estimated number of 1560 people will change their behaviour.

The number of trips was calculated the following way: 3,7 trips per day x 0,33 (33% leisure time trips) x 0,3 (every third trip is affected) = 0,407 affected leisure time trips per day. The average trip length is 5 km.

In total this should lead to 204 tons of savings in the area of leisure time trips associated with the transport of goods.

The following conversion factors were used for diesel and petrol, respectively:

$$1 \text{ litre diesel} = 2{,}62 \text{ kg } CO_2; \; 1 \text{ litre petrol} = 2{,}32 \text{ kg } CO_2$$

This leads to specific savings of 1200t/fuel and 3743 t/CO_2 per year (see also table below).

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Fuel savings and CO2 savings within the project duration

Extension of activities of CycleLogistics delivery partners and subcontractors area 1

Nr. Bikes	Trips a day	Average distance	Days per year	Liter fuel per km	Density fuel	Fuel saving tons	CO2 tons
100	23	2,1	220	0,13	0,832	115	362

New cargo bike activities triggered by CycleLogistics activities in area 1

Nr. Bikes	Trips a day	Average distance	Days per year	Liter fuel per km	Density fuel	Fuel saving tons	CO2 tons
150	20	2	220	0,13	0,832	150	472

Co-modal trips shiftert from Lorry to Bike and train - area1

	Trips / year	Distance /km		Liter fuel per km	Density fuel	Fuel saving tons	CO2 tons
	1.000	250		0,13	0,832	27	85

Municipal services shift to cycling (maintainance, social services) area 2

Nr. Bikes	Trips a day	Average distance	Days per year	Liter fuel per km	Density fuel	Fuel saving tons	CO2 tons
20	15	2	220	0,13	0,832	14	43

Bicycle for bussiness services; triggered by all consortium partners and subcontractors - area 2

Nr. Bikes	Trips a day	Average distance	Days per year	Liter fuel per km	Density fuel	Fuel saving tons	CO2 tons
120	5	4	220	0,13	0,832	57	180

Private Logistics shopping test month - area 3

Persons	Shop Trips a day	Average distance to shop & home	2,5 test month	Liter fuel per km	Density fuel	Fuel saving tons	CO2 tons
3.000	0,999	3	65	0,09	0,748	39	122

Private Logistics shopping permanent shift of test users - area 3

Persons	Shop Trips a day	Average distance to shop & home	Year	Liter fuel per km	Density fuel	Fuel saving tons	CO2 tons
1.000	0,999	3	215	0,09	0,748	43	135

Private Logistics shopping permanent shift by reaching the target group with info from area 4

Concerned people	Shop trips a day	Average distance to shop & home	Year	Liter fuel per km	Density fuel	Fuel saving tons	CO2 tons
9.300	0,6993	3	280	0,09	0,748	368	1.141

Private Logistics shopping permanent shift by talking to other people

Concerned people	Shop trips a day	Average distance to shop & home	Year	Liter fuel per km	Density fuel	Fuel saving tons	CO2 tons
4650	0,6993	3	280	0,09	0,748	184	570

Private Logistics leisure trips by spill over effects from peole who changed schopping travel behaviour

Concerned people	Shop trips a day	Average distance to shop & home	Year	Liter fuel per km	Density fuel	Fuel saving tons	CO2 tons
1860	0,407	4	280	0,09	0,748	57	177

Private Logistics leisure trips permanent shift by reaching the target group with info from area 4

Concerned people	Shop trips a day	Average distance to shop & home	Year	Liter fuel per km	Density fuel	Fuel saving tons	CO2 tons
4800	0,407	4	280	0,09	0,748	147	457

Sum of all savings **1.201 t/fuel** **3.743 t/CO2**

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