CIVITAS CAPITAL	CIVITAS INITIATIVE
Advisory Group 5	CAPITAL
Data and Statistics	CAPITAL
City level Sustainable Mobility Indicator Descriptions	2016

Introduction

This document provides a simple, easy to use set of indicators that cities can use to measure how well their transport and mobility system is performing. Data gathered regularly can show that objectives are achieved, that what is supposed to function, does function, and to show politicians and citizens that their city is improving. This document was prepared as part of the CIVITAS CAPITAL project by a selected group of experts (see page 5 for more details).

Why gather data on mobility in a city?

It is useful to gather data for the following reasons:

- Deciding exactly what measures to implement, where.
- Monitoring the effects of measures to ensure that they were as intended
- Monitoring trends/development
- Setting objectives for urban mobility
- Comparing/benchmarking
- Adjusting and/or justifying policy and measures, internally and externally
- Communicating the results of the city's mobility policies and activities
- Providing focus on what needs to be delivered.

Structure of this document

This document presents a list of indicators and prioritises 9 of these. The full list of indicators is divided into four main categories:

- Output indicators what the city has actually delivered or implemented.
- Intermediate outcomes, such as travel patterns.
- Final outcomes, such as public transport speed and reliability.
- Final impacts on policy objectives such as levels of air pollution, public health and safety.

Certain of these categories are also subdivided by mode of transport.

For each indicator a definition is provided along with a summary of the urban mobility objectives that it is related to. Then some information is provided on how to gather the necessary data and how often, and the costs of so doing. Finally, examples are given of cities that have gathered such data already and how they have used it.

How much data should I gather and for which indicators?

The indicators in this document have been selected to provide as comprehensive view of mobility in a city as possible. However, it is recognised that collecting data on a regular basis for all indicators is a challenging task, mainly due to various resource constraints. Therefore, this list of indicators has been prioritised to show those that are most important.

To reduce subjectivity and improve the usefulness of the indicators, the experts proposed that this prioritisation should follow a set of criteria and should take into consideration the characteristics of each individual city, such as size, level of economic development, political governance and history.

The following criteria were used:

- Relevance for one or more of the three impact dimensions of sustainability (environment, social, economic), or measuring key transport system features (which are precursors of those impacts);
- Representation of all urban modes, especially SUMP compatible modes such as walking, cycling and public transport, bust also motor vehicles and freight distribution that need to be managed;
- Alignment with data and indicators that many cities use already;
- Easy data collection, preferably with standard concepts and methods;
- Actionability and decision relevance for a city, including for urban planning, financial allocation, and communication;
- Support reporting for key European urban transport policy goals, such a GHG emissions, fuel mix of vehicles in use, traffic safety, congestion, ICT/ITS deployment.

The prioritisation started with dividing the entire set of indicators into the following nine groups:

- 1. Travel patterns
- 2. Accessibility
- 3. Speed and safety
- 4. Walking
- 5. Cycling
- 6. Public transport
- 7. Cars and parking
- 8. Social impacts/Liveability
- 9. Environmental impacts

The prioritisation exercise resulted in selecting one indicator with the highest score within each category. For the purposes of the prioritisation exercise, a simple matrix was used and each of the indicators was assessed on a 1-5 scale (where 1 is poor fit and 5 is best fit) to see how well each of

the indicators corresponds to each of the criteria. A score for each of the indicators was obtained and the ranking of indicators within each group was also derived.

The indicators with the highest scores within each category are presented in the table below.

Top priority indicators per category

Category	Indicator with highest score within
	category
Travel Patterns	<u>Modal split</u>
Accessibility	Density (land use)
Speed and safety	Safety – people killed and seriously
	injured in traffic collisions
Walking	Accessibility of outside built
	environment
Cycling	Extent of on-street cycle network
Public Transport	Public transport service per head of
	population
Cars and parking	Car ownership
Social impacts/Liveability	Citizen satisfaction with transport
	<u>system</u>
Environmental impacts	CO ₂ emissions from personal transport
	<u>per capita</u>

List of indicators

No	Indicator
	Travel patterns
1	Modal split
2	Trip lengths and travel time by different modes
	Accessibility
3	Density (land use)
4	Accessibility to key services
5	Distance from home to nearest public transport stop
	Speed and safety
6	Traffic calmed and car-free/pedestrianised streets
7	Percentage of vehicles speeding
8	Safety – people killed and seriously injured in traffic collisions
	Walking
9	Extent of off-street walking path network
10	Accessibility of outside built environment
	Cycling
11	Extent of on-street cycle network
12	Bike ownership
13	Bike sharing bikes and stations per capita
	Public transport
14	Public transport service per head of population
15	Cost of public transport
16	Peak PT speed related to car speed at peak times
17	Public transport reliability
	Cars and parking
18	Use of space for parking
19	Parking cost
20	Car ownership
21	Car share cars and stations per capita
	Social impacts/Liveability
22	Citizen satisfaction with transport system

23	Health (physical activity)
24	Retail activity
	Environmental impacts
25	CO2 emissions from personal transport per capita
26	PM10 (particulates)
27	NO
28	Noise

Origins of this document

This document has been prepared by Tom Rye and Damian Stantchev, Transport Research Institute, Edinburgh Napier University (a partner in CIVITAS CAPITAL), based on the deliberations and discussions of the expert members of the project's Advisory Group 5 on Data and Statistics. These members are:

- Isabelle Maës, European Commission
- Daniel Sauter, Urban Mobility Research
- Jimmy Armoogum, IFSTTAR
- Henrik Gudmundsson, DTU
- Christian Ryden, Lunds Kommun

These members together generated and prioritised this list of indicators during 2014 and 2015. This process was based on their pre-existing knowledge of the field and, in the case of Lunds Kommun, the City's own use of indicators to develop and monitor its own mobility policy.

The format of this document is based on the Indicator Descriptions document produced in the Ecomobility SHIFT project. That document's format was developed by Trivector Trafik AB and its content was the result of a collaboration between Trivector Trafik, Mobiel21 and Edinburgh Napier University and other Ecomobility SHIFT partners.

O1. Modal split

Definition

Number of all trips by residents made by each mode for all purposes. Walking, cycling, public transport, car driver or passenger, and other modes are all included in the definition. The main mode of a trip is that used for the longest stage of the trip by distance. With stages of equal length the mode of the last stage is used.

Purpose and link to objectives

Relates to many objectives of Sustainable Urban Mobility Plans (SUMPs).

How to gather data and derive indicator

The best way to collect data is through a household survey. If necessary, the people conducting the survey need to be given detailed guidance on how to do household survey, how often, the format, sampling, drafting relevant questions, etc or potentially how to exploit existing national surveys (including paying to boost sample size locally). A lower cost but rather less accurate alternative to a household survey is to conduct visual counts of pedestrians and vehicle (bus, car, van) occupants across a cordon or screenline, once or twice per year, in the peak hour. It has to be noted that peak hour for pedestrians may be different from motor vehicles. Near the city centre the pedestrian peak hour is often at noon. Whilst not accurate in absolute terms, this can help to monitor trends over time in modal split although it will not produce data for trip length and therefore emissions.

Ease and cost of gathering data

Household surveys conducted by French cities cost around €70 for each household surveyed, according to the national institute IFFSTAR that part funds each survey, or the French Institute of Science and Technology for Transport, Development and Networks. In contrast a cordon count requires the payment of 1-2 surveyors per cordon point for 3 hours, so in the order of 200 person hours for a medium sized city with 25-30 cordon points.

Example of how such data has been used previously by cities

Many cities use modal split as a target by which to measure the success of their mobility polices/SUMP. The City of Copenhagen uses modal split data to monitor their environmental policies as well as their cycling strategy, as shown below.

Further information and related examples

Figure 014.1 - Commuting and education trips by mode, Copenhagen

MODAL SHARE OF TRIPS IN 2012



Source: Copenhagen Bike Account 2012

In another example, City of Edinburgh Council (Scotland, UK) wanted to know where it should concentrate its investment in cycling facilities. One way to do this was to look at those areas of the city where residents' journeys to work are between 2km and 5km – an ideal distance for cycling. They carried out this analysis using the national Census data and the results are shown in the graphic below (source: City of Edinburgh Council 2011).



O2. Trip lengths and travel time by different modes

Definition

Total distance and time per day for all trips by mode. All stages of a trip serve as a basis. When a trip consists of 400m walk, a 3km bus ride and a 200m walk all stages per mode are added up, resulting in this example in 600 m walking. Interchange and waiting time are also included in this definition and are usually attributed to the walking stage. Ideally, interchange and waiting times are collected separately from the actual walking times.

Purpose and link to objectives

This indicator allows for emissions and exposure data to be collected. It also serves as basis for physical activity and health assessments (see indicator 27). It also allows average speeds by different modes to be calculated; an objective of a SUMP may be to make sustainable modes faster over time, relative to car.

How to gather data and derive indicator

The only regularly used method currently of gathering this data is via a household survey.

Ease and cost of gathering data

Costs of these surveys are reported under O14, above. Emerging data collection methods via GPS tracking may reduce costs in the medium term but these methods are still experimental at this point in time.

Example of how such data has been used previously by cities

The graphs on the right and below provide examples of how the City of Copenhagen has used such data to inform policy on public health and physical activity..

Figure 015.1 - Time spent walking daily average, Copenhagen residents

2013 STATUS



Source: Urban Life account 2013 Data: National Travel survey, extract for Copenhagen

Issues to note

Interchange and waiting times can make up a substantial share of the total time of walking. Since this does not have any health effect, caution needs to be in place as to how much of the time is health relevant. Ideally, the interchange and waiting times are collected separately in order to take account of this.



Source: Copenhagen Green Account 2013



O3. Density (land use)

Definition

Total population per hectare of urbanized land area.

Land use is defined broadly to include new development and the type and intensity of use of existing development. New development covers the issue of what is built and where; it includes both greenfield development and redevelopment of brownfield sites. Land use type covers the way in which a given development is used; for example old industrial buildings may be converted to housing or leisure use, dramatically changing their demands for travel and their impact on the community; less obviously, the output of a shopping centre or business park may change over time as demands change. Land use intensity covers the amount of activity in a given land use, including population density and retail and business turnover.

Purpose and link to objectives

The way in which land is developed (or redeveloped) will affect the demand for travel. Development density, style and location will all affect journey length, and this can significantly influence the use of the transport system. Higher density, mixed development and development closer to employment and services will all help to reduce journey lengths. If new developments are at lower density, remote from public transport and provided with extensive parking, they will attract longer journeys, predominantly by car. Conversely, higher density mixed developments are more likely to facilitate shorter journeys, more of which will be made by public transport, walking and cycling.

How to gather data and derive indicator

A count of the number of people inhabiting a given urbanized land area and the measurement in hectare of that urbanized land area (so excluding green areas smaller than 1 hectare in area, lakes, rivers).

Ease and cost of gathering data

Can be derived readily from population data and even a paper map.

Further information and related examples

Research conducted by Guildford Borough Council in England and reported in "Local Plan Strategy and Sites Issues and Options" (http://www.guildford.gov.uk/article/3976/Issues-and-Options) suggests that increasing development densities can help to make development more sustainable as less land is needed for the number of homes built. Higher densities also tend to support more services and facilities. It is claimed that higher densities in some areas can be accommodated, although careful account should be taken of the negative impacts on the character of the area and the ability of infrastructure to cope, especially in relation to roads. The correct balance between providing much-needed homes of a suitable size and type, and protecting and enhancing the character of the borough should be pursued.

The following policy recommendations have been made – please see the table below.

Options The right mix and density of homes When planning new homes we could set a specific mix and density of homes for the different areas within the borough

We could generally seek lower or similar densities than we do now and so use more land to deliver the development we need

We could seek higher densities and use less land

We could take a more flexible approach and assess each site on a case by case basis having regard to the character of the surrounding area and the sustainability of the location

Issues to note

City boundaries differ from each other. While some include only the core city, others also include larger suburban areas. This may be a problem when making comparisons.

Green spaces are a necessity for the quality of life in very dense neighbourhoods and should count towards the total surface area of a city. Urban sprawl consumes green space and agricultural land and reduces the sustainability of development. Sustainable urban design (appropriate land-use planning) will help reduce urban sprawl and the loss of natural habitats and biodiversity. Avoiding urban sprawl through high density and mixed-use settlement patterns offers environmental advantages regarding land use and transport, contributing to less resource use per capita.

O4. Accessibility to key services

Definition

Percentage of population living within a 300m linear crow fly distance of a (public) primary school.

Purpose and link to objectives

This indicator has been selected to represent accessibility of services in the city. As transport is a derived demand, if services are provided locally then, all other things being equal, they will require less transport to access those services, and people will be able to make use of modes such as walking and cycling that are more suited to shorter distances than the car.

How to gather data and derive indicator

It is easy to map the location of primary schools across a city. This can even be done manually and then a 300m radius around each school can be drawn onto a map. From this, the percentage of the population within this distance can be estimated. This is of course easier with GIS.

Ease and cost of gathering data

If a city has no GIS, then it should consider using the Density indicator instead (see O6).

The derived data is an approximation to the real distance as the routes may not always be direct or requiring detours due to natural or infrastructure barriers (e.g. river, rail line or motorway).

Example of how such data has been used previously by cities

Two municipalities around Nottingham in England developed the "Greater Nottingham Accessibility Strategy". This analysed the proportion of children who lived within easy walking distance of school. This helped to inform work on how to encourage children and their parents to use more sustainable modes of transport to travel to school.

Further information and related examples



Figure 05.1 - Locations of key education destinations in Greater Nottingham (**urban area**) - Source: Greater Nottingham Accessibility Strategy http://www.nottinghamshire.gov.uk/travelling/travel/plansstrategiesandtenders/accessibilitystrategy/

O5. Distance from home to nearest public transport stop

Definition

Percentage of citizens living within 300m of a stop with service of at least once an hour.

Purpose and link to objectives

The ease of access to public transport contributes to solving problems related to social equity and inclusion. It is also a driver behind mode shift away from car travel because the more accessible is the public transport system in their own city, the less likely people will be to use their cars.

How to gather data and derive indicator

Derived as the percentage of citizens living within 300m of a stop with service of at least once an hour.

Ease and cost of gathering data

It is easy to map public transport routes and their stops across a city. This can even be done manually and then a 300m radius around each stop can be drawn onto a map. From this, the percentage of the population with this level of public transport service can be estimated. This is of course easier with GIS.

The derived data is an approximation to the real distance as access routes may not always be direct or requiring detours due to natural or infrastructure barriers (e.g. river, rail line or motorway).

Example of how such data has been used previously by cities

It is common practice in the UK for public transport accessibility to be analysed before new buildings are granted planning (building) permission to be built. If the buildings are proposed to be more than 300 m from the nearest public transport service, the building may be relocated, or the developer may pay to bring the public transport service closer to the building.

This indicator is also used as an element in selecting cities for the annual "European Green Capital Award" (http://ec.europa.eu/environment/europeangreencapital/index_en.htm)

Further information and related examples

Figure O3.1 below (taken from Greater Nottingham Accessibility Strategy – Chapter 7) shows public transport supply in terms of whether Super Output Areas (SOAs) in Greater Nottingham achieve a service standard for accessibility to the bus network for an hourly or better daytime service based on 400m walk to the nearest bus stop.



O6. Traffic calmed and car-free/pedestrianised streets

Definition

Percentage of the total distance of the city's streets and squares that are entirely car free or where there is a speed limit of 30 km/h or below. The "distance" of a square is the sum of the length of its sides.

Purpose and link to objectives

If the city is to be friendly to active travel and more environmentally-friendly modes (such as walking and cycling) and to cut traffic casualties then reducing motor vehicle speeds is crucial. This measure also makes these modes more competitive in terms of journey time. Traffic calming is a key measure in cities that are recognised to be leaders in sustainable transport, such as Freiburg, Groningen and Vienna in making these cities more liveable and welcoming with a higher quality of life and safety for their residents.

How to gather data and derive indicator

Most easily done via GIS. Otherwise it is recommneded to conduct a manual survey.

For cities that do not currently collect data on this indicator, it is recommended that they begin to collect data on the following:

- Percentage of road network that is car free. This excludes pedestrian walkways away from the road network, which are counted in O7.
- Percentage of road network with speed limit of 30 kph or below.

Ease and cost of gathering data

Not technically difficult but could be moderately resource-hungry when first measured. Manual surveys can survey around 4km of street per hour. Another low cost option is to use Google Earth for pedestrianised streets. A prequisite is

to know the entire length of streets in the city but this is a basic piece of data that all cities should have.

Example of how such data has been used previously by cities

Traffic calming is popular with residents since it deters through traffic. The City of Edinburgh in Scotland uses the data that it has on the proportion of its streets that are covered by 30kph zones to show that it is responding to residents' wishes.

Figure 09.1 – Traffic calming in a suburb of Ljubljana in Slovenia (note yellow road humps)



O7. Percentage of vehicles speeding

Definition

The percentage of motor vehicles on a sample of urban roads that exceed the posted speed limit.

Purpose and link to objectives

On mixed use urban roads there are more collisions leading to injuries if speeds are higher. Even on motorways, the severity of injuries from collisions increases with increasing speed. In Poland, 80% of drivers exceed the urban speed limit and there were 87 road deaths per 100,000 population in 2013. In Britain, 50% of drivers exceed the urban speed limit and there were 28 road deaths per 100,000 population that year (www.etsc.eu).

How to gather data and derive indicator

Certain types of automatic traffic counters can measure vehicle speeds and count vehicles. Otherwise, periodic manual surveys need to be conducted. Manual observations with speed gun (one capable of measuring multiple vehicle speeds simultaneously) can be undertaken if the other two methods are not available. A further manual enumerator is required to count the traffic in a single direction during the same hour. Only one radar gun is required since all surveys do not need to be carried out simultaneously.

Sample surveys can be carried out for a relatively short period (e.g. one hour per location) when traffic volumes are neither at their heaviest or their lightest, such as the middle of the day in April, May, September or October. The sample of streets where speeds are measured should be as large as possible but if resources are limited, begin with the streets where collisions are highest. If no accurate data on collisions exists, these streets are most likely to be the main arterials where there are a lot of turning traffic and crossing pedestrians.

Ease and cost of gathering data

The cost is two surveyor hours per site per year, for manual surveys.

Example of how such data has been used previously by cities

In the UK the percentage of vehicles exceeding the speed limit is frequently used as a justification for installing physical traffic calming measures to slow traffic down.

Figure 017.1 – speed measurement with a hand held radar gun (source www.gloucestershirecitizen.co.uk)



O8. Safety – people killed and seriously injured in traffic collisions

Definition

The number of people killed and seriously injured (KSI) in traffic collisions is a critically important measure of road safety. It is traditionally measured per 100,000 population but here it is recommended to relate it also to the amount of travel, measured in terms of the time spent travelling by each mode. This is because if, for example, pedestrian casualties are reduced, but the time spent walking reduces still faster, this is not an indication that roads are becoming more dangerous for pedestrians, and that they are withdrawing from the transport system. Exposure is the key to adequately reflecting this.

Purpose and link to objectives

A measure of safety and perceived quality of life on the road network for citizens.

How to gather data and derive indicator

Police and preferably hospital records can normally provide total numbers of KSI (hospital records are useful because police records normally underreport the number of collisions involving KSI). A household survey is required for time spent in traffic.

Ease and cost of gathering data

Problematic if police uncooperative or do not routinely collect such data. In this case, it may be necessary to bring police from another country or city where they do collect such data routinely to explain to local police how it is done. Hospital records may not be accessible in some countries.

Further information and related examples

Many cities use such data to inform their road safety policy, set targets and then work to achieve them. The graph below shows the number of cyclists seriously injured on the roads, including fatalities, between 2005 and 2013 as well as the target for reducing the number of these accidents by 2015, in Copenhagen.

Figure 028.1 - Trend in cyclists seriously injured in Copenhagen

NUMBER OF CYCLISTS SERIOUSLY INJURED ON THE ROADS, INCLUDING FATALITIES



Source: Copenhagen Green Account 2013

O9. Extent of off-street walking path network

Definition

Percentage of paths and links of at least 50m in length that are off-street, as a percentage of the length of total walkable routes. In urban neighbourhoods, these paths and links include those through and in green spaces, pedestrianised zones and so on. Total walkable routes are all routes along which pedestrians can travel, including footpaths alongside roads, but also those that are off-street.

Purpose and link to objectives

The availability of an extensive off-street walking path network in a city allows more people to make use of more environmentally-friendly modes such as walking that are more suited to shorter distances than the car. They are usually safer to walk (no vehicles - no danger), are often shortcuts and provide an attractive environment. Last but not least, the health benefits of walking should also be considered.

How to gather data and derive indicator

The on- and off-street networks must be identified, through mapping, and their length then measured in metres. If a road has footpaths along both sides, the network length is that length of road multiplied by two. Distances can be measured by measuring off a map or by using GIS.

Ease and cost of gathering data

Most cities have at least an approximate view on how long their street network – and therefore on-street walking network – is. A map or GIS will have to be referred to in order to derive the off-street network length.

Example of how such data has been used previously by cities

An example will be added here

Further information and related examples

The impacts of providing additional off-road walking and cycling paths in Britain can be read in the evaluation reports for 50 projects managed by the sustainable transport charity Sustrans that can be found (one for each project) at www.sustrans.org.uk/policy-evidence/the-impact-of-our-work. An example of a single evaluation can be found here:

 $http://www.sustrans.org.uk/sites/default/files/file_content_type/argoed_welsh.p~df$

Figure 07.1 - New Sustrans walking and cycling route (source: Sustrans)



O10. Accessibility of outside built environment

Definition

Percentage of signalled pedestrian crossings that have tactile paving, dropped kerbs and audible and touch warning of pedestrian crossing signal at all sides. A signalled pedestrian crossing is any crossing with traffic signals where there is a part of the signal that indicates to pedestrians when it is safe to cross.

Purpose and link to objectives

The ease of access of the outside built environment contributes to solving problems related to social equity and inclusion. It is important for "future proofing" cities for an increasingly agening population. All elements have to be in place in order to "qualify" because one missing element can make a route inaccessible.

The needs of disabled pedestrians should be considered when designing the layout of crossings. Dropped kerbs provide easy access for wheelchair users and people with walking difficulties. To ensure the safety of blind and partially sighted people at these sites it is important to provide tactile paving. The ramped section, leading to the crossing and the immediate approaches, should be indicated by contrasting coloured tactile surfaces. At signal-controlled crossings audible signals or bleepers in the form of a pulsed tone and/or tactile signals are normally used during the crossing period so that blind or partially sighted pedestrians know when to cross. If audible signals cannot be used then tactile signals should always be provided. These are small cones mounted beneath the push button box which rotate when the steady green figure is shown. They are also helpful to deaf blind people.

How to gather data and derive indicator

Survey to establish proportion of signalled crossings conforming to standard defined in indicator.

Ease and cost of gathering data

Gathering the data is not technically difficult, but could be resource demanding. This of course depends on the number of signalled crossings in your city. At a signalled crossroads, a manual visual inspection of the facilities provided should take no more than 3 minutes, often less. To limit data gathering costs in the first instance a city might decide to start with recording this information for a defined area, such as the city centre, and then measures the situation in other areas later.

Example of how such data has been used previously by cities

The national transport agency in Scotland (Transport Scotland) has compiled a database of this information for all the national roads in the country and its contractors are required to consult the database and add these accessibility facilities where they are missing.

Further information and related examples

"Roads for All: Good Practice Guide for Roads" contains Transport Scotland's requirements for inclusive design in the construction, operation and maintenance of road infrastructure. Inclusive design is an approach which aims to create environments which can be used by everyone regardless of age or disability. The Guide provides practitioners with current international good practice and advice on providing for the needs of people with sensory, cognitive and physical impairments, within the road environment. See http://www.transportscotland.gov.uk/guides/j256264-00.htm

Figure 0.4.1 - a fully accessible pedestrian crossing (note that the black and yellow bar at the bottom of each yellow box rotates to indicate to deaf blind people when the walk signal is at green)



O11. Extent of on-street cycle network

Definition

Percentage of urban roads with speed limits of 40 km/h or more with segregated cycle facilities alongside or on close parallel routes providing similar journey times.

Purpose and link to objectives

An extensive on-street cycle network in a city should provide users with direct, convenient and safe routes, minimising unnecessary delay and effort in reaching their destinations. It also contributes to improving the image of cycling and allows more people to make use of more environmentally-friendly modes such as walking and cycling that are more suited to shorter distances than the car. The positive health aspects of cycling should also be considered.

How to gather data and derive indicator

Most easily done via GIS. If GIS data is unavailable or difficult to obtain, a manual survey or manual measurement from maps can be conducted instead.

Ease and cost of gathering data

The data are not problematic to gather but the ease is increased if GIS is available.

Example of how such data has been used previously by cities

Some data related to this indicator, from Copenhagen, is shown to the right. The data are used to track progress in infrastructure development.

Further information and related examples

The example below is from the city of Copenhagen. This does not show the percentage of the road network paralleled by cycleways, but it does show the growth of the network over time.

Fig 08.1 – Cycle data CPH

OTHER KEY FIGURES	'96	'98	<i>'</i> 00	<i>'</i> 02	<i>'</i> 04	'06	<i>'</i> 08	'10	'12
Cycled kilometres									
(mil. km per weekday)	0.93	0.92	1.05	1.11	1.13	1.15	1.17	1.21	1.27
Cycled km between serious									
casualties (mil. km)	1.2	1.8	2.4	2.4	3.0	4.0	3.2	4.4	4.2
Cycling speed (km/h)					15.3	16.0	16.2	15.8	15.5
Cycle tracks (km)	294	302	307	323	329	332	338	346	359
Cycle lanes (km)		6	10	12	14	17	18	23	24
Green cycle routes (km)	29	30	31	32	37	39	41	42	43
Cycle super highways (km)*									17.5
Cycle parking spaces on									
roads and pavements (1000s)						42	47	48	49

*Total for the Capital Region of Denmark (consists of the municipalities of Copenhagen and Frederiksberg, the former counties of Copenhagen and Frederiksborg, and the regional municipality of Bornholm)

Source: Copenhagen bike account 2012

O12. Bike ownership

Definition

Bikes (pedal cycles) owned per 1000 population, disaggregated by city district if possible. Toy bicycles and those for children aged under 5 should not be counted.

Purpose and link to objectives

A measure of the degree of diversity of mobility options. Bikes owned, if used, support an active healthy lifestyle. In some cities, extensive bike share systems perform a similar function, and should be monitored as well.

How to gather data and derive indicator

If a household survey of travel behaviour is carried out (see indicator on Modal Split) then this indicator can be gathered at the same time. If not, a smaller sample survey of residents should be carried out, preferably of a random sample of households by telephone, or if not, by an on-street survey in two to three locations in the city (e.g. city centre, out of town shopping centre), aiming for a sample of 200 households. Only bikes that actually function should be counted.

Ease and cost of gathering data

Costs of household surveys are shown under the indicator on Modal Split. A specific household survey should not be commissioned solely to gather data on bike ownership. Short telephone surveys (3-4 questions) cost around €10 per respondent. An on-street survey would require in the region of one surveyor one day to obtain 200 responses.

Figure O21.1 - Some parked bikes (source www.colourbox.com)



O13. Bike sharing bikes and stations per capita

Definition

This indicator is derived by dividing total population by the number of bike share bikes. Bike share bikes are those that are available on street for users (who sometimes have to go through a registration process and pay a registration fee) to hire, although often the first half hour of use is free of charge.

Purpose and link to objectives

Bike sharing adds to and diversifies the exisiting set of mobility options within a city. It can contribute to increased levels of cycling, and to changing motor vehicle driver attitudes and behaviour towards cyclists.

How to gather data and derive indicator

The method is defined in the indicator definition.

Ease and cost of gathering data

The bike share operator in a city can supply data on the number of bikes. The population is derived from national statistics.

Example of how such data has been used previously by cities

There is an interesting study done in Spain by Alberto Castro and Esther Anaya https://bicicletapublica.wordpress.com/ https://bicicletapublica.wordpress.com

Figure 013.1 - A bike sharing station (source: Wikipedia)



O14. Public transport service per head of population

Definition

Number of departures per day from all public transport stops divided by the total population of the city. Train services that stop at only one station within the city boundary should be excluded.

Purpose and link to objectives

In cities of more than 50,000 population, public transport can be the backbone of a sustainable urban mobility system. It is important to be able to quantify how well the population is served by the system, so that improvements can be made.

How to gather data and derive indicator

A map of public transport stops, timetables from each of these stops, and total population numbers are required.

For each route (e.g. tram line 1) take one stop and derive the number of departures per day for a normal weekday, excluding night services. Multiply this by the number of stops on the route. Do the same for each route in the city. The sum of the results is the total number of departures for all stops in the city as a whole each day. Divide the resulting number by the total population of the city.

Ease and cost of gathering data

All data should be easy to obtain. If data is not available from public transport provider, it should be gathered manually from one stop at each line. The data can be updated every 1-2 years.

Example of how such data has been used previously by cities

In the region of Skåne in south west Sweden around the city of Malmö, public transport service density is a key planning variable. All rail stops should have a minimum of 14 daily departures, for example. In Manchester and around Bristol in the UK, local authorities stipulate minimum bus frequencies that must be provided by private bus operators on key corridors in the conurbation.

Issues to note

If (part of) the public transport system is run by organisations other than the city, there might be difficulty in gathering data on user needs. If this is the case, note this in the relevant report(s). If (lack of) PT capacity is a major issue in a city then the result of the first calculation could also be multiplied by vehicle capacity of each departure to give an indication of system capacity.

Further information and related examples

There are no further examples in this case.

O15. Cost of public transport

Definition

Cost of a monthly network-wide public transport ticket for all modes (if such a multi modal ticket is available; for bus alone, if not) in the city as % of average gross monthly individual income.

Purpose and link to objectives

In the long term, the affordability of public transport has a significant impact on how many people choose to use it (long term price elasticities of demand approach 1, meaning that for example a 10% increase in fares can over a period of 5 years lead to a 10% reduction in passenger numbers if real incomes do not also increase). Affordability is also a social equity and inclusion issue. Therefore, it is important to gather data to show whether public transport is becoming more or less affordable.

How to gather data and derive indicator

Average gross monthly income for city or region is usually available from national statistics departments.

The cost of an adult ticket network wide ticket should be easily available from the main public transport operator or organisation in the city. If there is more than one operator and each issues their own ticket, refer to the ticket issued by the operator that runs the largest network of services.

Ease and cost of gathering data

If national statistics are available, then data for this indicator are simple and cheap to gather. If not, a small survey in which 100-200 people provide data on

their income will be required. Such a survey should cover a sample of people aged 16 and over who are in paid work, not in paid work, in education and retired. Ideally it should be carried out by telephone with a random sample of households.

Example of how such data has been used previously by cities

The City of Gent in Belgium in its 2015 Parking Strategy has in part related increases in parking charges to the cost of public transport, the idea being that it should be cheaper to take public transport than to park.

O16. Peak PT speed related to car speed at peak times

Definition

Average ratio between total peak hour journey time by public transport and by car for five common trips within the city. For PT this includes: walking time, average waiting time (including punctuality) and travel time; for car this includes: walking time, travel time and parking search time.

Purpose and link to objectives

A key factor in the decision of whether or not to take public transport is its speed relative to alternatives. A driver behind mode shift away from car travel.

How to gather data and derive indicator

The method is defined in the indicator. The choice of routes is up to each city but it is recommended that at least one of the trips is between two suburbs, rather than to the city centre.

Note that walking time to/from the public transport stop or parking space, waiting time, interchange time and parking search time should be weighted more heavily than in-vehicle time (typically 1.5 to 2 times greater) in calculating the overall journey time of the trips.

So for example if for the first common trip selected the car journey time is 20 minutes and the public transport journey time is 30 minutes, the ratio is 1.5:1. If the second trip has a ratio of 2:1, then the average is 1.75:1.

Ease and cost of gathering data

Could be derived from household travel survey if one is undertaken for other reasons. If no household travel survey is available, this indicator can be derived from actually doing each trip by PT and car several times and taking the average journey time.

Example of how such data has been used previously by cities

The City of Lund in Sweden has in the past used relative journey times by car and public transport (the "journey time quotient") to ensure that new development is located in places where public transport journey times are competitive with those by car.

Figure O18.1 – Bus lane aimed at speeding up public transport journey times, in this case in Ljubljana (source: <u>www.greencitystreets.com</u>)



O17. Public Transport reliability

Definition

Percentage of public transport services arriving at a sample of 10 key stops within 5 minutes of scheduled arrival time.

Purpose and link to objectives

Public transport reliability is a key driver behind mode shift away from car travel.

How to gather data and derive indicator

The method is defined in the indicator. A manual survey can be used if public transport vehicles are not fitted with Automatic Vehicle Location (AVL). For cities of 100,000 people or less, the surveys can be carried out on one day (in April, May, September or October) at each stop for one hour in the morning rush hour, one in the interpeak and one in the afternoon peak. For larger cities, a longer period of data gathering, or even continuous monitoring, is recommended. The 10 stops should be chosen to reflect major origins and destinations: major housing areas, significant out of centre employment areas (e.g. hospitals), major out of centre shopping areas, and the city centre.

Where there is a range of public transport modes (e.g. bus, tram) then shared stops should be selected as much as possible. If few shared stops are available, the 10 sample stops should be split between bus, tram, metro etc in the approximate ratio of the percentage of passengers on each mode. For example, if 20% of all public transport passengers travel by tram, 2 tram stops should be selected.

Ease and cost of gathering data

This indicator is simple to gather data for and not expensive, requiring in the smallest cities 30 hours per year of surveyor time; in larger cities this could rise to as much as 120 hours per year.

Example of how such data has been used previously by cities

Transport for London gathers data on the reliability of its bus services from onstreet surveys and from automatic vehicle location data. It then uses this data to identify where bus priority measures are needed on street, and where further resources may be needed in the bus service itself (more vehicles) to run a more reliable service.

A further example

Figure O19.1 below shows the punctuality of S-trains in Copenhagen. The Strain (S-tog in Danish) is an urban rail network which serves Copenhagen, Denmark and its environs. It connects the city centre to the inner and outer boroughs and suburbs (with the exception of Amager Island). The average distance between stations is 2.0 km, shorter in the city core and inner boroughs, longer at the end of lines that serve suburbs. Of the 85 stations, 32 are located within the central ticket fare zones, 1 and 2. The S-tog is roughly analogous to S-Bahn systems in Germany, and is a separate system from the Copenhagen Metro, which operates only in the city centre.



019.1 - S train punctuality. (Source: State Railways' monitoring for Copenhagen 'S-trains')

O18. Use of space for parking

Definition

Space devoted to parking (total, includes on street, off-street, private residential and non-residential) as proportion of an urban area.

Off-street parking means parking your vehicle anywhere but on the streets. These are usually parking facilities like garages and surface car parks. Off-street parking can be both indoors and outdoors.

On street parking means parking your vehicle on the street, anywhere on or along the curb of streets, in contrast to parking it in a parking garage. In some streets you can always park your vehicle on the street, but sometimes there are restrictions. There are also on-street parking situations where you need a parking permit to park. To make sure people follow these rules and restrictions, cities may employ enforcement officers, or enforcement may be the responsibility of the police.

Private residential parking refers to areas for short-term and long-term storage of cars and other private vehicles which is not open to the general public. Most commonly these are only available to owners and tenants.

Private non-residential parking (PNR) is generally associated with parking at a workplace which is reserved for the use of employees and is not available to the general public; or at shops and other facilities, where it is reserved for their customers and visitors. PNR parking can affect mode choice by encouraging workers to continue to travel to work by private car.

Purpose and link to objectives

This measure is a driver behind mode shift away from car, has the potential to reduce congestion and parking search and improves streetspace and therefore quality of life.

How to gather data and derive indicator

Requires count of parking spaces. There may be problems counting private non-residential (e.g. workplace, shopping centre) spaces as they are on private land.

Ease and cost of gathering data

Not technically difficult but could be resource-hungry.

Example of how such data has been used previously by cities

Nottingham in England counted all private non-residential spaces in the city in order to implement its workplace parking charge, a form of local tax on these parking spaces.

Further information and related examples

The City of Graz, Austria, measured the amount of space for parking stationary vehicles that is devoted to different modes of transport. A survey on the use of public space by stationary traffic for different modes of transport showed that 92% is used for parking cars (although private parking and garages are not included in this!). Only 2% is for bicycle parking, 3% are areas that could be summarized as being for pedestrian use (included are benches, street cafes etc.) and 3% is dedicated to public transport (incl. PT stops and train stations).

Figure O10.1 Bike parking on former car parking spaces, Malmö, Sweden



O19. Parking cost

Definition

Cost per hour of on-street parking in city's most expensive **on**-street spaces, as a percentage of gross monthly individual income.

Cost per hour of off-street parking in city's most expensive **off**-street spaces, as a percentage of gross monthly individual income.

See also definitions for indicator 10.

Purpose and link to objectives

In the short and long term, the cost of parking has a very significant impact on how many people choose to travel by car (price elasticities of demand are around -0.3, meaning that for example a 10% increase in parking charges can lead to a 3% reduction in car use if real incomes do not also increase). Therefore, it is important to gather data to show whether parking is becoming more or less affordable.

How to gather data and derive indicator

Average gross monthly income for city or region is usually available from national statistics departments.

The cost of parking on street should be easily available from the City's own parking operator, whilst for off-street, rates will be published online or can be established from visiting the car park concerned. It is important to choose the on-street spaces and the car park with the highest hourly rate in the city.

Example of how such data has been used previously by cities

City of Gent gathered this data with respect to on-street spaces and compared its own charges with those in other cities. This helped to inform a decision to raise charges in Gent over time.

Figure O11.1 – Parking charges in various EU cities (source: City of Gent, 2013)



Further information and related examples None at the moment

O20. Car ownership

Definition

All cars (including company cars) owned per 1000 of the population aged 18 or over. Percentage of households that have no car, preferably disaggregated by city district.

Purpose and link to objectives

A measure of the degree of diversity of mobility options, and an extremely important determinant of the use of other modes of transport.

How to gather data and derive indicator

This piece of information can be gathered from a household survey, but if not available, the national statistics department in your country will most likely have data on car ownership at a lower level of spatial resolution.

Example of how such data has been used previously by cities

Many cities have previously used this information to, for example, make decisions on which parts of their city need additional bus services.

Figure O20.1 - number of cars owned by 100 households in Copenhagen Municipality.



Source: 'Kortlægning – Grøn Mobilitet (Green Mobility Mapping) (2012)

O21. Car share cars and stations per capita

Definition

This indicator is derived by dividing driving age population (18 and over) by the number of car share cars, that is, those cars in commercially or community run car share clubs that provide hourly hire of cars parked on street in local areas, bookable and payable by the hour, by club members only. An example is www.cambio.be; another is www.citycarclub.co.uk.

Purpose and link to objectives

Each car share club car may replace several individually owned cars. Car sharing reduces the mileage driven and increases the use of other modes such as walking, cycling and public transport.

How to gather data and derive indicator

Driving age population is available from national censuses. The number of car share club cars in a city is available from the operator(s) of those car clubs.

Ease and cost of gathering data

There are no problems in gathering the required data.

Example of how such data has been used previously by cities

Cities that have car share clubs often give them preferential access to on-street parking and in some cases promote them as part of new developments, so that certain parking spaces in new buildings are dedicated to these vehicles. However, in countries such as Germany and Switzerland where membership of car share clubs is high, the case for public aid to these private sector operators may become less compelling. Data on the "spread" or density of car share clubs can help to inform decisions about access to parking for them.

Figure 0.12.1 – a carshare club parking bay with car (*source: Sustainable Development Commission*)



O22. Citizen satisfaction with transport system

Definition

Rating on a scale of the quality of transport infrastructure and service by mode on journeys the respondent makes regularly

Purpose and link to objectives

The quality of transport infrastructure and service is closely linked to the pereceived quality of life and safety in a city. The more satisfied people are with the public transport system in their own city, the less likely they will be to use their cars, which is also a driver behind mode shift away from car travel. The level of citizen satisfaction is also important to city authorities as it informs them about what people really think.

How to gather data and derive indicator

Household or opinion survey – could be added to household survey used for modal shift. An alternative will be to piggy back onto any general survey about quality of public services. A question in either survey should be "How satisfied are you with the quality of your regular walk/cycle/bus/train/metro/car journeys in the city?" and the answer can be given on a five point scale of "very satisfied".

Ease and cost of gathering data

if the question is added to a household survey, costs are as in O14. If it is added to a different form of survey carried out on- street or on vehicle, costs can be reduced to a few Euro per respondent.

Example of how such data has been used previously by cities

The graphs on the right and below provide examples from the city of Copenhagen.

Figure 016.1 - Customer satisfaction with public transport in Copenhagen

120,00% 100,00% 80,00% 60,00% 40,00% 20,30% 20,00% Meget tilfredse Tilfredse kunder Samlet meget kunder tilfredse og tilfredse kunder

Kundetilfredshed Movia 2012

Customer satisfaction survey. MOVIA Copenhagen Regional Transport Authority ('satisfied and very satisfied')



Figure 016.3 - Share of cyclists feeling safe



Source: København Miljøregnskab 2013 (internal version of Green account)

SATISFACTION 1996-2012 - PERCENTAGE SATISFIED

'96	'98	'00	'02	'04	'06	'08	'10	'12	
71	79	79	77	83	83	85	93	95	Copenhagen as a cycling city
56	55	66	58	64	65	65	68	76	Amount of cycle tracks
54	44	49	51	54	58	49	55	60	Combination of bicycle and public transport
67	68	62	45	50	48	43	47	50	Width of cycle tracks
41	33	38	27	30	26	26	27	29	Bicycle parking in general
48	51	40	45	50	48	54	50	61	Condition of cycle tracks
24	27	23	28	27	28	26	31	32	Condition of roads

Source: Copenhagen Bike Account 2012

O23. Health (physical activity)

Definition

Percentage of adults (18 years and over) doing 150 minutes or more of exercise in the form of walking and cycling per week.

Percentage of adults (18 years and over) doing at least 30 minutes of walking and cycling a day.

Purpose and link to objectives

Leading an active lifestyle may contribute to maintaining and improving health; using active travel modes helps to support sustainable transport objectives. There are also huge financial benefits in terms of health costs saved. Ideally all physical activities would be measured in total, with walking and cycling being assessed as part of the total. Since these are transport related indicators, the focus on the amount of walking and cycling only is justified.

How to gather data and derive indicator

If a household survey of travel behaviour is carried out (see indicator on Modal Split) then this indicator can be gathered at the same time. Some cities and countries have also health surveys besides their travel surveys with relevant data collection. If not, a smaller sample survey of residents should be carried out, preferably of a random sample of households by telephone, or if not, by an on-street survey in two to three locations in the city (e.g. city centre, out of town shopping centre), aiming for a sample of 200 people.

Ease and cost of gathering data

Costs of household surveys are shown under the indicator on Modal Split. A specific household survey should not be commissioned solely to gather data on physical activity. Short telephone surveys (3-4 questions) cost around $\notin 10$ per respondent. An on-street survey would require in the region of one surveyor for one day to obtain 200 responses.

Example of how such data has been used previously by cities

Further information and related examples

Even though the example below relates only to cycling, this gives an indication of the helpfulness of data on physical activity – it can be used to make the case for investment in infrastructure and services that support such activity.

Figure 026.1

HEALTH BENEFITS OF CYCLING

30%

Reduction of mortality for adults who cycle to and from work every day

1.7 BILLION

Value of annual health benefits from cycling in Copenhagen (DKK)

Source: Copenhagen Bike account (2012)

O24. Retail activity

Definition

Footfall (number of pedestrians) in major shopping streets during the busiest 8 hours (peak hours) of a normal weekday and a Saturday.

Purpose and link to objectives

This is a measure of local economic health and development, since the health of shopping areas is a product of the number of people who spend time there. It is also a measure of how attractive the shopping environment is, for example in comparison to malls outside the city. The data may also be used for providing good infrastructure so businesses can flourish. Footfall is a measure of the number of people. It is also important to bear in mind that income in shops comes from people who travel by a variety of modes, not just car (see Figure O27.1, right).

How to gather data and derive indicator

Manual pedestrian counts at a limited number of points on defined streets, for the same weekday and a Saturday at same time of year, during the 8 busiest hours (peak hours) a day, usually during shop opening hours. Per 25,000 of city population we suggest two count points (so for example, 8 points in a city of 100,000).

Ease and cost of gathering data

Labour intensive but not complex. A maximum of two surveyors will be required per count point if a narrow section of street is selected. In some cities, automatic pedestrian counters have been installed allowing for continuous pedestrian counts.

Example of how such data has been used previously by cities

Many retail monitoring organisations gather data on footfall. Transport for London for many years gathered data on footfall to measure the retail health of district shopping centres in London to see whether there was any relationship between traffic management on major roads in those centres and their retail health (there was not).

Figure 027.1 - Revenue in shops in Copenhagen by mode



Revenue in shops and supermarkets by mode of transport (DKK billion per year)

Source: Copenhagen Bike account (2012)

O25. CO2 emissions from personal transport per capita

Definition

Greenhouse gas emissions stemming from the personal transport sector per capita in tonnes of CO2 equivalent per person per year for city residents.

Purpose and link to objectives

This indicator gives an indication of how efficient the city's transport is in CO2 terms. Whilst ideally this indicator would measure emissions resulting from all travel in the city, methodologically this is likely to be very difficult, so it is limited to trips made by residents.

How to gather data and derive indicator

This data can be derived from a household travel survey. The survey needs to gather data on trip distances but also the details of vehicles used for motorised trips, including the bus fleet in the city, and the fuel mix for trams and rail (diesel and generation mix (e.g. coal, oil, wind) for electricity).

Ease and cost of gathering data

This indicator is complicated and expensive to derive data for, and requires some detailed knowledge of the mix of vehicles in the city's fleet, as well as their fuel consumption characteristics. A specialist consultant may need to be employed to derive this data. In France emissions indicators are derived from household travel surveys. If a car is used for a trip, the following data is collected for this car: age, power and fuel characteristics.

Cities joining the Covenant of Mayors should be able to derive these data as part of their Sustainable Energy Action Plan, using the guidance documents (http://www.covenantofmayors.eu/Covenant-technical-materials.html). Currently more than 6.000 municipalies in Europe have signed the Covenant.

Example of how such data has been used previously by cities

The graph on the next page shows how Copenhagen has used this information to monitor the impact of its carbon emissions strategy in its Green Account. It is to be noted that emissions from traffic were only around 10% lower in 2013 than they were in 2005, indicating the difficulty of tackling this source of carbon emissions – and hence, its importance.

Figure 022.1 – Trends in Carbon Emissions by Sector, Copenhagen CARBON EMMISSIONS BY SECTOR

INCLUDING CREDITTED RENEWABLE ELECTRICITY PRODUCTION



O26. PM10 (particulates)

Definition

Concentration of PM10 in the air $\mu g/m^3$ (particulate matter PM10; very small soot particles that are hazardous to health). Exceedances of EU air quality standards for cities).

Purpose and link to objectives

To give an indication of how well the city is addressing air quality targets. Not meeting these targets can have serious implications for the health of citizens.

How to gather data and derive indicator

Air quality monitoring equipment and monitoring guidance (http://www.eionet.europa.eu/aqportal).

Ease and cost of gathering data

Costly if equipment not already in place; however, in order to monitor their compliance with the 2005 EU Air Quality Directive, all cities should already have monitoring equipment in place.

Example of how such data has been used previously by cities

Data from Copenhagen show how the City has gathered this information to monitor its compliance with the EU Directive. This particular example relates to the most polluted street in the City.

Figure 023.1 - Trends in particulate concentrations

AIR CONTENT OF PARTICLES (PMI0) ANNUAL MEAN H.C.ANDERSENS BOULEVARD AT AMBIENT TEMP. AND PRESSURE

= EU LIMIT VALUE ENTERED INTO FORCE 2005



Source: Copenhagen Green Accounts (2013)

027. NO

Definition

Concentration of NOX 10 in the air $\mu g/m^3$ (Nitrogen Oxides). Exceedances of EU air quality standards for cities.

Purpose and link to objectives

To give an indication of how well the city is addressing air quality targets. Not meeting these targets can have serious implications for the health of citizens.

How to gather data and derive indicator

Air quality monitoring equipment.

Ease and cost of gathering data

Costly if equipment not already in place; however, in order to monitor their compliance with the 2005 EU Air Quality Directive, all cities should already have monitoring equipment in place.

Example of how such data has been used previously by cities

Once again data from Copenhagen show how the City has gathered this information to monitor its compliance with the EU Directive.

Figure 024.1 - Trends in Nitrogen Dioxide (NO) concentrations

AIR CONTENT OF NITROGEN DIOXIDE (NO₂) ANNUAL MEAN H.C.ANDERSENS BOULEVARD



Source: Copenhagen Green Accounts (2013)

O28. Noise

Definition

Percentage of the city's population exposed to noise levels above 55 dB(A) during the day and 50 dB(A) at night.

Purpose and link to objectives

To give an indication of how well the city is addressing noise pollution reduction targets. Not meeting these targets can have serious implications for the health of citizens.

How to gather data and derive indicator

Noise monitoring equipment.

Ease and cost of gathering data

Costly if equipment not already in place; however, in order to monitor their compliance with the 2002 EU Noise Directive, all agglomerations of 250,000 people or more should already have monitoring equipment in place. For smaller cities, specialist consultancy support will be required.

Example of how such data has been used previously by cities

Once again data from Copenhagen show how the City has gathered this information to monitor its compliance with the EU Directive.

Figure O25.1 - Average daily noise (share of population being exposed to relevant noise level during day time)



Figure 025.2 - Noise at schools and daycare centres



Both figures sourced from Copenhagen Green Accounts (2013