

Analysing the
impact of walking
and cycling
on urban road
performance:
**a conceptual
framework**

Analysing the
impact of walking
and cycling
on urban road
performance:
**a conceptual
framework**



Release information

Author: Frederic Rudolph, Wuppertal Institute

Printed in January 2017
Brussels

FLOW project coordinator:
Bernard Gyergyay, Rupprecht Consult
b.gyergyay@rupprecht-consult.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 635998.



TABLE OF CONTENTS

1.	THE ROLE OF WALKING AND CYCLING IN REDUCING CONGESTION	9
1.1.	Congestion as a multimodal issue	11
1.2.	Assessing multimodal transport network performance	12
1.3.	When walking and cycling reduce congestion	14
2.	HOW DOES MODELLING FIT IN?	15
3.	ANALYSING CONGESTION	19
4.	SOCIO-ECONOMIC ANALYSIS OF WALKING AND CYCLING IMPROVEMENTS	25
5.	FLOW IN PRACTICE	29
6.	REFERENCES	31

Introduction to FLOW

The impact of walking and cycling on urban congestion must be precisely evaluated. FLOW is developing a user-friendly methodology for evaluating these impacts as well as assessment tools for cities to use in evaluating the effects of walking and cycling measures on urban road performance (where poor performance is usually described as “congestion”).

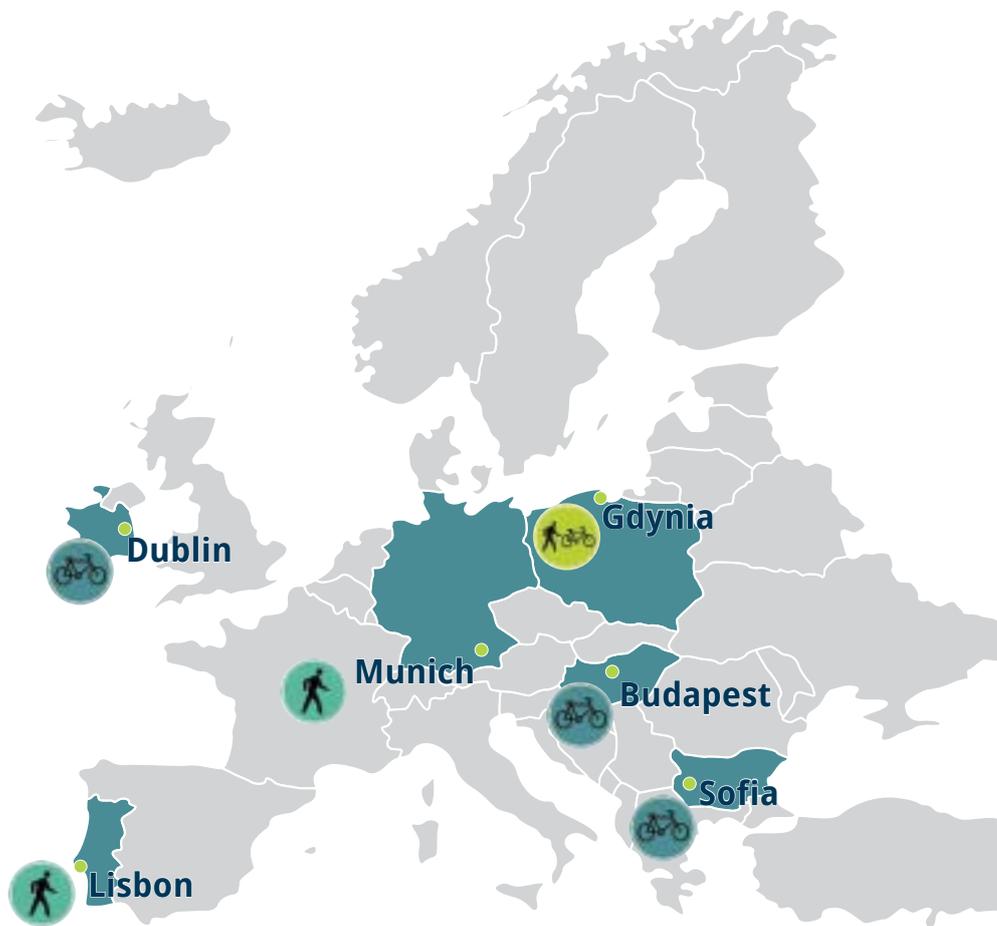
The tools include an impact assessment tool (including socio-economic impact, an assessment of soft measures, congestion evaluation based on KPIs and a cost benefit analysis) and traffic modelling.

As part of FLOW, existing transport demand models are being calibrated and customised in the FLOW partner cities to help analyse the relationship of cyclist and pedestrian movements to urban road performance. The modelling and impact assessment will identify the congestion reducing effect of walking and cycling measures. FLOW partner cities will develop implementation scenarios and action plans for adding or up-scaling measures that are shown to reduce congestion.

FLOW will target three distinct audiences, with appropriate materials and messaging for each. Cities will learn about the value and use of new transport modelling tools, transport planning consultants will be made aware of the benefits of using the FLOW outputs and decision makers will be provided with facts to argue for walking and cycling to be put on equal footing with other modes of transport. FLOW will meet the challenge of “significantly reducing urban road congestion and improving the financial and environmental sustainability of urban transport” by improving the understanding of walking and cycling measures that have potential to reduce urban congestion.

The communication and dissemination work in the project will disseminate FLOW outcomes and outputs to a wider group of cities and regions as well as other urban transport stakeholders across Europe through a set of supporting communication products and networking tools. The project will develop a comprehensive set of highly targeted dissemination activities including e-newsletters, website, social media campaigns, reports including the “Implementer’s Guide” on tools and measures for tackling congestion with walking and cycling and the FLOW “Congestion Quick Facts” for decision makers.

Figure 1: FLOW partner cities and their project focus.





1

**The role
of walking
and cycling
in reducing
congestion**

Traffic congestion is a growing problem in many cities due to increasing urbanisation and motorisation.

For many years the standard solution for congestion has been widening roads for automobiles. However, today it is clear that simply providing more road space induces more automobile travel (e.g. Feng et al, 2017). What's more "[c]ongestion relief [...] does not necessarily make for a sustainable and liveable metropolis. Thus residents of places that are able to build themselves out of traffic congestion might not necessarily like what they get" (Cervero, 2003: 159).

In contrast, walking and cycling are rarely considered as measures for reducing congestion in spite of their well-documented benefits for travellers and cities (e.g. Ogilvie et al. 2007, Pucher et al. 2010, Goodman et al. 2013). More specifically, decision makers may be reluctant to implement walking and cycling measures because:

- they fear walking and cycling measures will increase congestion;
- they view public transport as the principal means of combatting congestion.

In both cases transport professionals need better tools for assessing the impacts of walking and cycling. The current inability to fully analyse the congestion reduction impacts of walking and cycling measures on transport network performance results in an over-emphasis on motor vehicle measures and an under-emphasis on walking and cycling. Importantly, the difficulty in assessing congestion impacts of walking and cycling measures feeds into potential fears that their implementation will increase congestion.

The socio-economic impacts of walking and cycling measures are also difficult to fully assess due to the extensive data requirements and complexity of standard evaluation processes such as cost-benefit analysis (Rudolph et al. 2015). Again, this lack of information can make it difficult to generate support for walking and cycling measures.

FLOW has developed tools that enable transport professionals to better understand both the congestion-related and the socio-economic impacts of walking and cycling measures. This document introduces the tools and methods developed in FLOW for doing so. These tools can feed critical information into the process of agenda setting and measure selection (i.e. before implementation) or they can be applied to evaluate a walking or cycling measure after implementation.

The remainder of Chapter 1 presents a background on multimodal congestion analysis. Chapter 2 explains how improved transport models and modelling support the use of the FLOW tools. Chapter 3 presents FLOW's Multimodal Transport Performance Analysis Methodology, which improves the ability to analyse road performance impacts (congestion reduction potential) of walking and cycling measures. Chapter 4 presents the FLOW Impact Assessment Tool, which was designed to improve the ability to assess both the transport and socio-economic impacts of walking and cycling measures. Chapter 5 describes how the FLOW analysis methodology and assessment tool can be applied in transport planning processes.

1.1. Congestion as a multimodal issue

The conventional understanding of transport network performance and congestion focuses on motorised transport, effectively ignoring a significant portion of urban transport (Weisbrod et al. 2001, Bovy and Salomon 2002, Stopher 2004, Litman 2015). FLOW's mission is to

place non-motorised transport on an equal footing with motorised modes with regard to analysing urban road performance. In an effort to address key shortcomings of earlier congestion definitions, the FLOW project defines congestion as follows:

Congestion is a state of traffic involving all modes on a multimodal transport network (e.g. road, cycle facilities, pavements, bus lane) characterised by high densities and overused infrastructure compared to an acceptable state across all modes against previously-agreed targets thereby leading to (perceived or actual) delay.

This definition considers the relationship between capacity and demand across all modes. It provides a complete view of network performance and of potential strategies for reducing congestion. Since people on foot, on bicycles or in public transport require less space than people in cars, any shift in demand from cars to non-motorised or shared transport modes can increase the effective transport network capacity.

User perspective also plays an important role in this multimodal definition. Delay is perceived by most traffic participants as the main impact of congestion (UK DfT 2001). The delay caused by congestion plays a role in determining mobility behaviour but it is just one factor of interest to travellers (Pooley et al. 2013). Delay is experienced when the actual travel time exceeds a threshold that the user perceives as acceptable. Importantly, travellers in different modes perceive delay differently. The perception of delay also depends on journey purpose, the ratio of delay to overall journey time and factors such as the need to make a public transport connection. Finally, the perception of delay is not linear with the increase in delay time.

FLOW has used this understanding to develop a methodology for analysing multimodal transport network performance that better includes non-motorised modes (FLOW Multimodal Transport Performance Analysis Methodology¹, chapter 3). Two important considerations used in developing this methodology were:

- 1 There is little research on “acceptable” delay for walking and cycling, therefore FLOW adopted the use of minimum travel time as a reference value for use in setting the acceptable travel time for all modes of travel.
- 2 The project goal was to develop a single multimodal performance index (MPI) for transport network service quality. This MPI is calculated by aggregating mode-specific key performance indicators (KPIs) for delay and level of service (LOS). These KPIs are person-based delay values for all transport modes (delay) and utility points for mode-specific LOS classes (LOS).

¹ available at <http://h2020-flow.eu/resources/publications/>

1.2. Assessing multimodal transport network performance

Cities have different reasons for implementing walking and cycling measures. Some may wish to create a sustainable and liveable metropolis. Others may see walking and cycling measures as tools for fighting congestion. Many wish to increase safety for vulnerable road users. But almost all cities are faced with the problem that many people fear that walking and

cycling measures could increase congestion. The FLOW project has developed transport analysis techniques designed to improve the ability to evaluate these impacts. To do this FLOW uses indicators that address both the performance of a transport system and the impacts arising from walking and cycling measures. More specifically:

Transport performance:

A city should be able to describe the network performance of its transport system. It may then define the status of a junction, segment or corridor as “congested”. Thus a walking or cycling measure may offer the direct mobility benefit of improving the city’s transport network performance (or at least not increasing congestion). FLOW has developed KPIs for describing transport network performance.

Socio-Economic Impacts:

A walking or cycling measure will have socio-economic impacts. These include mobility, economic, environmental, societal, and other impacts as shown in Figure 2. FLOW has developed a method and indicators to evaluate these socio-economic impacts.

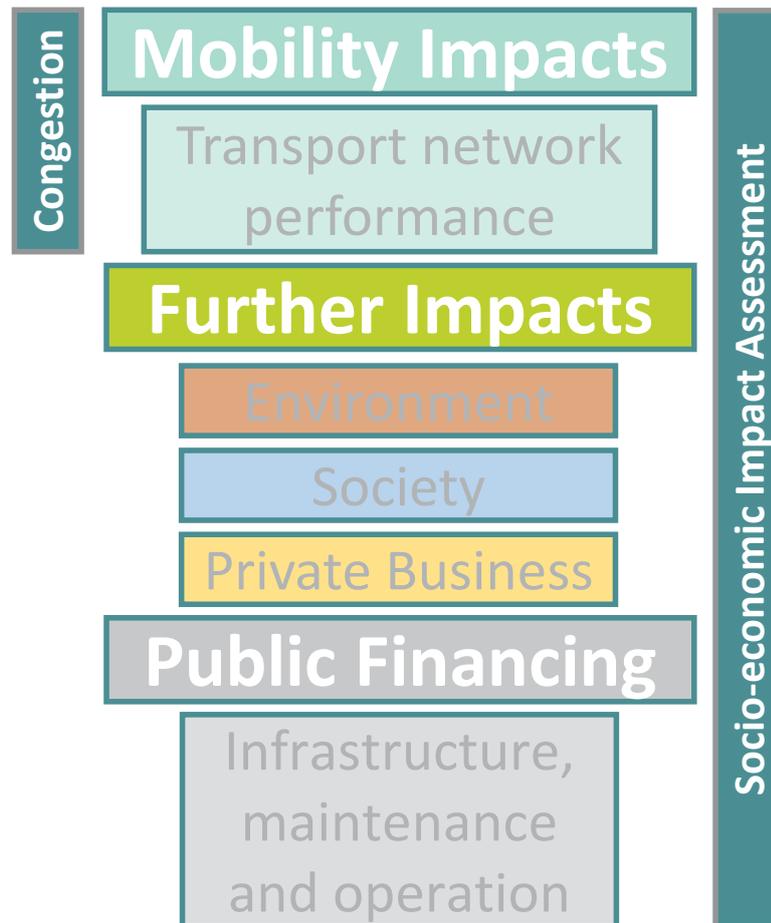


Figure 2: FLOW socio-economic analysis overview. Source: FLOW project

Cities can use the FLOW transport performance and socio-economic impact tools to compare “with measure” and “without measure” scenarios. The performance indicators are an essential part of FLOW’s multimodal transport performance analysis methodology, which is outlined in chapter 2 and described in detail in the document, Multimodal Analysis Methodology of Urban Road Transport Network Performance: A Base for

Analysing Congestion Effects of Walking and Cycling Measures². The analysis of socio-economic impacts, i.e. additional socio-economic costs and benefits of mobility measures can be found in the FLOW Impact Assessment Tool, which is outlined in chapter 3 and available in the publication Socio-economic Impact Assessment of Walking and Cycling Measures.

² All FLOW publications are available for download from the FLOW website: www.h2020-flow.eu.

1.3. When walking and cycling reduce congestion

An important FLOW goal is to facilitate a more informed debate about the impact of walking and cycling on transport network performance and congestion. Therefore, the project gathered 20 case studies of walking and cycling measures and looked at their impact on congestion in *The Role of Walking and Cycling in Reducing Congestion: A Portfolio of Measures*. In all 20 cases, conditions for walking and/or cycling were improved. In ten of the 20 cases, congestion was reduced for some modes while eight neither increased nor decreased congestion or an effect could not be measured. In two cases there were slight increases in motor vehicle congestion. None of the measures was evaluated multimodally, i.e. a mode-specific assessment was not carried out for each mode and an aggregation of the modes was not applied.

A key finding in analysing the 20 cases is that most of the measures were not implemented with the intention of reducing congestion. Almost all cases showed that there were other beneficial effects, such as a shift to sustainable modes, improved safety or improved quality of public space. From the perspective of congestion reduction, these could be seen simply as “co-benefits”. On the other hand, these effects can

also help reduce congestion in the long run; most of the walking and cycling measures described have the potential to invite behaviour change, thus improving the modal split for non-motorised modes over time.

To understand the transferability of the case study results, it is necessary to evaluate the context and conditions in which the measures were implemented. The case studies show that it is important to integrate measures into a broader concept. To raise the modal share of walking and cycling and reduce car traffic in order to reduce congestion, improvements such as cycle lanes on a single road segment or pedestrian-friendly signalling at a single intersection are not sufficient. Instead, these measures need to be accompanied by connected networks of footpaths and bike lanes and other supporting measures. Such measures include walking and cycling campaigns, traffic restrictions and reduced speed limits for motorised traffic, changes of signalling, better quality walking and cycling infrastructure and bicycle parking facilities. Therefore it is highly recommended that cities integrate walking and cycling planning and measures into comprehensive (sustainable urban) mobility plans.



2

**How
does
modelling
fit in?**

Many cities use transport models to analyse the impacts of proposed policies and improvement measures. There are two main types of models: macroscopic and microscopic

M Macroscopic models are strategic in the sense that they analyse the transport demand for whole cities or regions. Often this comprises a 4-step calculation procedure including trip generation, destination choice,

mode choice and route choice. Microscopic models mainly focus on simulating traffic flows on a detailed level consisting of several intersections and roadway segments or small geographic areas. Figure 3 illustrates the two types of models and the relationship between them.

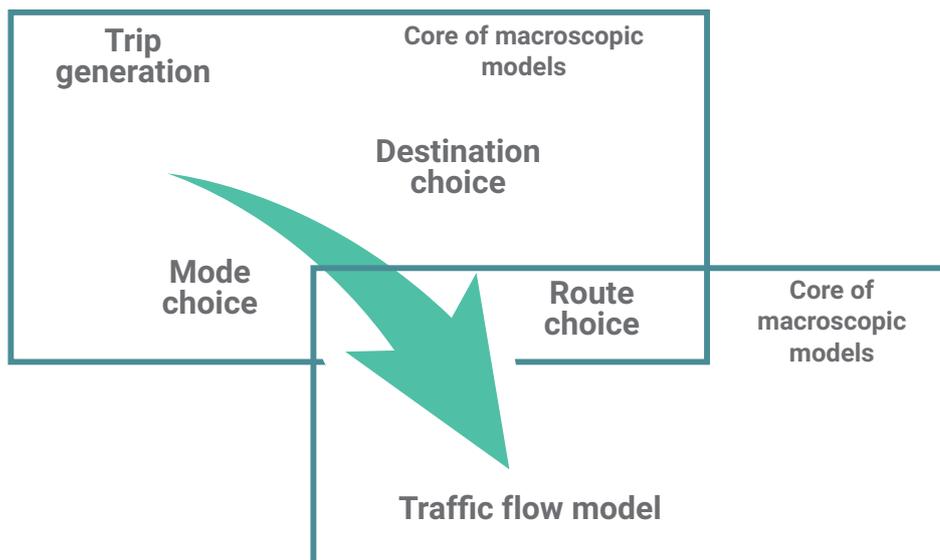


Figure 3: Simplified overview of the steps of transport modelling. Source: FLOW project

In the FLOW project, transport models are used to provide input to the FLOW Multimodal Transport Performance Analysis Methodology and the FLOW Impact Assessment Tool.³ The FLOW cities apply their

models to analyse the effects of walking and cycling measures. For example, Munich is using a microscopic simulation to assess different options for a pedestrian crossing of a major urban arterial (see Figure 4).



Figure 4: Microscopic modelling for Arcisstraße in Munich. Source: FLOW project

Budapest is using a macroscopic model to assess the impacts of its bike share scheme and cycling network improvements on mode share (see Figure 5). In both

cases, an important goal is to improve the situation of cyclists and pedestrians while avoiding negative impacts on transport network performance.

³ It is also possible to apply the FLOW tools without the use of transport models. The models simply take over many of the necessary calculations and they facilitate scenario simulation.



Figure 5: Macroscopic modelling for the city of Budapest. Source: FLOW project

Transport models can calculate different transport system performance indicators depending on the scale and goal of a measure. These indicators also provide a basis for analysing other impacts. For example:

- **travel time** is needed to calculate delay and to monetise travel time savings, and
- **motor vehicle** driving performance determines environmental indicators such as CO₂ emissions and local pollutants.



3

Analysing Congestion

FLOW's Multimodal Analysis Methodology of Urban Road Transport Network Performance is a tool for evaluating the impacts of cycling and walking measures on transport network performance and congestion.

Key Performance Indicators

The FLOW Multimodal Transport Analysis Methodology uses key performance indicators to operationalise its multimodal definition of transport network performance and congestion in terms of travel time and the relationship

between the demand for and supply of road space. The KPIs describe the state of traffic flow for all traffic participants, thereby enabling the analysis of transport network performance for all modes. The KPIs are (based on FGSV 2015):

- 1 **DELAY** – the additional travel time experienced by a traffic participant compared to the minimum travel time from origin to destination.
- 2 **DENSITY** – a measure of the number of persons or vehicles using a given space.
- 3 **LEVEL OF SERVICE (LOS)** – a measure reflecting the quality of service experienced by traffic participants at different levels of infrastructure use (i.e. more or fewer people travelling).

These indicators can be used for local (e.g. a road segment or a junction) or network level analysis and can be calculated for each transport mode separately.

The calculation of the KPIs consists of four steps, as illustrated in Figure 6 and described in more detail below.



Figure 6: Four steps of the FLOW methodology. Source: FLOW project

1

Step one in the FLOW Multimodal Transport Analysis Methodology is to determine the scope of the proposed improvement measure in order to set the assessment boundaries and determine what level of congestion assessment is needed. Walking and cycling measures may have local and/or network-wide impacts. Table 1 shows the multimodal applicability of the FLOW KPIs in relation to examples of walking and cycling measures.

Assessment level	Measure example	Indicators applied
Intersection: +	Reallocation of green times in favour of pedestrians and/or cyclists	Delay, LOS
Segment: ++	Introduction of 30 km/h speed limit	Density, LOS
Corridor (network segment): +-+ +-+	Public bicycle sharing scheme	Delay, LOS

Table 1: Application of FLOW KPIs on network elements (following the German Handbuch für die Bemessung von Straßenanlagen) (FGSV 2015). Source: FLOW project

2

Step two is to consider setting priorities for transport modes. The default value for the weighting is 1 (i.e., all transport modes have the same priority). However FLOW recognises that all cities establish their own priorities; some cities wish to prioritise sustainable transport modes like walking, cycling and/or public transport over car travel. Table 2 presents an example of mode-specific weighting factors that can be used in the FLOW Multimodal Transport Analysis Methodology.

Measure	Affected network element	Transport mode	Weighting factor
prioritisation of cycling: construction of a new cycling lane	separate cycle lane (extension) lanes for motorised traffic (reduced width)	car	1
		public transport	1
		cyclist	3
		pedestrian	1

Table 2: An example of weighting factors set based on a hypothetical prioritisation of cycling. Source: FLOW project

3

Step three is to calculate the KPIs separately for each mode, using the calculation procedures appropriate to the scope of the measure. Detailed calculation procedures are explained in the FLOW Multimodal Analysis Methodology of Urban Road Transport Network Performance.

Delay is defined as the mean time loss per traffic participant along a route. The FLOW methodology calculates this for motor vehicles following standard engineering practice as the difference between the actual travel time and the minimum travel time (free-flow conditions). For cyclists, FLOW defines minimum travel time as the average cycling speed (assumed to be 15 km/h, a common standard) multiplied by the distance over the network from origin to destination. Here, the network may include roadways with or without dedicated cycling facilities. For pedestrians, FLOW defines minimum travel time as the time it would take to walk as the crow flies between two points at an average walking speed (assumed to be between 1.2 and 1.4 m/second, a common standard). This definition recognises the nature of pedestrian movement and can be applied to dispersed movements at major junctions and open spaces as well as movement along links.

For density, FLOW adopts the commonly accepted definition (TRB 2010, FGSV 2015) based on the proximity of vehicles or persons to one another. Density is defined as the number of vehicles (cars, public transport vehicles or bicycles) as well as persons occupying a given length of roadway lane, usually specified as one kilometre.

Level of service (LOS) transforms quantitative, infrastructure-based performance indicators (here: delay and density) into a single measure to reflect the quality of service experienced by traffic participants (TRB 2010). The concept of LOS was originally developed to evaluate the quality of motor vehicle traffic flow but has been extended by defining basic variables and thresholds for walking and cycling to qualitatively evaluate system performance for each transport mode (e.g. Fruin 1971 for pedestrians).

Once a city has calculated values for these KPIs, it is possible to set a threshold value beyond which network

performance is considered unacceptable. This is the congestion threshold. Congestion thresholds can be defined in two ways: either based on continuous values (an element of the urban road network is perceived to be congested if the density or the delay per traffic participant exceeds a specified value), or based on discrete classes. LOS classification is an example of discrete class, it defines congestion based on LOS categories (e.g., LOS E is adopted as the congestion standard).

Cities must decide what level of congestion is “acceptable”, meaning that setting a congestion threshold is a political decision. One way of thinking about the threshold is that it represents the point at which the city believes intervention is required. Since the threshold is set by individual cities, there will be variation from city to city and from transport mode to transport mode based on local perceptions and policy objectives. As with the priority setting in step 2, the threshold can be established based on policy priorities formulated in a sustainable urban mobility planning process.

Standard traffic engineering references recognise that it is not possible to provide a high LOS in peak periods. For example, according to the US Highway Capacity Manual, LOS D “is a common goal for urban streets during peak hours, as attaining LOS C would require prohibitive cost and societal impact in bypass roads and lane additions ... LOS E is a common standard in larger urban areas, where some roadway congestion is inevitable.”

Recent research (Newton and Curry 2014) questions the whole idea of using LOS and other congestion-based methods for evaluating transport network performance because it leads to an overemphasis on roadway construction and does not fully consider the possibility that new roadways will lead to induced travel.

4

Once the KPIs have been calculated separately for each mode, the FLOW Multimodal Transport Analysis Methodology creates a single multimodal performance index (MPI) for a specific transport system element by aggregating the individual mode-specific values into mean multimodal delay and LOS values.⁴ This theoretical value represents the efficiency of the transport system element for all modes.

Most current definitions of congestion focus solely on high motor vehicle density or delay times, thereby neglecting available infrastructure capacity for non-motorised transport. The aggregated multimodal approach considers all modes of transport. It points out the multimodal transport system's capacity reserve and

highlights the potential for underused modes to take up excess demand. The methodology thereby enables policy makers to consider all modes as both potential sources and potential remedies for urban congestion. Thus aggregation emphasises the importance of a balanced and integrated transport system.

A pre-requisite for aggregation and comparison is a common base. The FLOW Multimodal Transport Analysis Methodology provides this by combining mode-specific variables into common units. These are:

- person-based delay values for all means of transport
- utility points for different mode-specific LOS classes

The person-based delay values are calculated by transforming mode-specific traffic volumes from vehicles/h into persons/h using mode- and purpose-specific vehicle occupancy ratios. Car occupancy is estimated based on trip purpose and public transport occupancy is estimated based on vehicle capacity and

demand. A vehicle occupancy ratio of 1 is assumed for bicycles; however, trip purpose adaptation may be necessary in order to account for the transport of children in trailers or cargo bikes. No transformation of pedestrians is required. Mode-specific vehicle occupancy ratios are determined by each city

¹ An aggregated MPI for density is not created because this would result in a loss of significance of the measurement.



4

**Socio-economic
analysis of
walking
and cycling
improvements**

FLOW recognises that transport network performance is only one of many aspects that influence the quality of urban transport systems.

Thus FLOW has elaborated a set of indicators including both mobility and other socio-economic impacts (see Szabo/Schäfer 2016). Unlike previous tools, the FLOW assessment procedure gives cities the possibility to evaluate the wide range of effects of walking and cycling measures including their effects on transport network performance. It is applicable to both ex-ante assessments and ex-post evaluations.

The FLOW Impact Assessment Tool reflects the mobility impacts (traffic performance, green row in Table 3), the environmental, societal and economic effects of a measure (orange, blue and yellow rows), and the impacts of the measure on public financing (grey).

The first column represents the focus area (see Figure 2), while the second represents the scope of what is to be assessed and the third shows the indicator and the unit which is measured.

Target System	Score	Indicator	Transport mode	
			MT	NMT
Public Financing	cost of (new) infrastructure	investment cost (EUR/year-annuity)		
		operating & maintenance cost (EUR/year)		
Traffic performance	travel time related	total travel time (person-h/year; ton-h/year)	x	x
Environment	GHG emission & local air pollution	total direct CO ₂ emission (t/year)	x	
		total direct NO _x emission (t/year)	x	
		total direct PM emission (t/year)	x	
	noise pollution	noise level in the daytime (dB/day)*	x	
	land consumption	sealed surface: total new / deconstructed traffic area (-)	x	x
Society	traffic safety	number of person killed (no./ year)	x	x
		number of (seriously & slightly) injured persons (no./ year)	x	x
	health	health benefits based on a reduced probability of death for people who cycle/walk (no./ year)		x
	increased access	accessibility increased access of non motorized residents to amenities (e.g. jobs) (-)		x
	social interaction	separation effect (-)		x
Private Business	vehicle operating costs	vehicle operating costs (EUR/year)	x	x
	energy consumption	total final energy consumption	x	x
	(monetary) attractiveness	comercial attractiveness increased retail rents (EUR/year)		x
		residential attractiveness increased residential rents (EUR/year)		x

Table 3: Indicators used in FLOW's impact assessment tool.⁵ Source: FLOW project

⁵ FLOW does not calculate the indicator "noise level" because of the complexity of the calculation and the difficulty to gather appropriate data. For details, see Szabo/Schäfer 2016.

Currently, transport project assessments vary greatly from city to city and many cities have no predefined guidelines or regulations at all. Qualitative data that arises from measures is often neglected due to the difficulties in assessing it. However, such data could significantly

influence the value of some policies and measures – particularly walking and/or cycling measures. Depending on the local political objectives and data accessibility, FLOW offers different approaches to analyse the socio-economic impact indicators as listed in Table 3.

POSSIBLE APPROACHES:

Multi-criteria analysis (MCA)
Weighted benefit analysis (WBA)
Cost-benefit analysis (CBA)
Qualitative appraisal

A very basic approach to assess the impacts of transport measures is a MCA. In this case all indicators are calculated individually in a “with measure” and “without measure” scenario. Cities do not need to aggregate them, but they compare the “with measure” case to the “without measure” case, meaning they can evaluate certain indicators against their political targets (e.g., congestion reduction is connected to the mitigation of local pollutant emission levels). If a city aims to reduce both congestion and local air pollution, but does not prioritise other issues, an analysis of these single indicators may be sufficient.

An aggregation of indicators may be advisable if several indicators form the basis for decision making. In the WBA, single basic indicators with their original physical units (e.g. total travel time in the network in person-hours) are transformed into a utility function by assigning a number of utility points to them. In this

way an aggregated result for different cases can be produced and the best option selected. This approach has the advantage that it accounts for both quantitative and qualitative indicators.

CBA is widely used to assess the economic viability of transport projects, especially large-scale infrastructure schemes and politically sensitive projects (Beukers et al. 2012). In most European countries, the preparation of a CBA is mandatory for infrastructure measures that apply for public funding. Cost-benefit analyses attempt to express the viability of a project by defining (as many as possible of) a measure’s relevant direct and indirect impacts in monetary terms. An important result of a CBA is the benefit-cost ratio (BCR), which describes the value of the benefits produced relative to the money invested. As the values are normalised, the BCR allows comparisons among (walking and cycling) projects of various sizes.

The FLOW approach also enables the measurement of effects that are not quantifiable. Qualitative evaluation makes use of a scale where each number is assigned an additional weighting factor (-2 to + 2). This qualitative appraisal can be incorporated into the WBA. Gathering appropriate data is crucial for any appraisal. Many

cities lack data on non-motorised transport modes; therefore, it may be helpful to calculate indicators from other indicators for which reliable data can be found. For some indicators, there is a greater difference between cities in one country than between countries. In principle, the following sources of data are available.

POSSIBLE SOURCES OF DATA:

Transport models

Local statistics, including traffic counts and household surveys

Official statistics from other private and public bodies

Scientific studies and research projects

National and international databases





5

FLOW
in practice

FLOW's ideas are being tested in its partner cities of Budapest, Dublin, Gdynia, Lisbon, Munich and Sofia.

The FLOW Multimodal Transport Analysis Methodology and Impact Assessment Tool together with improved transport modelling software are being used by the cities to better assess the impacts of walking and cycling measures on transport network performance

and congestion. At the same time the FLOW project is developing a comprehensive summary of information on why and how walking and cycling can be used to address congestion for use by city decision makers and other key stakeholders.

Figure 7 summarises FLOW's conceptual framework and how the FLOW tools assess:

- 1 the effects of walking and cycling measures on transport network performance, and
- 2 further socio-economic costs and benefits emerging from walking and cycling measures.

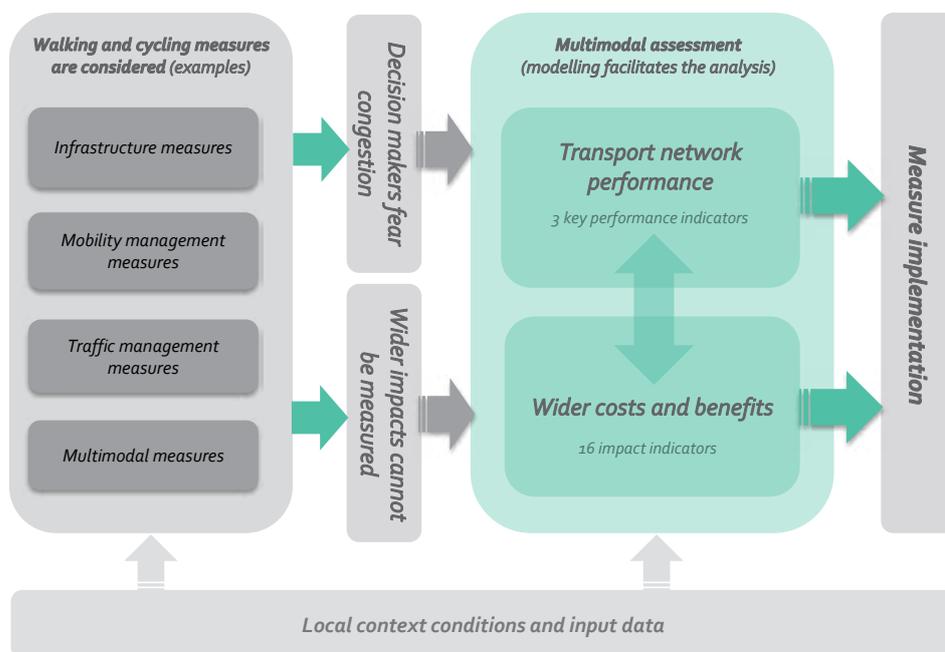


Figure 7: The FLOW conceptual framework. Source: FLOW project

The FLOW approach enters the process at the stage of agenda setting and measure selection, when decision makers consider implementing a walking or cycling measure but fear congestion or are unaware of potential

benefits. The FLOW analysis methodology and impact assessment tool provide a basis for decision making. Thereby, more walking and cycling measures will be implemented.



References

FLOW resources

Koska, Thorsten; Rudolph, Frederic (2016): The role of walking and cycling in reducing congestion. A portfolio of measures. Brussels. Available at <http://www.h2020-flow.eu>.

Mayne, Kevin; Ruebens, Carolien; Swennen, Benedicte (2016): FLOW Decision-Makers' Baseline Survey. Brussels. Available at <http://www.h2020-flow.eu>.

Rudolph, Frederic; Szabo, Nora (2016): Multimodal Analysis Methodology of Urban Road Transport Network Performance. A Base for Analysing Congestion Effects of Walking and Cycling Measures. Brussels. Available at <http://www.h2020-flow.eu>.

Szabo, Nora; Kretz, Tobias; Sielemann, Sebastian (2016): Extended Versions of PTV Visum, PTV Vissim and PTV Viswalk. Brussels. Available at <http://www.h2020-flow.eu>.

Szabo, Nora; Schäfer, Tanja (2016): FLOW Impact Assessment Tool – Guideline. Brussels. Available at <http://www.h2020-flow.eu>.

Szabo, Nora; Schlaich, Johannes; Kretz, Tobias (2016): Congestion impact evaluation of walking and cycling: state-of-the-art survey. Brussels. Available at <http://www.h2020-flow.eu>.

Other literature

Beukers, E., Bertolini, L., Te Brömmelstroet, M. (2012). Why Cost Benefit Analysis is perceived as a problematic tool for assessment of transport plans: A process perspective. *Transportation Research Part A: Policy and Practice* 46, pp. 68-78.

Bovy, P.H.L. and I. Salomon (2002). Congestion in Europe: Measurements, Patterns and Policies. In: E. Stern, I. Salomon, P.H.L. Bovy (Eds). *Travel Behaviour: Spatial Patterns, Congestion and Modelling*, pp. 143-179. Cheltenham.

Cervero, Robert (2003). Road Expansion, Urban Growth, and Induced Travel – A Path Analysis, *APA Journal*, Vol. 69, No. 2.

Feng, Jianxi; Dijst, Martin; Wissink, Bart; Prillwitz, Jan (2017). Changing travel behaviour in urban China: Evidence from Nanjing 2008–2011. In: *Transport Policy* 53, pp 1-10.

Forschungsgesellschaft für Straßen- und Verkehrswesen (2015). *Handbuch für die Bemessung von Straßenverkehrsanlagen (HBS) Teil 5 Stadtstraßen*. FGSV Verlag Köln.

Fruin, John J. (1971). *Pedestrian Planning and Design*. Metropolitan Association of Urban Designers and Environmental Planners. New York.

Goodman, A., Panter, J., Sharp, S.J., Ogilvie, D. (2013). Effectiveness and equity impacts of town-wide cycling initiatives in England: A longitudinal, controlled natural experimental study. *Social Science & Medicine*. 97 (0) 228-237.

Litman, Todd (2016). *Smart Congestion Relief. Comprehensive Evaluation of Traffic Congestion Costs and Congestion Reduction Strategies*. Victoria Transport Policy Institute. Available at http://www.vtpi.org/cong_relief.pdf.

Newton, D. and Curry, M. (2014). California has officially ditched car-centric “Level of Service”. Available at: <http://la.streetsblog.org/2014/08/07/california-has-officially-ditched-car-centric-level-of-service/>.

Ogilvie, D., Foster, C., Rothnie, H., Cavill, N., Hamilton, V., Fitzsimons, C., et al. (2007). Interventions to promote walking: systematic review. *BMJ* 334, Issue 7605.

Pooley, Colin, D. Horton, G. Scheldeman, C. Mullen, T. Jones, M. Tight, A. Jopson, A. Chisholm (2013). Policies for Promoting Walking and Cycling in England: A View from the Street. *Transport Policy* 27 (2013) 66-72.

Pucher, J., Dill, J., Handy, S. (2010). Infrastructure, programs, and policies to increase bicycling: An international review. *Preventive Medicine* 50 (2010) 106-125.

Rudolph, Frederic; Black, Colin; Glensor, Kain; Hüging, Hanna; Lah, Oliver; McGeever, James; Mingardo, Giuliano; Parkhurst, Graham; Plevnik, Aljaž; Shergold, Ian; Streng, Martijn (2015). Decision-Making in Sustainable Urban Mobility Planning: common practice and future directions. In: *World Transport Policy and Practice* 21.3 (2015) 54-64.

Stopher, P. R. (2004). Reducing Road Congestion: A Reality Check. *Transport Policy* 11 (2004) 117-131.

Weisbrod, Glen; Vary, Donald; Treyz, George (2001). *Economic Implications of Congestion*. Transportation Research Board – National Research Council. Washington, D.C.

United Kingdom Department for Transport. Perceptions of and Attitudes to Congestion, http://webarchive.nationalarchives.gov.uk/20031216140150/http://www.odpm.gov.uk:80/stellent/groups/dft_transstats/documents/pdf/dft_transstats_pdf_505810.pdf.

Transport Research Board (2010). *Highway Capacity Manual 2010*. National Research Council, Washington, D.C.





