Roadmaps for congestion reducing walking and cycling measures in Exchange Cities

Greater Manchester, Izmir, Örebro, Pisa, Ploiesti, Tallinn, Thessaloniki

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1. The FLOW Project

Despite the acknowledged benefits of walking and cycling in terms of health, travel-time reliability and cost effectiveness, motorised traffic is still often the main focus of mainstream urban mobility policy. FLOW sees a need for:

- a clear link between walking and cycling and congestion.
- a paradigm shift wherein non-motorised transport, often seen from a transport policy perspective simply as a nice "extra", is placed on an equal footing with motorised modes.
- improving the understanding of walking and cycling measures that have the potential to reduce urban congestion.

The mission of the FLOW project is to place non-motorised transport on an equal footing with motorised modes with regard to urban road congestion. It will achieve this by developing a conceptual framework and tools to assess the ability of walking and cycling measures to reduce congestion in European cities.

The FLOW objectives are:

- to define the role of walking and cycling in congestion reduction;
- to develop and apply tools for assessing the congestion-reducing potential of various walking and cycling measures;
- to increase awareness of the congestion reduction potential of walking and cycling;
- to actively support take-up of congestion reducing walking and cycling measures by public administrations;
- to foster the market for new walking and cycling products and services for congestion reduction;
- to communicate congestion reduction facts on walking and cycling.

FLOW includes six partner cities: Budapest, Dublin, Gdynia, Lisbon, Munich and Sofia. All employed the FLOW tools and conceptual framework to assess the role of walking and/or cycling in congestion reduction. Each of these cities was matched with one or more of the FLOW Exchange Cities.

2. About D3.6 Roadmaps for congestion reducing walking and cycling measures in Exchange Cities

Within the first year of the FLOW project, nine cities from across Europe were selected via an open call for applications to become a FLOW Exchange City. These nine cities were:

- Greater Manchester (United Kingdom)
- Izmir (Turkey)
- Nicosia (Cyprus)
- Örebro (Sweden)
- Pisa (Italy)
- Ploiesti (Romania)
- Tallinn (Estonia)
- Thessaloniki (Greece)
- Zurich (Switzerland)

Based on the activities the Exchange Cities chose to pursue within the context of FLOW, they were “twinned” with the FLOW Partner Cities in thematic groups for more focused exchange (see figure below). Each group was led by a Technical Support Partner (Rupprecht Consult, the Budapest University of Economics, Traject and Gdansk University of Technology), who supported the FLOW Exchange Cities in developing their roadmaps. Through a series of three workshops, e-courses and webinars, the Exchange Cities learned about FLOW's multimodal approach to managing congestion, how to use the FLOW tools, and the policy context of applying the FLOW tools. These learning opportunities served to further support the Exchange Cities in testing the FLOW tools, refining their measures and developing their roadmaps.

The Exchange Cities’ roadmaps are intended as concise descriptions of their activities within FLOW as well as recommended post-project steps. The roadmaps are intended as both technical and policy documents which can enable decision makers to support and guide their technical staff in carrying out the implementation or up-scaling/expansion of a (package of) walking and cycling measure(s) and/or of an approach to evaluating such a measure (e.g. microscopic modelling, impact assessment).

Seven of the nine Exchange Cities (Greater Manchester, Izmir, Örebro, Pisa, Ploiesti, Tallinn, Thessaloniki) were able to complete their roadmaps, to varying degrees of detail. This is due to the variation in available data and previous experience working with modelling and impact assessment tools. Technical Support Partner Gdansk University of Technology made a continuous effort to work together with their cities, Nicosia and Zurich, to develop their roadmaps. However, these two cities were unable to complete roadmaps before the end of the FLOW project.

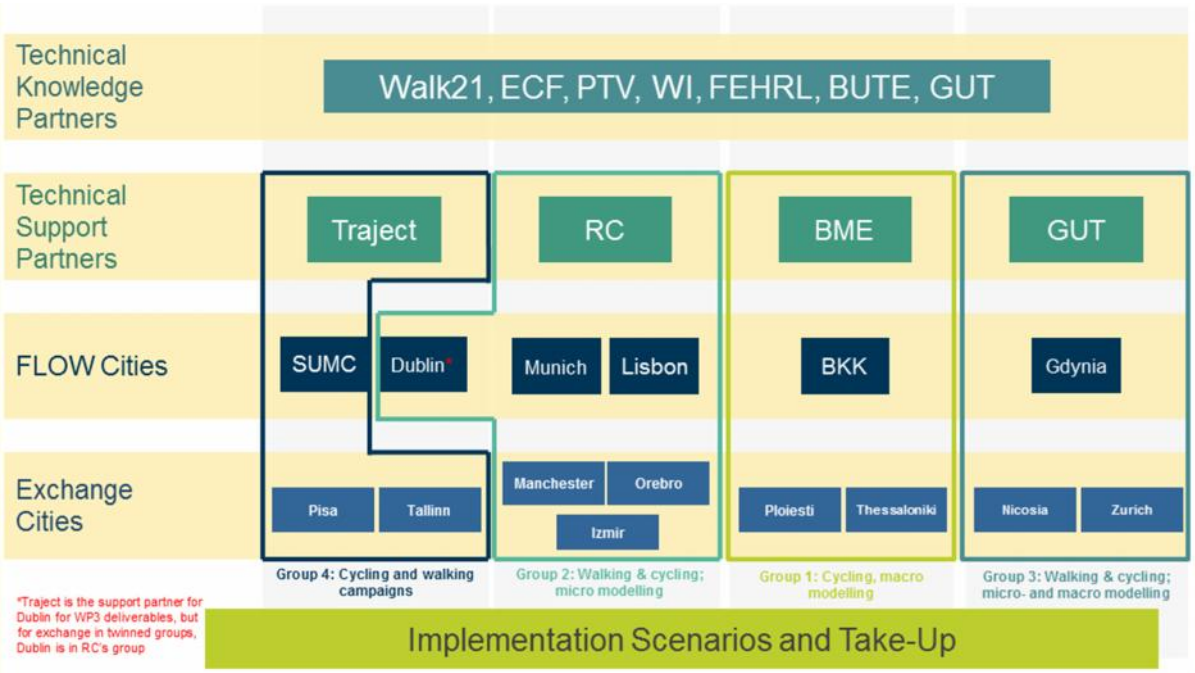


Figure 1: FLOW 'twinned' city groups

3. Introduction to Greater Manchester

Greater Manchester is a metropolitan county in North West England, with a population of 2.8 million. It encompasses one of the largest metropolitan areas in the United Kingdom and comprises ten metropolitan boroughs: Bolton, Bury, Oldham, Rochdale, Stockport, Tameside, Trafford, Wigan, and the cities of Manchester and Salford. Greater Manchester was created on 1 April 1974 as a result of the Local Government Act 1972; and designated a City Region on 1 April 2011.

Greater Manchester spans 493 square miles (1,277 km2), which roughly covers the territory of the Greater Manchester Built-up Area, the second most populous urban area in the UK. There is a mix of high-density urban areas, suburbs, semi-rural and rural locations in Greater Manchester.

In April 2011, the Greater Manchester Combined Authority was established as the strategic county-wide authority for Greater Manchester, taking on functions and responsibilities for economic development, regeneration and transport, with transport planning and delivery co-ordinated through the Transport for Greater Manchester agency. A further devolution of powers to Greater Manchester took place upon the election Andy Burnham as the inaugural Mayor of Greater Manchester on 4 May 2017.

Greater Manchester has recently published its 2040 Strategy which has several aims to meet the future transport needs of a growing Greater Manchester population. The stated aims are to:

- support sustainable economic growth;
- protect our environment;
- improve quality of life for all; and
- develop an innovative city-region.

Reference year		Past (2012)	Present (2016)	Projection for 2030
Population (Source: Oxford Economics – Greater Manchester Forecasting Model- AGS 2017) http://www.neweconomymanchester.com/publications/greater-manchester-forecasting-model		2,702,000	2,776,000	2,992,000
City area		1,276 km²		
Population density		2117/km²	2175/km²	2,992/km²
Modal split (based on distance of all trips)	**Walking**	28.0% (Data source: 2017 GMTRADS)		No targets set
	Cycling	Not reported separately		No targets set

	Public transport	11% (Data source: 2017 GM TRADS)		No targets set
	Private car	58.1% (Data source: 2017 GM TRADS)		No targets set
Route km of:	**Cycle routes**	No Data Available	1,011 miles of which 644 are physically segregated.	No targets set – Significant Growth anticipated.
	Bus	Not available	Not available	No targets set
	Urban rail	209km + 92km LRT	209km + 92km LRT	No committed Heavy Rail schemes – Approx 8 additional km under constructio n for LRT system
	Road	9177.5	9186.4 (2014 – most recent available estimate of network size)	Limited roadbuildin g to support developme nt sites under discussion
Number of car parking spaces		50,571	49,806	

Table 1: City data for Greater Manchester

The infographics on the following page summarise our transport and development challenges and ambitions.

Currently, there are about 202 million bus trips, 27 million rail trips and 38 million light rail trips annually in Greater Manchester (2016-17 statistics). Cycling is a minority mode of transport but there are ambitious plans to develop cycling as a mainstream mode of transport, spearheaded by Chris Boardman who was appointed the first Commissioned for Cycling and Walking in July 2017.

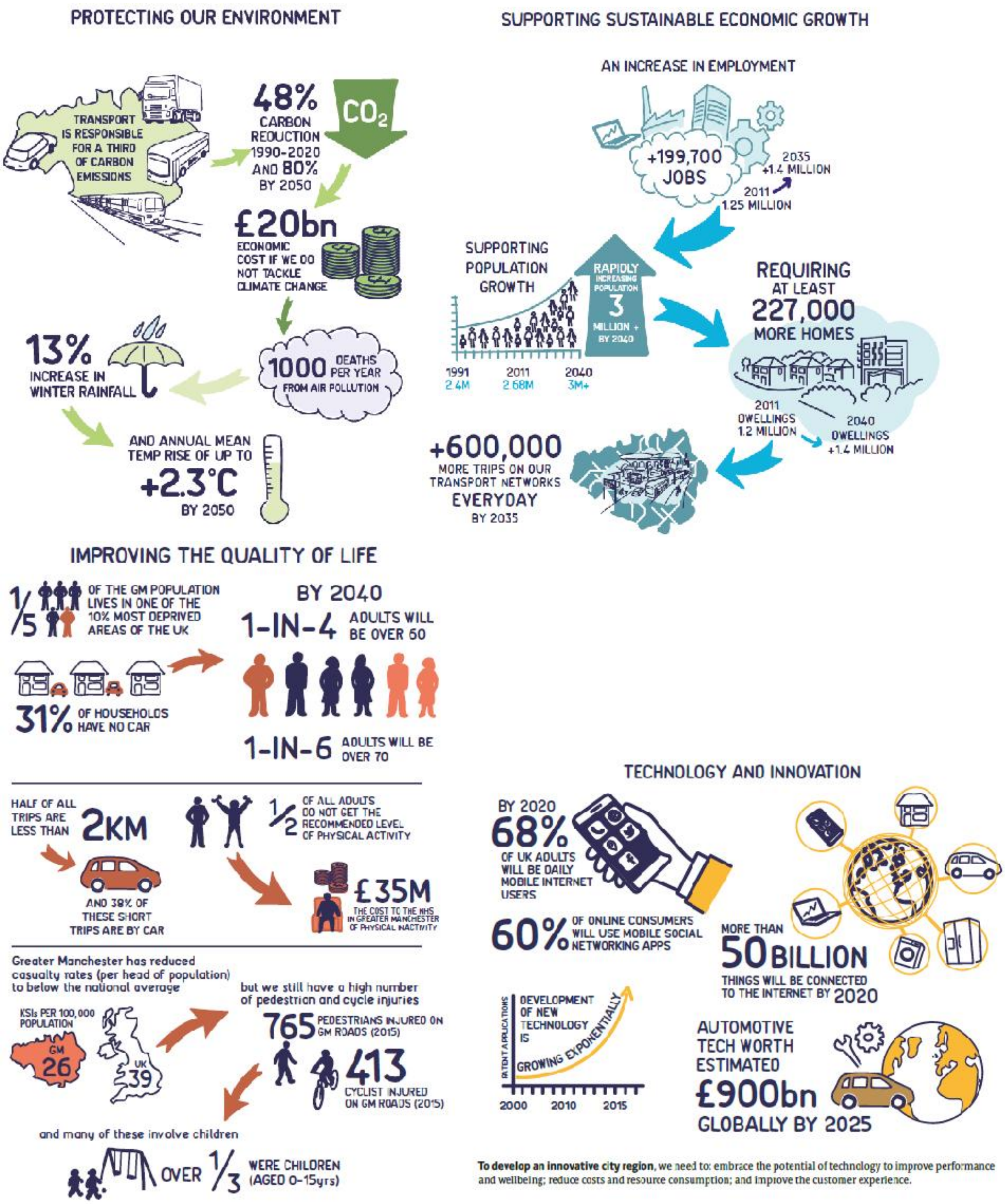


Figure 2: Infographic summarising TfGM's transport and development challenges and ambitions (Source: TfGM)

4. Local context conditions

4.1. The problem

Greater Manchester's population is forecast to grow by 300,000 people in the next 20 years. Overall growth in traffic is jeopardising our economic competitiveness with an estimated cost of congestion annually of £1.3Bn (Source: TfGM Highway Forecasting and Analysis Services Team, 2015).

The environment is not clean and nitrogen dioxide targets are exceeded in Greater Manchester at roadside locations and in busy town centres. The UK Government Department for the Environment Food and Rural Affairs (Defra) forecasts that compliance with nitrogen dioxide limits will not be achieved until 2020 in Greater Manchester. Pollution from road traffic is the most significant cause of poor air quality in Greater Manchester. The two pollutants of most concern are nitrogen dioxide (NO2) and particulates less than 10 microns. (PM10).

The UK accepts that under its current air-quality plans, most other urban regions and cities, including Manchester, Birmingham, Leeds and Glasgow, will not comply until 2020. Greater Manchester's own modelling work paints a similar picture of exceedances beyond 2020 in some areas.

The following graphics are taken from a consultation document that the Mayor of Manchester issued in 2017, asking for residents to comment on how they thought congestion issues should be tackled in Manchester.

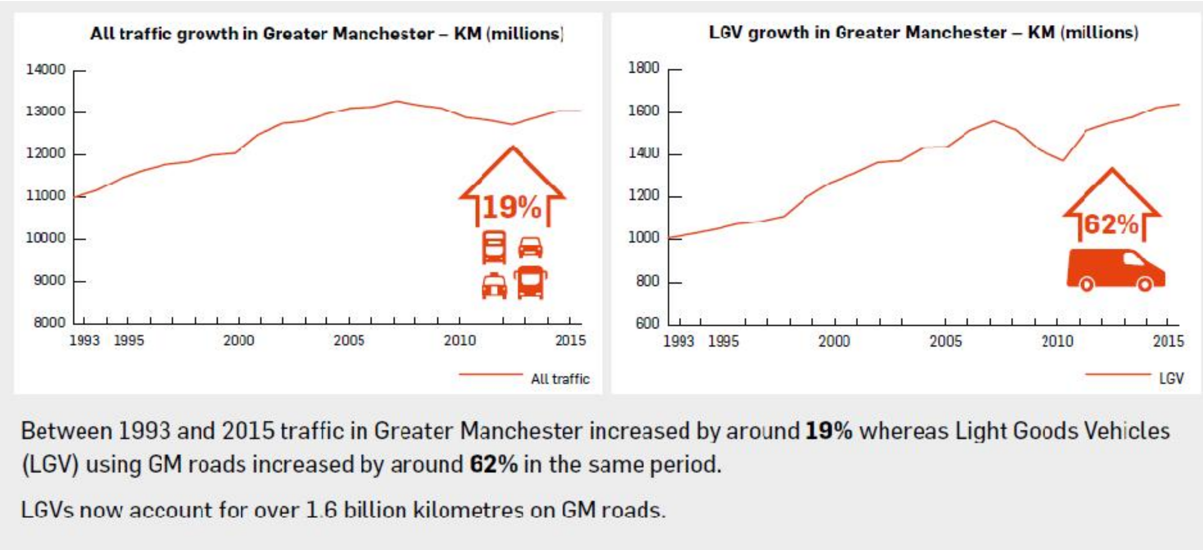


Figure 3: Traffic and Light Goods Vehicles growth in Greater Manchester 1993-2015 (Source: TfGM https://www.tfgm.com/congestion)

As with many other city-regions across the world, Greater Manchester faces decisions as to how to deliver economic growth while improving the quality of life of its residents and visitors. The 2040 Strategy sets out aims to innovate and be sustainable while delivering this growth.

It is expected active travel will form an important core of this future transport network. Investment in infrastructure has increased recently, and it is expected this trend will continue.

4.2. The vision

Transport for Greater Manchester has adopted a holistic, long term approach to developing Manchester as a cycling city. Our Cycling Strategy has 7 key themes, and aims to deliver high quality, consistent infrastructure supported by a comprehensive programme of training, engagement and promotional activities. We are aiming to quadruple our cycling mode share by 2025. The following strategies are of relevance to this aim;

- Greater Manchester Cycling Strategy: http://cycling.tfgm.com/pages/pdfs/Cycling-Strategy-summary.pdf
- Greater Manchester Cycle Design Guidance: http://cycling.tfgm.com/pages/pdfs/GM-Cycle-Design-Guide.pdf
- In addition, the new Cycling Commissioner, Chris Boardman, has issued a policy document, “Made to Move”, that envisages up to 30% cycle commute mode share in the longer term. https://www.greatermanchester-ca.gov.uk/downloads/download/131/walking_and_cycling_report

The aim of these strategies is to establish a fully integrated, high capacity transport system for Greater Manchester, with travelling customers at its heart, and which places a focus on good health, quality of life and the creation of attractive communities and streets for all.

An effective transport system supports a strong economy by enabling goods to reach customers, and businesses to access skills and talent. And it has a major bearing on people’s health and well-being by facilitating social interaction, encouraging more active travel and addressing traffic pollution.

Specific activities relating to congestion are to increase the use of new technologies on motorways and major roads to tackle congestion and support growth.

Journeys between centres or to other major destinations will be made easier through better and faster orbital links, reduced congestion and accidents, a more reliable bus network, more effective interchange and better-connected cycle routes.

Finally, the 2040 Strategy stipulates that any significant new development, expected in the region through the Greater Manchester Spatial Framework (GMSF), shall be accessible by sustainable modes, so that the impact of the extra trips on the road network is reduced.

One objective of the 2040 Strategy, which is explored in greater detail the associated Greater Manchester Cycling and Walking Strategy, is that we must make walking and cycling the natural choice for everyday shorter trips, many of which are currently made by car.

The draft Greater Manchester Cycling and Walking Strategy sets out five key areas for future investment:

- Routes & Networks: linking key destinations
- Integration: public transport access for longer journeys
- Better Streets and Spaces: making it easier to walk and cycle
- Changing Perceptions: making active travel the natural choice
- Maximising the Benefits to Greater Manchester

4.3. Scope of activities in FLOW

4.3.1. Local FLOW activities

Site name	Chorlton Cycleway
Site size	4.8 km of main road leading to Manchester City Centre
Network size	1,011 miles (1,627 km) of which 644 miles (1,036 km) are physically segregated
Enhancements aimed at through the measure	Improvements of cycle lane on 4.8 km stretch of main road
Indicator(s) of prime interest	Number of cyclists using road

Table 2: Overview of FLOW activities in Greater Manchester

TfGM has undertaken appraisal of active mode schemes in the past using Department for Transport Web Based Transport Appraisal Guidance (DfT WebTAG) and have a detailed economic and financial appraisal spreadsheet tool to support such schemes. The application of the FLOW toolkit has been reviewed in a comparative way alongside the FLOW analysis and appraisal tools. In particular, the appraisal components of the FLOW toolset have been applied to the Chorlton Road preliminary scheme selection and design activities. The outputs have been compared with those that were used to inform designs using the existing TfGM scheme selection and appraisal toolkit.

Preliminary scheme selection and design (the Chorlton Road Scheme)

Chorlton is a suburb, three miles (five kilometres) south of Manchester city centre. Several locally important roads pass through Chorlton, with the central area located on a busy crossroads. A proposed scheme is to improve cycling infrastructure along one of those roads running north-south toward the city centre and is part of the CCAG (Cycle City Ambition Grant) package of measures. The map overleaf shows the Chorlton Cycleway in its local context and its connectivity with other cycling infrastructure.

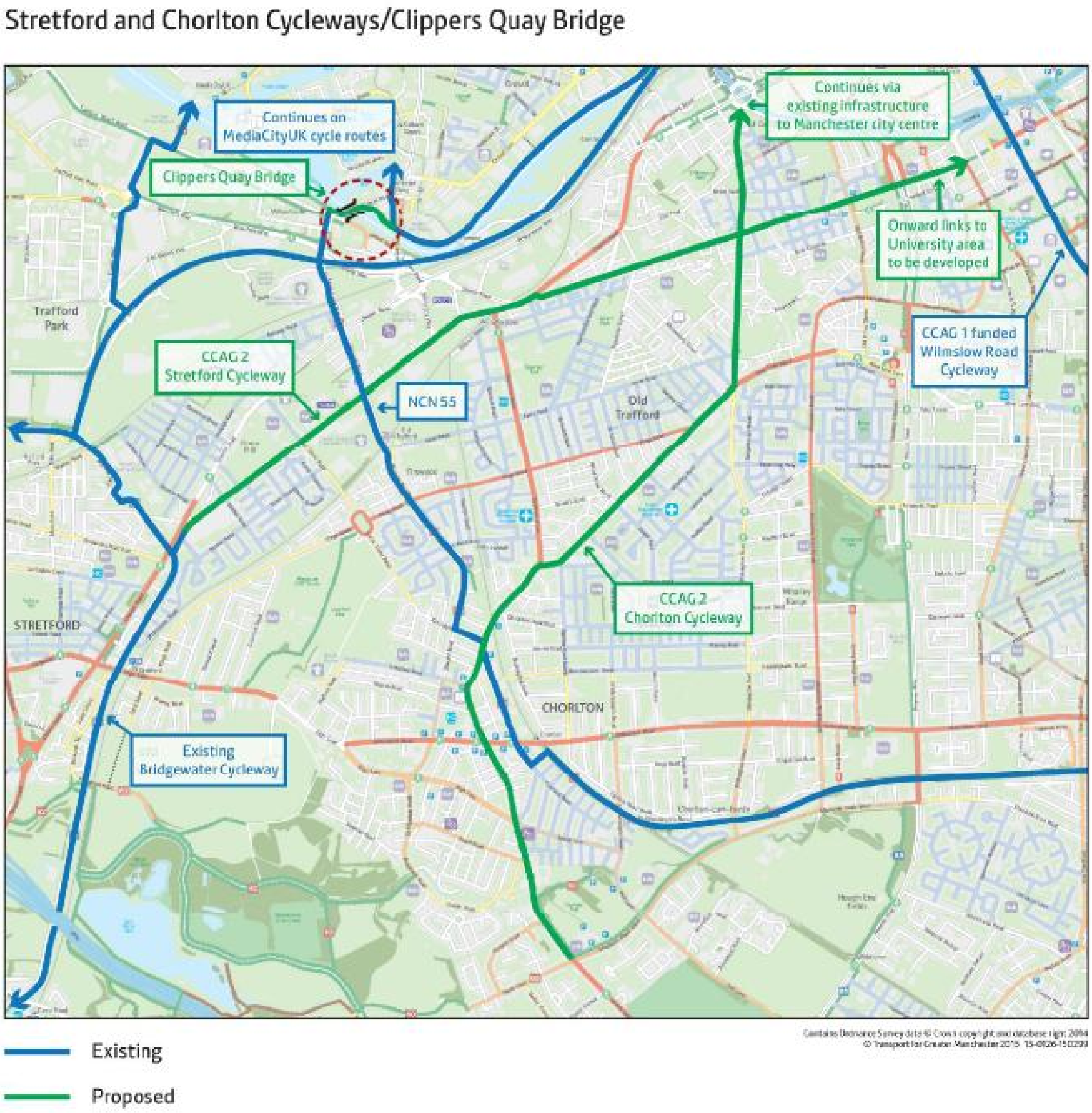


Figure 4: Map of Chorlton Cycleway, Greater Manchester (Source: TfGM)

This part of south Manchester provides an ideal environment within which to encourage cycling as the travel mode of choice for short trips. As noted above, the demographics of the area are well suited for increasing cycle use and, despite poor existing facilities, this corridor is one of the busiest for cycling in Greater Manchester. Cycle use in Chorlton is one of the highest in the conurbation. The major upgrade to facilities proposed provides potential for substantial growth. Currently facilities for cyclists on the corridor are limited to discontinuous advisory cycle lanes, which are often blighted by parked vehicles. There are also several large junctions on the corridor which present significant hazards to cyclists and discourage cycle use.

The proposed scheme will provide high quality segregated facilities for cyclists, compliant with Greater Manchester Cycle Design Guidance along the full length 5km length of the corridor, providing high quality cycle access between residential areas, major local centres and the extensive employment, educational, retail and commercial opportunities of the regional centre.

Currently in excess of 1,000 cyclists a day use the corridor and this is expected to increase by a minimum of 30% in the first year following delivery, based on evidence from similar corridors. Given the particularly favourable demographic and topographic conditions in the catchment of this cycleway, this is likely to be an underestimate.

Enhanced connectivity will be provided between residential areas to the south of Chorlton district centre, and major employment opportunities in Salford Quays/MediaCityUK, via the new cycleway and the upgraded National Cycle Network Route 55.

Forecast impacts of CCAG 2	**Impact**
No. of new cyclists (per day)	1758
% change in cyclist trips on interventions	158%
% change in cycle speed	25%
% of additional cyclists that would have gone by car	25%
Car-km removed from road per year	699,242
CO_2 emissions avoided (tonnes) per year	90
Health benefits per year	1,789,423
Absenteeism benefits per year	42,507

4.4. Key stakeholders

Our stakeholders on this project have been mainly internal with Transport for Greater Manchester.

To implement cycle and streets schemes, TfGM work closely with many local stakeholders including local authorities who have shared (and in some cases sole) jurisdiction for the roads upon which we wish to intervene.

As a result, and as part of the development of the Multi-modal Streets for All Strategy, further work is anticipated to be required to engage with and win support from key stakeholders for the new approaches anticipated in support of analysing and appraising the performance of streets interventions and schemes.

5. Applying the FLOW Methodology and impact assessment tool

5.1. Applying the FLOW Methodology in your local context

In application, the use of the multi-modal performance index looked intuitively correct.

Corridor Delay	Input			Result of delay calculation			Result of transformation	Result of aggregation
	1	2	3	4	5			
transport mode	priority factor (-)	vehicle occupancy ratio (pers/veh)	decisive traffic vol. (veh/h/ln; ped/h)	actual travel time (s/pers/ln, s/pers)	minimum travel time (s/pers/ln, s/pers)	mean total delay per mode (s/pers/ln)	traffic volume (pers/h)	mean delay (s/pers)
car	1	1	1050	600	400	200	1365	210
public transport	1	40	10	900	600	300	400	
cycle	1	1	100	1200	1200	0	100	
pedestrian	1	1	10	3600	3600	0	10	

Figure 5: FLOW Multimodal Calculation Procedure results for Greater Manchester

Further trials on more sites will be required to socialise the use of this tool and understand how the results are different from traditional LoS and other performance metrics.

A variety of alternative weightings were chosen to sensitivity test the results. The “core” weighting of 1 for each mode is shown above. This reflects a “modally agnostic” position which TfGM strives to maintain. An alternative set of weights that seeks to promote cycling, walking and healthy travel choices may be equally valid. In practice altering the weights (for example, weighting bus to 2, and cycle and walk to 3 resulted in a mean delay of 206 in the above example). It is difficult to interpret the significance/importance of a difference of this order of magnitude. Good practice guidance that explains how these weights might be applied would be useful, as would guidance on how to interpret results.

Our current economic appraisal system would reflect user (rather than vehicle) delays within assessment and therefore the economic case to proceed with an intervention and/or to optimise it for all users would be based on evidence that reflects a “multi-modal” approach to assessing how the street is used.

However, the standard practice approach to junction design in GM is to assess junction design based on traditional highway LoS design standards. Moving to an acceptance of multi-modal LoS in place of a highway LoS is therefore a significant challenge.

5.2. Use of the FLOW impact assessment tool

We have completed the impact assessment tool and compared the cost benefit results to that obtained from an earlier appraisal exercise using Transport for Greater Manchester's own appraisal methods.

We do not have micro-simulation results for the scheme. We have therefore calculated some inputs (mainly vehicle hours and vehicle km) ourselves from the data that we have available.

We chose to conduct a peak hour test, to best match with our car counts data.

Vehicle hours and vehicle km were calculated for cars by combining vehicle counts with an assumed peak hour vehicle speed between each junction of the scheme.

For cycles, we assumed all cyclists were travelling the full length of the cycle scheme, and calculated person hours and km on that basis.

It was assumed that traffic spends 100% of its time in heavy traffic conditions. As this is a peak-hour test, we feel that this a reasonable assumption. We also applied this assumption in the post-scheme case.

In the traffic data section we have not assumed any number of generated cyclists or mode-shift from car in the post scheme case. Our initial attempts assumed that in the post scheme case we had many more cyclists travelling through the scheme area in the post scheme case, with an associated increase in total travel time. This appeared as a disbenefit in the total travel time section of the cost benefit analysis. Therefore, we have assumed no change in the number of people driving or cycling in this area of the tool, just that cyclists are able to cross the scheme area at a higher speed. We have assumed that cyclists will be generated in the HEAT inputs section of the tool.

Once we had calculated these inputs, the tool was fairly simple and fast to complete.

No attempt has been made to estimate the number of accidents in the post-scheme case. Whilst accident data is available in Greater Manchester, there appear to have been no incidents in the scheme area. We also have no way of estimating how cycle safety will improve in the post scheme case. Therefore, we have left the number of accidents and injuries as zero in both pre- and post- scheme cases.

Rental values are not available. We have assumed dummy values with no change.

At the current time it is unknown precisely what benefits for pedestrians will be designed into the scheme, and so PERS scores are not available. We have assumed scores of 0 – therefore possibly limiting the benefits of the scheme.

The tool gives a Benefit to Cost Ratio (BCR) of 3.72. It is possible that this is an underestimation of the benefits. We have assumed no improvement in post-scheme traffic speeds, no improvement in pedestrian facilities, and no improvement in accident figures. It is likely that pedestrian facilities at least will be improved as part of the junction improvements in the scheme.

As far as possible the inputs used in the FLOW tool were matched to those used in the original appraisal by TfGM which produced a BCR of 5.55. The TfGM appraisal includes assessments of decongestion benefits that accrue from having more cyclists on the road as a result of the scheme. It also takes into account changes in public transport and government revenue as a result of abstraction to cycle from car and other modes. However, in both appraisals, the benefits consist mainly of health benefits to scheme users, far outweighing those from reduced journey times.

Of note, however, the DfT guidance that generated that result has been changed recently (December 2017). The associated DfT Active Mode Appraisal Toolkit spreadsheet has not yet been updated to reflect the new guidance but when released, is expected to generate a significant reduction in the amount of health benefits generated in connection with increases in active mode participation. A three-way comparison of FLOW with old and new DfT appraisal toolkits is planned when the latest DfT appraisal toolkit (Excel workbook) is released.

Cost-Benefit Analysis

Result	
(Reference year: measure fully accepted)	
Sum of all Benefits	1,043,978
Sum of all Costs	280,329
Benefit-cost ratio - BCR	3.72
Benefits-Costs [EUR/year]	763,648

Costs

Target System	Scope	Number	Indicator	Result [EUR/a]
public financing	costs of (new) infrastructure	C1	Investment costs	270,440
		C2	Operating & maintenance costs	9,889
Sum of Yearly Capitalised Costs				280,329

Benefits

Target System	Scope	Number	Indicator	Value without measure [EUR/a]	Value with measure [EUR/a]	Result - Benefit [EUR/a]
transport network performance	travel time	B1	total travel time costs over all transport modes per year	20,087,934	19,918,907	169,027
environment	GHG emission & local air pollution	B2	total direct CO_2 emission costs over all transport modes per year	428,595	428,595	0
		B3	total direct NOx emission costs over all transport modes per year	28,624	28,624	0
		B4	total direct PM emission costs over all transport modes per year	308,655	308,655	0
society	traffic safety	B5	total personal costs of fatal accidents over all transport modes per year	0	0	0
		B6	total personal costs of accidents with injuries over all transport modes per year	0	0	0
	health	B7	health benefits based on a reduced probability of death for people who cycle/walk	862,508		862,508
private business	vehicle operating costs	B8	total vehicle operating costs over all transport modes per year	9,050,520	9,038,077	12,443
	energy consumption	B9	total final fuel/energy consumption costs over all transport modes	626,325	626,325	0
	(monetary) attractiveness	B10	Commercial attractiveness: total increased retail rents	0		0
		B11	Residential attractiveness: total increased residential rents	0		0
Sum of Benefits						1,043,978

Table 3: FLOW Impact Assessment Cost-Benefit Analysis results for Greater Manchester

5.3. Conclusion and lessons learned

We have used our involvement in the FLOW project to benchmark our current approach to appraisal. We have also used our involvement (in particular through information exchange with our mentor city Dublin) to better understand the potential value of applying micro-simulation tools to the analysis of both simple and complex urban streets where pedestrians, cycles and vehicles interact.

Lessons learnt include the need to be pragmatic and cautious when approaching large scale micro-simulation exercises and that the approach to validate pedestrian and cycle movements in such studies requires careful consideration at study inception.

Through our own use of the appraisal tools, we have seen that similar results can be obtained as would generally be created using the DfT appraisal toolkit, providing a useful cross-check of output. Both toolkits are simple to use and intuitive.

The multi-modal level of service component of the toolkit is a tool that we are planning to trial on the next tranche of highways interventions and we are seeking views from other FLOW cities to understand their experiences in transitioning from vehicle LoS to multi-modal LoS within design standards and appraisal framework.

6. Action plan and outlook

6.1. Short-term planning

Based on the activities we have carried out within FLOW, we plan the following ongoing actions:

- We expect to trial multi-modal Level of Service tools alongside traditional junction LoS techniques to support the development of schemes within the "Multi-Modal Street for All" programme which could comprise up to £200 million of investment in streets across Greater Manchester.
- We also plan to review the ability to introduce integrated pedestrian, cycling and vehicle micro-simulation techniques within this program using information and experiences from our mentor city in Dublin to explain how these approaches could support the development of good streets design.
- TfGM are updating our approach to assessing the performance of streets schemes, with updated guidance envisaged to be drafted by Spring 2018. This will include guidance in the application of detailed junction forecasting and performance tools. It is envisaged that a people/community focus, embracing "multi-modal level of service" concepts will form an important component of that updated guidance, and that it will include details of (and recommendations relating to) the experience of FLOW partner cities in applying micro-simulation techniques.

6.2. Long-term perspective

We anticipate long term value from our involvement with the FLOW project as follows:

- In particular, building upon our experience and knowledge gain, we hope to reinforce that learning with the learnings of other cities after the final results and conference are held in March 2018.
- We see ongoing value in continuing to develop the approach to analysis of active mode schemes in Greater Manchester.
- We hope to maintain contacts with professionals in our mentor city of Dublin.

A measure of success will be the launch of our updated appraisal guidance and the use of the Multi-Modal Level of Service concept during development of future streets schemes in Greater Manchester.

7. Introduction to Izmir

Izmir is a developing city that has a population of 4.1 million and it has worldwide importance. The main sectors driving the local economy are tourism, education, health and service. Izmir Metropolitan Municipality develops and implements local administration policies which take sustainable development strategies into consideration in order to strike a balance between resource protection and use.

Image 1: Photo of Izmir (Source: http://www.izmir.bel.tr, 2018)

Although the general tendency in Turkey is towards private vehicle ownership, the municipality of Izmir is trying to change this habit. There are quite a few organisations working to provide the best conditions for cyclists or to raise awareness in Izmir. The number of NGOs in Izmir related to this topic is increasing and the municipality eager to cooperate with them.

Reference year		Past (2009)	Present (2015)	Projection for 2030
Population		3,928,308	4,168,415	6,208,056
City area		11,892 km^2		
Population density		330 $/km^2$	350 $/km^2$	522 $/km^2$
Modal split (based on	**Walking**	35% (Data source: 2015)		31%
	Cycling	0.5% (Data source: 2015)		1.5%

distance of all trips)	**Public transport**	39% (Data source: 2015)		42%
	Private car	25.5% (Data source: 2015)		25.5%
Route km of:	**Cycle routes**	-	51.12	402
	Bus	-	6,191	No projection
	Urban rail	11.5	153	464.1
	Road	-	14,534	No projection
Number of car parking spaces		72,000 (estimated)	90,605	Parking strategy is under development

Table 4: City data for Izmir

8. Local context conditions

8.1. The problem

İzmir's population is increasing rapidly, with many migrants settling in the city. The majority of the migrant populations live in the housing quarters in the outskirts of the centre and commute to the city centre for work. The existing transportation infrastructure is under a heavy load of fossil-fuel based transportation, which is causing increased traffic congestion and reduced air quality. Izmir's Sustainable Energy Action Plan (SEAP) states that urban transportation covers nearly 20% of all carbon emissions, and that the modal share of cycling is 2% and walking is 5%.

8.2. The vision

With regard to non-motorised transport, Izmir Metropolitan Municipality aims to increase the safety and provision of cycling and walking facilities to enable diverse populations (e.g. commuters and students) to commute by bicycle and on foot, and to enable disadvantaged groups to reach their destinations easily.

The Transportation Master Plan for İzmir and Its Hinterland for 2015-2030 aims to develop sustainable transportation solutions for a carbon-free future, including the expansion of the cycling and pedestrian networks.

The Metropolitan Municipality also has large-scale urban development projects underway, such as the re-designing of the historical city centre and the coastline, where pedestrian zones, walking routes and waterfront regeneration are planned. (e.g. İzmir Port - Kemeraltı Pedestrian Trail Project, İzmir Historical City Centre Sustainable Transportation Project). Travel demand management applications (prevention of traffic congestion in the city centre, establishment of hubs, and restriction of heavy vehicles entering the city centre) are also being developed. When the plan is fully implemented the cycling modal share is anticipated to increase from

0.5% to 1.5%, public transportation from 39% to 42%, and the share of private vehicles will be stabilised at 25.5%.

In addition, the local government is collecting up-to-date data via household surveys and workshops related to cycling for updating the large-scale transportation master plan of İzmir in order to improve transportation safety and increase urban mobility. Since 2009, micro-simulation and multi-modal demand models are being applied to improve a macro-scale model of transportation, to develop specialisation in transport modeling knowledge and to train experienced staff in cycling modeling. Due to Izmir's membership to The European Union Covenant of mayors, a "Sustainable Energy Action Plan (SEAP)" is being prepared at the moment, aiming to reduce CO_2 emissions by 20% by 2020. This strategy document states that urban transportation covers nearly about 20% of all carbon emissions, and the aim is to reduce it to 15% by the year 2020. In order to achieve this goal, the share of cycling (1.5%) and walking (5%) will be increased. İzmir recently participated in The European Mobility Week and The European Cycling Challenge 2016 and led a successful campaign to promote cycling and walking.

8.3. Scope of activities in FLOW

8.3.1. Local FLOW activities

Site name	Transfer Center (Evka 3 Metro Station) → Industrial Zone (4. Sanayi Sitesi) & School Zone
Site size	Corridor
Network size	The junction is part of a 2.7 km extension of a (currently) 3.6 km premium cycle route.
Enhancements aimed at through the measure	Provide a method for managing the interaction of all road users after introducing a two-way segregated cycle path into an existing corridor
Indicator(s) of prime interest	Junction capacities for all modes

Izmir plans to develop and implement three strategies in relation to traffic congestion, walking and cycling. The first strategy aims to connect the existing cycling routes of the coastal areas to non-coastal areas via approximately 300 km cycle paths. The second strategy targets young populations and aims to connect all schools/campuses and transportation hubs via 150 km cycling routes. When the objectives of these two strategies are achieved, the third strategy aims to connect the inner city to rural areas via 347 km cycling route (see **Fehler! Verweisquelle konnte nicht gefunden werden.**).

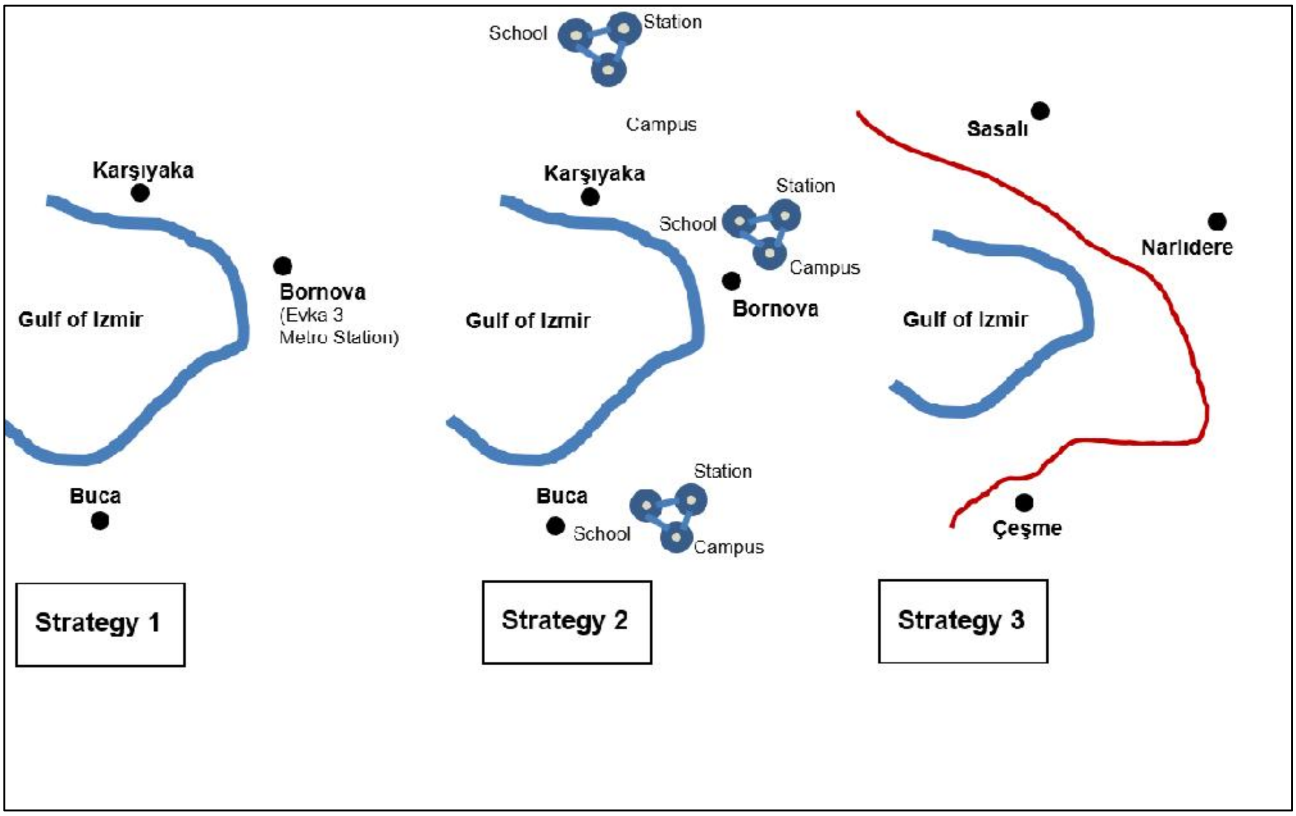


Figure 6: Illustration of Izmir's planned cycling and walking strategies

There are three designated districts around the Gulf of Izmir for which cycling projects are being developed. These are Karsiyaka District in the north, Bornova District in the east, and Buca District in the south of the centre. In FLOW, the first project is planned for the Bornova district as a pilot project, with a specific focus on the EVKA 3 housing neighbourhood. A 2.7 km cycle route will be implemented linking the metro station and the traffic education centre for children located within the school zone in EVKA 3 (Fig.2). This project prioritises students and targets them as cyclists now and in the future. The students and their parents from any district in Izmir are expected to first come to the metro station and then to ride their bicycles to go to the school zone.

Figure 7: Cycling route in Izmir between Evka 3 Metro Station and the Traffic Education Complex (Source: İzmir Metropolitan Municipality, 2016)

A microscopic model has been developed to model cycling modes for the first detailed FLOW implementation in Izmir. The Bogazici Project Planning and Engineering Company is training municipality staff on modelling with PTV VISSIM software in cooperation with PTV. The performance of this project and the feedback collected during implementation will allow the municipality to start similar projects in the above-mentioned districts in the north and south parts of the city.

8.4. Key stakeholders

A project team in the Transportation Planning Department has been working on FLOW-related projects in coordination. In the planning and implementation process the municipality's Urban Traffic and Construction Departments will provide traffic-related infrastructure and manage the post-construction phase of the FLOW projects. The Chamber of Urban Planners, The Chamber of Architects and other outside influencers will provide feedback and support on architectural, urban and cycling related issues.

9. Applying the FLOW Methodology and impact assessment tool

9.1. Applying the FLOW Methodology in your local context

The multi-modal performance index calculation result is a mean delay of 26 seconds per person. This result seems reasonable for a city that has serious congestion problems. In some metropolitan areas it can be as high as 40 seconds per person.

The Sustainable Urban Transportation Policies of Izmir Metropolitan Municipality designates the public transport system (especially the railway system) as the main priority, with pedestrian and cycling facilities also identified as a priority. Based on this, the weighting for each road segment to be analysed was chosen keeping in mind the modes that currently use these segments. For example, on the segment which has a cycle route, a weighting of 3 was chosen for cyclists, while the weighting for cars is 1.

One of the challenging parts of the project was calculating the delay and travel times for pedestrians and cyclists. Because there are continuous pavements and separated cycle roads, the junctions are only intersecting points of motorised traffic and pedestrians/cyclists at the project area. Because of this, it was decided to use the waiting times at traffic signals and average speeds of pedestrians and cyclists.

Delay at Junction			Input				Result of transformation	Result of aggregation	
			1	2	3	4 - Delay			
transport mode			priority factor (-)	vehicle occupancy ratio (pers/veh)	traffic vol. (veh/h/ln; ped/h)	mean delay per mode (s/pers/turn. mov.)	traffic volume (pers/h/ln)	mean delay per arm (s/pers)	mean delay per junction (s/pers)
Junction arm 1	car	right	1	1.5	41	14	62	25	26
		through	2		453	27	680		
		left	1		148	27	222		
	public transport (bus)	right	1	30	12	14	360		
		through	1		11	27	330		
		left	1		14	27	420		
	cycle	right	1	1	1	0	1		
		through	3		5	0	5		
		left	1		0	0	0		
	pedest-rian	crossing 1*	2	1	9	14	9		
		crossing 2*	2		8	14	8		
Junction arm 2	car	right	2	1.5	405	27	608	26	
		through	1		152	17	228		
		left	1		104	17	156		
	public transport (bus)	right	3	30	67	27	2010		
		through	1		12	17	360		
		left	1		14	17	420		
	cycle	right	3	1	1	0	1		
		through	1		2	12	2		
		left	3		0	0	0		
	pedest-rian	crossing 1*	2	1	1	20	1		
		crossing 2*	2		2	20	2		
Junction arm 3	car	right	1	1.5	42	17	63	27	
		through	2		256	27	384		
		left	1		257	27	386		
	public transport (bus)	right	1	30	0	0	0		
		through	1		0	0	0		
		left	2		35	27	1050		
	cycle	right	1	1	1	12	1		
		through	3		5	0	5		
		left	2		1	12	1		
	pedest-rian	crossing 1*	2	1	4	14	4		
		crossing 2*	2		4	14	4		
Junction arm 4	car	right	1	1.5	6	27	9	20	
		through	1		102	17	153		
		left	1		73	27	110		
	public transport (bus)	right	1	30	0	0	0		
		through	1		0	0	0		
		left	1		0	0	0		
	cycle	right	3	1	2	12	2		
		through	1		0	0	0		
		left	3		1	12	1		
	pedest-rian	crossing 1*	2	1	6	14	6		
		crossing 2*	2		8	14	8		

Table 5: FLOW Multimodal Calculation Procedure results for Izmir

9.2. Use of the FLOW impact assessment tool

After applying the FLOW impact assessment tool, we can say that the project is successful when we look at the model resulting benefit-cost ratio: 152,31. In the model, total travel time of cars reduced 4.3 hours, while cycling travel time increased 1.2 hours from none. The more important thing for us is changing the purpose of using the bicycle noticeably. In the implementation area, the main purpose of using a bicycle is as a leisure time activity. After implementing our FLOW measure, home-work and home-education bicycle trips have increased by about 10%. This has resulted in fewer short trips by private vehicle, as well as reduced traffic congestion, emissions and operating costs. This provides a positive effect on traffic safety and infrastructure costs. Because of the low public transportation density in the implementation area, travel times for buses and minibuses did not change significantly.

Indicator: Total travel time	Non-motorised Private Transport (cycling)		Non-motorised Private Transport (cycling)	
Trip Purpose	distribution of trip purpose	vehicle occupancy ratio [pers/veh]	distribution of trip purpose	vehicle occupancy ratio [pers/veh]
work passenger trip	0.05	1	0.05	1
commute short distance (e.g. home-work, home-education)	0.2	1	0.3	1
other short distance (e.g. leisure, shopping)	0.75	1	0.65	1
Vehicle occupancy ratio (weighted average) [EUR/pers-h]				

The outcome of the impact assessment is reasonable for us because we also tested the modal split with transportation surveys before and after the implementation of the bicycle road and junction regulation.

Collecting the data of fatal accidents and injuries was easy for us because Izmir Transportation Master Plan 2030 has just finished and we already had this data. In order to collect the vehicle, cyclist and pedestrian values, traffic counts were conducted at three peak hours on three days on three junctions along the corridor. Data on trip purpose was collected through transportation surveys that were conducted before and after implementation.

The most challenging part of the impact assessment tool was related to working with the HEAT data. Because there isn't any HEAT data for Turkey, we had to calibrate the model with the values of countries which have similar economic and demographic situations, e.g. Portugal and Greece. We also have not worked with the PERS weighting before, so we were not able to fill in the section related to it.

Indicators								
Number	Target System	Scope	Indicator	Transport mode		Result		
				MT	NMT	Value without measure [per annum]	Value with measure [per annum]	Difference [per annum]
1	Public Financing	**costs** of (new) infrastructure	**investment costs** [EUR/year - annuity]				39,122	-39,122
2			**operating & maintenance costs** [EUR/year]				20,300	-20,300
3a	Traffic Perfor-mance	travel time related	**total travel time** [person-h/year]	X	X	2,279,904	1,988,218	291,686
3b			**total travel time** [ton-h/year]	X		0	0	0
4	Environment	GHG emission & local air pollution	total direct **CO_2 emission** [t/year]	X		1,199.425	1,079.316	120.108
5			total direct **NO_x emission** [t/year]	X		5.043	4.627	0.417
6			total direct **PM emission** [t/year]	X		0.534	0.460	0.075
7		*noise pollution*	*noise level in the daytime [dB/day]**	*X*				0
8		land consumption	sealed surface: **total new / deconstructed traffic area** [-]	X	X			0
9	Society	traffic safety	number of **persons killed** [no./year]	X	X	18	16	2
10			number of (seriously & slightly) **injured persons** [no./year]	X	X	3,765	3,696	69
11		health	**health benefits** based on a reduced probability of death for people who cycle/walk [no./year]		X	0.3886		0.3886
12		increased access	**accessibility** - increased access of non-motorized residents' to amenities (e.g. jobs) [-]		X			0
13		social interaction	**separation effect** [-]		X			0
14	Private Business	vehicle operating costs	**vehicle operating costs** [EUR/year]	X	X	2,938,718	2,628,507	310,211
15		energy consumption	total final **energy consumption** [kWh/year]	X	X	4,729,228	4,035,735	693,492
16		(monetary) attractiveness	commercial attractiveness: **increased retail rents** [EUR/year]		X	0		0
17			residential attractiveness: **increased residential rents** [EUR/year]		X	0		0

Table 6: Indicators used in the impact assessment for Izmir

Cost-Benefit Analysis

Result	
(Reference year: measure fully accepted)	
Sum of all Benefits	9,501,344
Sum of all Costs	59,422
Benefit-cost ratio - BCR [EUR/year]	159.90
Benefits-Costs [EUR/year]	9,441,922

Costs

Target System	Scope	Number	Indicator	Result [EUR/a]
public financing	costs of (new) infrastructure	C1	Investment costs	39,122
		C2	Operating & maintenance costs	20,300
Sum of Yearly Capitalised Costs				59,422

Benefits

Target System	Scope	Number	Indicator	Value without measure [EUR/a]	Value with measure [EUR/a]	Result - Benefit [EUR/a]
transport network performanc	travel time	B1	total travel time costs over all transport modes per year	16,489,504	14,523,654	1,965,850
environment	GHG emission & local air pollution	B2	total direct CO_2 emission costs over all transport modes per year	143,931	129,518	14,413
		B3	total direct NOx emission costs over all transport modes per year	11	10	1
		B4	total direct PM emission costs over all transport modes per year	62	53	9
society	traffic safety	B5	total personal costs of fatal accidents over all transport modes per year	19,154,481	17,026,206	2,128,276
		B6	total personal costs of accidents with injuries over all transport modes per year	294,418,050	289,948,289	4,469,761
	health	B7	health benefits based on a reduced probability of death for people who cycle/walk	413,498		413,498
private business	vehicle operating costs	B8	total vehicle operating costs over all transport modes per year	2,938,718	2,511,849	426,869
	energy consumption	B9	total final fuel/energy consumption costs over all transport modes	562,768	480,100	82,668
	(monetary) attractiveness	B10	Commercial attractiveness: total increased retail rents	0		0
		B11	Residential attractiveness: total increased residential rents	0		0
Sum of Benefits						9,501,344

Table 7: FLOW Impact Assessment Cost-Benefit Analysis results for Izmir

9.3. Conclusion and lessons learned

In Izmir, traffic congestion is a serious problem which is getting bigger day by day because of the new residential areas and continuous population growth. We recognise that this problem cannot be solved simply by adding new junctions, motorways or highways because they would increase the demand to private vehicles. In our view, the only perspective from which congestion problems can be solved is one which focuses on investing in public transportation and non-motorised modes in our city.

Because of high fuel prices and time wasted in traffic congestion, there is considerable demand to use the bicycle. But there are some infrastructure and security issues which reduce the cycling mode share for daily trips. In particular, topographical barriers (e.g. places with very high slope) and property barriers (e.g. military or private areas) prevent cycle paths from being implemented on every motorway, and people don't want to cycle on the road because it is insecure. In our view, the only way to encourage people to cycle or walk is to make it possible for cars and bicycles to share the road space. But in Turkey there is a lack of awareness among drivers about the importance of cycling, and at the same time it is challenging to persuade decision makers.

We have seen for ourselves the impact on home-work trip ratios over the 2.2 km project cycle route. This is reflected in the impressive benefit-costs ratio, even though the project focused only on a relatively small area. In order to reach our goal of increasing the cycling modal share in our city, we have to persuade decision makers that cycling investments should be a main priority. This tool will be useful to decide these investments more easily in the future.

Based on our experience in the FLOW project, we can use the FLOW multimodal calculation procedure, impact assessment tool and our updated database to estimate the efficiency and effects of future bicycle road projects on the transportation system of Izmir.

10. Action plan and outlook

10.1. Short-term planning

In the short term, we aim to assess and implement a similar new project in Karşıyaka, Bostanlı district. It is planned to be finished within the next few months and involves three points of interest: Bostanlı Pier – Tram Stations – Marketplace. The project will focus on connecting these three points to the cycle path which reaches the Bird Sanctuary. It is a 2.2 km project and involves 1,560 meters of car-bicycle shared road and 560 meters of bicycle-pedestrian shared road. On the route, two critical intersections will be analysed using a microscopic model and the FLOW impact assessment tool to assess its costs and benefits.

Image 2: Planned cycle path project in Karşıyaka, Bostanlı district in Izmir, connecting Bostanlı Pier – Tram Stations – Marketplace (Source: İzmir Metropolitan Municipality, 2018)

10.2. Long-term perspective

According to the İzmir Transportation Master Plan looking towards 2030, in the long term, the cycle path network will be increased from 51 kilometres to 350 kilometres. The pedestrian paths will also be increased from 7 kilometres to 24 kilometres. To work towards these goals, the FLOW methodology will be considered to help us to predict costs and benefits of projects, to show decision makers how cycling and walking projects are effective, and ultimately to create more healthy and sustainable urban areas.

The main challenge for us in the long-term will be to gather more data and to build up our databases similar to HEAT and PERS. Furthermore, variable pedestrian walking habits and approval processes of new bicycle roads and lines could be challenging for us now and in the near future.

We consider our FLOW measure to be a success because of its potential to help persuade decision makers to invest in cycle paths using the concrete, quantitative results of the FLOW impact assessment tool. When we are able to reliably predict the effects of measures, it can help to speed up approval processes and will help us to repeat our measure in another part of the city.

The most important thing that we would like to see after modelling an area is a decrease in the use of private vehicles and an increase in cycling, especially for home-work trips. This will affect all transport modes and provide a major improvement in traffic congestion.

11. Introduction to Örebro

Örebro is the 7th largest city in Sweden with a population of 144,200 inhabitants, in the municipality and 116,294 in the city, (2015-12-31) and growing with approximately 2,500 inhabitants/year. Örebro is a regional centre, situated 200 km west of Stockholm. Its location in the country is advantageous for the city's position as a logistical centre, for both road, rail and air transport.

The transport challenges for the city consist of:

- Transforming the modal split from a majority of trips, 54%, by car to 60% by bike, walking and public transport until 2020.
- Transform bigger traffic links in the city center mainly planned for cars to city streets with more space for sustainable transport modes
- How to combine prioritizing both bus and bicycle in important parts of the transport network

Figure 8: The city centre of Örebro (Source: Susanne Flink, 2017)

Reference year		Past, 2012	Present, 2016	Projection for 2030
Population		109,520	116,294	125,000
City area		55 km^2		
Population density		1,991/km^2	2,114/km^2	2,272/km^2
Modal split (based on distance of all trips)	Walking	15% (Data source: 2017)		15% (goal for 2020)
	Cycling	27% (Data source: 2017)		30% (goal for 2020)
	Public transport	8% (Data source: 2017)		15% (goal for 2020)
	Private car	50% (Data source: 2017)		40% (goal for 2020)
Route km of:	Cycle routes	250	270	320
	Bus	0.7	0.7	15 minimum
	Road	550	568	600
Number of car parking spaces		5,000 (city centre)	5,000 (city centre)	5,500 (city centre)

Table 8: City data for Örebro

12. Local context conditions

12.1. The problem

Örebro is one of Sweden's fastest growing cities in inhabitants per capita and with a very fast construction rate. The challenge in transportation consists of changing the modal split in Örebro towards more trips made by sustainable transport modes. Part of that work consists of improving the conditions for pedestrians, cyclists and public transport users. With more inhabitants to share the same spaces there's a need to focus more on efficient and less space consuming transport modes.

The city's bicycle plan [Cykelnätplan för Örebro Kommun, 2016-08-09] points out the network of bicycle lanes in the city and indicates the new bike lanes that will be created in order to make a more connected network by building new bike lanes in missing links.

The bicycle plan also points out the main bicycle tracks where there should be higher accessibility and more direct routes. The strategic work with public transport points out potential Bus Rapid Transit lanes and works with prioritisation for buses in traffic signals. One of the challenges is how to program the traffic signals when two prioritised transport modes cross each other. There is also a need of improving modelling of pedestrians and cyclists in the macroscopic model of the city.

12.2. The vision

In October 2014 the city council accepted the SUMP of Örebro also called the Traffic program. It contains three objectives, two of which concern cycling:

- 60% of all journeys should be done with sustainable transport modes by 2020
- The total amount of car traffic with non-renewable fuel should be reduced in absolute numbers compared to 2011 levels until 2020.
- Within Örebro it should take maximum twice the time to take the bus compared to car and one and a half the time to go by bike for the same journey.

12.3. Scope of activities in FLOW

12.3.1. Local FLOW activities

Site name	Hertig Karls Allé, Junctions Hagagatan to Karlslundsgatan
Site size	400 meters
Network size	850 m
Enhancements aimed at through the measure	Provide a method for managing the interaction of all road users after introducing a two-way segregated cycle track into an existing junction.
Indicator(s) of prime interest	Junction capacity for all modes

Table 9: Overview of FLOW activities in Örebro

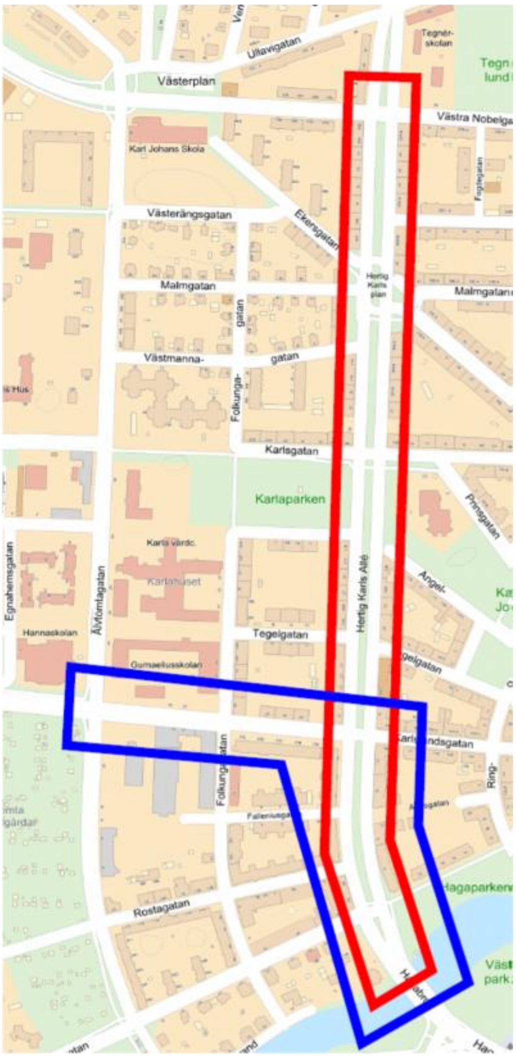


Figure 9: Hertig Karls Allé in red and the FLOW-assessment area in blue (Source: Örebro Municipality)

The city of Örebro is looking into the possibility of implementing green-wave for cyclists in the traffic signals. Implementing the green-wave by itself is possible; the twist is to implement this along with bus priority along the selected segment. The segment that is selected is the south part of Hertig Karls Allé, (see **Fehler! Verweisquelle konnte nicht gefunden werden.**). It is this part of the street that has been identified as the main obstacle for implementing a green-wave for cyclist. The main reason for this is that these intersections have a lot of traffic and a lot of the bus lines in the city pass through. These buses also have priority at the intersections.

To reach the goal of implementing the green-wave for cyclists, a microscopic model is going to be built which compares three different scenarios: with a green-wave for cyclists, without a green-wave for cyclists and a compromise between the bus-priority and the green-wave.

Hertig Karls Allé is today a four-lane street without a separated bike path. The street is planned to be re-built to include both separated walking and bike paths. This is planned to start in the south part of the street in early 2019. In the process of re-modifying the streets four lanes will be made more compact to allow more room to cyclists and pedestrians.

12.4. Key stakeholders

The key stakeholders involved in the City of Örebro's FLOW measures are the city planning department and the technical department of Örebro, as well as the local politicians. The city planning department is responsible for the project planning, evaluation and modelling. The technical department's role in the project is to help implement the results of the project connected to the traffic signals.

The main stakeholders in the project are the local politicians, who have initiated the street re-modification project and who also have the final say if the project is going to be built according to plan.

13. Applying the FLOW Methodology and impact assessment tool

13.1. Applying the FLOW Methodology in your local context

In the case of Örebro, the methodology for calculating the multimodal performance index gave a result that is perceived as reasonable, with an aggregated mean delay at 15 seconds per person.

The weighting of the different modes was in this case rather simple, as we had clear political directives on giving public transport and cyclists high priority while maintaining high capacity for cars. The analysed road segment is one of the most heavily trafficked links in the city. Public transport on the core network and most of all cyclists in all arms got the highest priority factor, while pedestrians and cars got second priority.

Most challenging in the evaluation was defining when the pedestrians and cyclists were delayed; even in the model it was hard to decide at what point these two were delayed. It was later decided to use the same definition that is used for motorised traffic. In the model this only differs in some junction arms compared to motorised traffic.

Delay at Junction			Input				Result of transformation	Result of aggregation	
			1	2	3	4 - Delay			
transport mode			priority factor (-)	vehicle occupancy ratio (pers/veh)	traffic vol. (veh/h/ln; ped/h)	mean delay per mode (s/pers/turn. mov.)	traffic volume (pers/h/ln)	mean delay per arm (s/pers)	mean delay per junction (s/pers)
Junction arm 1	car	right	2	1,2	118	12	142	17	**15**
		through	2		623	12	748		
		left	2		242	23	290		
	public transport (bus)	right	1	40	0	0	0		
		through	1		2	12	80		
		left	3		8	23	320		
	cycle	right	3	1	6	23	6		
		through	3		25	12	25		
		left	2		2	23	2		
	pedest-rian	crossing 1*	2	1	9	23	9		
		crossing 2*	2		0	0	0		
Junction arm 2	car	right	2	1,2	104	12	125	13	
		through	2		451	12	541		
		left	2		23	23	28		
	public transport (bus)	right	1	40	0	0	0		
		through	1		2	12	80		
		left	1		0	0	0		
	cycle	right	2	1	5	23	5		
		through	3		30	12	30		
		left	3		3	23	3		
	pedest-rian	crossing 1*	2	1	30	23	30		
		crossing 2*	2		0	0	0		
Junction arm 3	car	right	2	1,2	31	14	37	15	
		through	2		112	14	134		
		left	2		91	14	109		
	public transport (bus)	right	1	40	0	0	0		
		through	1		0	0	0		
		left	1		0	0	0		
	cycle	right	2	1	3	14	3		
		through	3		8	23	8		
		left	3		15	14	15		
	pedest-rian	crossing 1*	2	1	13	23	13		
		crossing 2*	2		0	0	0		
Junction arm 4	car	right	2	1,2	201	14	241	15	
		through	2		138	14	166		
		left	2		101	14	121		
	public transport (bus)	right	3	40	8	15	320		
		through	1		0	0	0		
		left	1		0	0	0		
	cycle	right	2	1	25	14	25		
		through	3		12	23	12		
		left	3		9	14	9		
	pedest-rian	crossing 1*	2	1	30	23	30		
		crossing 2*	2		0	0	0		

Table 10: Aggregated mean delay for the intersection Karlslundsgatan - Hertig Karls allé, Örebro

13.2. Use of the FLOW impact assessment tool

In the case of Örebro, the results for the scenario “with a green wave for cyclists” are not really what we expected at first, with a BCR of -1.71. But looking back on the output of the model and the impact assessment tool, the result explains itself. In the model, as the total travel time for cars increased by a total of 4.5 h – which in the impact assessment tool is valued more than the increased travel time for cyclists at 1.52 h – the number of pedestrians and cyclists is increased in the model. This is due to the priority that is given to public transport and cyclists in the traffic signals. The model output also indicates that the green wave for cyclists has a minimal effect on public transport, which only has a minimal increase in total travel time. Therefore, if the assessment tool were used on a measure where the travel times for motorised traffic is reduced, we would see a positive result in the BCR.

On the other hand, we find the results that the assessment tool provides a fair and good representation of the impacts of our measure, with only minor changes on most of the results for the different indicators. It is fair to say that the assessment tool gives a larger weight to motorised traffic and its added travel time, as the environmental effects have a greater impact on the result in terms of the increased number of cyclists.

The data needed to complete the assessment was not that hard to collect; it was just time consuming. The data that needed to be collected varied from numbers of accidents in the city and vehicle composition to average rent cost for both apartments and retail space. It is also hard to either estimate or calculate the effects that the measure will have on the maintenance costs for the given measure.

The great challenge using the tool was to get the data from HEAT. HEAT was only challenging because that tool is seldom used in our planning today and we consider the HEAT tool to be difficult to use with many measures that are difficult to estimate and calculate. Otherwise the tool is easy to use in the case of microscopic modelling, where one can get almost all of the data needed to complete the spreadsheet and get a result.

Cost-Benefit Analysis

Result	
(Reference year: measure fully accepted)	
Sum of all Benefits	-271 375
Sum of all Costs	158 746
Benefit-cost ratio - BCR	-1,71
Benefits-Costs [EUR/year]	-430 121

Costs

Target System	Scope	Number	Indicator	Result [EUR/a]
public financing	costs of (new) infrastructure	C1	Investment costs	152 746
		C2	Operating & maintenance costs	6 000
Sum of Yearly Capitalised Costs				158 746

Benefits

Target System	Scope	Number	Indicator	Value without measure [EUR/a]	Value with measure [EUR/a]	Result - Benefit [EUR/a]
transport network performance	travel time	B1	total travel time costs over all transport modes per year	4 049 797	4 345 161	-295 364
environment	GHG emission & local air pollution	B2	total direct CO_2 emission costs over all transport modes per year	100 706	99 570	1 136
		B3	total direct NOx emission costs over all transport modes per year	6 338	6 266	72
		B4	total direct PM emission costs over all transport modes per year	80 988	80 679	310
society	traffic safety	B5	total personal costs of fatal accidents over all transport modes per year	0	0	0
		B6	total personal costs of accidents with injuries over all transport modes per year	383 959	354 815	29 144
	health	B7	health benefits based on a reduced probability of death for people who cycle/walk	97 610		97 610
private business	vehicle operating costs	B8	total vehicle operating costs over all transport modes per year	1 725 064	1 831 343	-106 279
	energy consumption	B9	total final fuel/energy consumption costs over all transport modes	176 595	174 599	1 997
	(monetary) attractiveness	B10	Commercial attractiveness: total increased retail rents	0		0
		B11	Residential attractiveness: total increased residential rents	0		0
Sum of Benefits						-271 375

Table 11: FLOW Impact Assessment Cost-Benefit Analysis results for Örebro

13.3. Conclusion and lessons learned

The FLOW project has given Örebro a broadened perspective on congestion by enabling us to look at the capacity and accessibility for all transport modes – not only for motorised traffic, as is the norm today. The project has also increased Örebro's knowledge in improved modelling of pedestrians and cyclists.

Putting walking and cycling on the same level of motorised transport as a solution of congestion has been well perceived in the municipality. It's also in the same direction as our SUMP, where the objective is to increase the modal split of pedestrians, cyclists and public transport, although different streets and intersections have different functions and priorities in these respects.

With all parameters accessible the FLOW tool is useful for evaluation and also flexible in the choice of the three different kinds of analysis. Otherwise the gathering of data to the model is rather demanding to be able to apply the model.

Looking at the usability of the two different tools we do find that the FLOW Methodology caters more to measures where there are a lot of pedestrians or cyclists that have problems crossing an intersection.

However, we feel that the assessment tool cannot be used at any given place in the city, as the assessment tool caters to a better traffic flow with reduced numbers of accidents and travel time for the motorised traffic.

As the city of Örebro previously worked a lot to encourage both walking and cycling, the reception to looking at congestion as a multimodal issue was welcomed by the local politicians; they wondered more why we had not looked at it in this way before, especially in the city centre where there is both a lot of motorised traffic with buses, car and distribution trucks, as well as cyclists and pedestrians.

14. Action plan and outlook

14.1. Short-term planning

In the upcoming three years, we see that the FLOW tools, especially the FLOW methodology, will be used in both bigger and smaller projects located near the city centre where we have problems with congestion involving both cyclists and pedestrians, e.g. the city streets rebuilding projects. The FLOW tools and methodology add another layer of information to the background perspective of several street projects, enabling better modelling of pedestrians and cyclists.

We also see that we will use more modelling when it comes to making improvements for cyclists and pedestrians, something that today is used frequently when it comes to motorised traffic. For example, we will look into making an extended model for the area surrounding the central station in Örebro, which includes a station for a planned BRT-system in Örebro and new cycling lanes along the busiest street in Örebro. In this project we will use the FLOW tools to add another dimension to the substrates that should be delivered to the local politicians later on.

14.2. Long-term perspective

In the short term we see that the measure that we evaluated in FLOW, green wave for cyclists, will be implemented and tested in the field. In the long term (about three to five years), it may then be scaled up to look at other strong cycle routes in the city. Looking ahead, we see this as a measure that will further strengthen the bicycle's role in the city.

When the measure is tested in the field and we see just about the same result as in the model, the measure will be a success. But we already see the results from the model itself as a success, because it is possible to implement a green wave for cyclists and at the same time have bus priority in the traffic lights, with the total travel time for motorised traffic only increasing a small amount as a result.

Analysing if and how it is possible to implement a green wave for cyclists combined with prioritisation in traffic lights for public transport is a relevant issue in several of our intersections in the city. Therefore, there will be several more cases to use the model in the future, e.g. the city streets rebuilding projects. It also encourages the continued gathering of traffic data, which is a necessity for the work with the analysis in the FLOW methodology.

15. Introduction to Pisa

Pisa is located in the densely populated valley of the river Arno in Tuscany, 4km from the Tyrrhenian seaside. The municipality has a population of about 91,000 inhabitants, and the metropolitan area has 200,000 inhabitants, representing the second largest conurbation in Tuscany.

With regard to transport, Pisa is an important transport hub: the International Airport (Galileo Galilei) with over 4 million passengers per year, is the largest in Tuscany. It is the gateway to key tourist and business destinations (including Florence, Siena, Liguria and the Tuscany sea side). The railway station, at the crossroads between the central and the coastal axis of the Italian rail network, sees over 15 million passengers per year. Inland waterways – called the Pisa Circuit – and the coastal territory of Pisa is characterised by a particular river-maritime circuit with great potential.

Image 3: Photo of Pisa (Source: www.discovertuscany.com)

Reference year	Past (2011)	Present (2016)	Projection for 2030
Population	85,858	90,488	NA
City area	185 km^2		
Population density	464/km^2	488.39/km^2	NA
Walking	31%		NA

Modal split (based on distance of all trips)		(Data source: http://www.epomm.eu/tems/result_city.phtml?city=547&list=1, year 2011)		
	Cycling	17% (Data source: http://www.epomm.eu/tems/result_city.phtml?city=547&list=1, year:2011)		NA
	Public transport	12% (Data source: http://www.epomm.eu/tems/result_city.phtml?city=547&list=1, year:2011)		NA
	Private car/motorcycle	29%/11% (Data source: http://www.epomm.eu/tems/result_city.phtml?city=547&list=1, year: 2011)		NA
Route km of:	**Cycle routes**	27	35	50
	Bus	NA	NA	NA
	Urban rail	0	0	15
	Road	NA	NA	NA
Number of car parking spaces		3,100	3,200	3,200

Table 12: City data for Pisa

16. Local context conditions

16.1. The problem

Due to the presence of 50,000 students and the urban structure of the City, cycling is very popular in the city of Pisa. But at the moment, there are major issues with cycling safety and bicycle theft.

We estimate that an average of bicycles 1,500 per year are stolen (source: Police data about denunciations, that are commonly evaluated as half of total thefts). This has a clear impact on the cycling modal share in Pisa: according to a survey conducted by Pisa Municipality in 2017 (http://www.comune.pisa.it/mobilitandopisa/) 40% of respondents cited bicycle theft as a reason why they do not cycle.

The results of another survey, “Mobilitando Pisa”, show that many people do not cycle because they feel unsafe cycling in the crowded streets of Pisa (outside of the Low Traffic Zone). Indeed, approximately 18,000 cars drive through the compact streets of the city centre each day. Therefore, a main priority of the present administration is to reduce car congestion and to promote the use of more sustainable modes of transport.

In order to promote sustainable mobility, the City is now working on behaviour change and the use of virtual infrastructures for the application of ICT technologies and informative services.

16.2. The vision

Pisa's Cycle Mobility Plan intends to act as a reference point for future achievements, in the municipality of Pisa, for the aspects concerning cycling. Its aim is to make Pisa more of a cycling city by increasing the priority of cycling and encouraging citizens to consider cycling as a legitimate means of transport, in addition to being environmentally friendly and healthy. The Cycle Mobility Plan starts from the analysis of the current conditions and the most urgent needs and was approved by various bodies and associations through a participatory process. The main aspects of the Plan concern:

The completion of the existing network of cycle paths, implemented with separated lanes only (outside of the Limited Traffic Zone)

- The connection of the new Cisanello hospital centre with the centre
- The restoration of the "Trammino" route as a cycle link to the sea, within the "Ciclopista dell'Arno"
- The creation of safe cycling in the parking lots of Pietrasantina and Pratale
- The creation of a signage system dedicated to cyclists
- The constant increase in the number of municipal bicycle parking places (only frame-locking type)
- The implementation of contraflow paths for bicycles on all roads within the Limited Traffic Zone.

The overall 2020 objective is to reach a 20% modal share for cycling.

From a regulator and programming point of view Pisa has adopted in the last years a global planning framework that includes:

- A Plan for Cycling
- Securing bicycle paths and completion of the existing network (expanding into new areas and connecting the existing lanes)
- Increasing the bike sharing system
- Mobility urban plans in progress (SUMP-SULP)
- New measures to improve access in the historical centre (EVs-EFVs)
- SEAP
- Regulatory plan of the digital city

16.3. Scope of activities in FLOW

16.3.1. Local FLOW activities

Campaign name	Safety and security for cycling in Pisa
Campaign size	City wide area

Enhancements aimed at through the measure	Developing a communication campaign to decrease bicycle theft and increase good cycling behaviour in order to improve cycling modal split and decrease accidents
Indicator(s) of prime interest	Number of bicycles stolen (existing annual statistics in collaboration with "Polizia di Stato" Number cycle related of accidents (existing annual reports by local police) Modal share for cycling (existing annual on-site survey in September, in collaboration with FIAB, that is Italian Cycling Federation)

Table 13: Overview of FLOW activities in Pisa

In 2011 the city council provided the appropriate budget to fully implement a bike-sharing system. At the start, bike theft was a major issue. Every year 20 bikes out of 160 in total had to be replaced.

We relocated the bike-sharing stations to locations with better visibility and better usage, put a video-monitoring system at each station and required a surveillance service for night hours.

The results are astonishing: zero theft, zero vandalism, after three years.

Now, many local businesses ask for new stations (i.e. IKEA is buying their own station). CNR (national research council) published a study on our bike sharing system based on an international review on an EU-funded project (Quanticol).

Depending on the season and weather, we count 300-1200 daily trips. The bike-sharing system is continuously growing thanks to funding from the government of Tuscany, resulting in a system that is twice the size now. We are now close to doubling the size of the bike sharing system.

Figure 10: Bicycle sharing system in Pisa (Source: www.ciclopi.eu)

In parallel the City needs to work to promote safety rules and define specific measures to avoid theft of private bikes. Pisa aimed is to analyse and develop these two topics with the support and expertise provided by the FLOW project. In this phase we're defining the priorities and the specific measures to develop, the next step will be to realise the communication campaign for safety with the main goal of showing that cycling is safer and has many more advantages than most people perceive.

The FLOW measure will influence the cycling modal share in general, and in an indirect way it will also influence the usage of the bike sharing system.

The communication campaign will take place according to the following **lines of intervention**:

1. Creation of a communication campaign on Facebook, through the publication of 5 viral posts and 1 video concerning the following themes:

- 1 post related to the description of the FLOW Project;
- 3 posts related to safety of cyclists:
    - cycling security (which also concerns the behaviours that must be observed by citizens who use cars and motorcycles)
    - devices and behaviours for using the bike at night
    - obligation to use the helmet for children under 14 years
- 1 post for the adoption of the best anti-theft devices available on the market.
- 1 video showing the correct behaviours to be observed on the street, both for the cyclists and for the drivers of motorised vehicles, the safety devices to be adopted for children under 14 and overnight, and the best anti-theft devices.

The communication campaign will have the **following characteristics**:

- Period: April 2018 - December 2018
- Estimated daily coverage: from 1,300 to 3,400 people on FB
- Geographical coverage: Pisa + 80 Km^2

2. Creation of **informative panels**, through additional financial resources provided by the city, to be placed at the bike sharing stations present to strengthen the media impact and reach a wider audience, in particular users who do not use social networks and tourists.

Estimated cost of the campaign 5,000.00 euro to cover the graphic concept and the cost of the social network dissemination for 9 months. The City will provide external financial resources to create and print informative panels with the same objectives of the social networks campaign.

16.4. Key stakeholders

The main stakeholders involved in the project are related to IT and to technical solutions to manage traffic, to set new pricing policies to reduce traffic congestion and to promote cycling among specific parts of the population who don’t cycle much.

In practice, our first technical stakeholders will be companies and research centres that operate in the transport sector and that develop IT solutions.

Additionally, the involvement of research centres, local associations on cycling, schools, etc could be strategic for promoting behaviour change.

Target groups:

The communication campaign will address the following target groups:

- **Citizens** (in general), to reach the largest number of people. This category includes the parents of children under the age of 14 for whom there is a helmet obligation.
- student and **University students**, which represent the category that most uses the bicycle for urban travel, both personal and through the bike sharing service
- **Elderly people**, who represent the most vulnerable category of cycling in terms of road safety: greater slowness of reflexes, less reactivity, presence of physical problems and fear are all elements that increase their vulnerability on the road. This category includes the grandparents of children under the age of 14 for whom there is a helmet obligation.

The Facebook posts and video will be targeted to these selected groups, with the exception of the post on the helmet obligation for children under 14, which will only cover the "Citizens" and "Elderly" categories to sensitise parents and grandparents.

17. Applying the FLOW Methodology and impact assessment tool

17.1. Applying the FLOW Methodology in your local context

In general, it is not possible to apply the FLOW methodology to a campaign. As Pisa's campaign is not limited to a specific area in the city, it is not possible to measure the impact of the measure () on congestion in a specific area. Furthermore, Pisa did not use a model to assess the campaign and therefore has no data available to use as input for the FLOW methodology.

17.2. Use of the FLOW impact assessment tool

Input

Since the campaign is still in a planning phase, before and after data is not available. In order to be able to try out the FLOW impact assessment tool we used estimated data.

The campaign is targeted to specific target groups and aims at reducing the number of bikes stolen as well as bicycle accidents. The underlying assumption is that this will increase the number of cyclists. The campaigns (posters at bike sharing stations) will be visible for everyone in the city, so we consider the whole population of Pisa as a target group and estimate that the campaign will increase the number of cyclists by 1% (from 17% to 18.%). For the purposes of the impact assessment, we assumed the increase in the cycling share will be completely at the cost of the car share, although in reality people will most likely also shift from walking or public transport to cycling).

We also assume the average trip length is 2.5 km, which takes a person about 12 minutes.

The table below provides an overview of the input data used.

	Before campaign	After campaign
Population	90,488	90,488
Modal share cycling	17%	18.% (= 17% + 1%)
Modal share walking	31%	31%
Modal share public transport	12%	12%
Modal share car	29%	28% (= 29%- 1%)
Modal share motorcycle	11%	11%
Average trip length bicycle	2.5km	2.5km
Average travel time bicycle	12 minutes	12 minutes
Cost of the campaign	5,000	5,000

Table 14: Input data for Pisa's impact assessment

<u>Output</u>

According to the FLOW impact assessment tool, the communication campaign will be very beneficial. This is mainly due to the relatively low cost of the campaign and the behaviour change of a very large (overestimated) target group. The positive result is also due to the decrease in kilometres driven by private car.

Cost-Benefit Analysis

Result	
(Reference year: measure fully accepted)	
Sum of all Benefits	149.969.198
Sum of all Costs	5.000
Benefit-cost ratio - BCR	29.990,84
Benefits-Costs [EUR/year]	149.964.197

Costs

Target System	Scope	Number	Indicator	Result [EUR/a]
public financing	costs of (new) infrastructure	C1	Investment costs	5.000
		C2	Operating & maintenance costs	0
Sum of Yearly Capitalised Costs				5.000

Benefits

Target System	Scope	Number	Indicator	Value without measure [EUR/a]	Value with measure [EUR/a]	Result - Benefit [EUR/a]
transport network performance	travel time	B1	total travel time costs over all transport modes per year	0	0	0
environment	GHG emission & local air pollution	B2	total direct CO_2 emission costs over all transport modes per year	0	0	0
		B3	total direct NOx emission costs over all transport modes per year	0	0	0
		B4	total direct PM emission costs over all transport modes per year	10.373.266	10.247.555	125.711
society	traffic safety	B5	total personal costs of fatal accidents over all transport modes per year	0	0	0
		B6	total personal costs of accidents with injuries over all transport modes per year	0	0	0
	health	B7	health benefits based on a reduced probability of death for people who cycle/walk	2.440		2.440
private business	vehicle operating costs	B8	total vehicle operating costs over all transport modes per year	6.671.581.314	6.521.740.268	149.841.046
	energy consumption	B9	total final fuel/energy consumption costs over all transport modes	0	0	0
	(monetary) attractiveness	B10	Commercial attractiveness: total increased retail rents	0		0
		B11	Residential attractiveness: total increased residential rents	0		0
Sum of Benefits						149.969.198

Table 15: FLOW Impact Assessment Cost-Benefit Analysis results for Pisa

<u>Challenges in using the tool:</u>

- Today only very limited data is available.
- Many of the available data had to be extrapolated/assumed which probably meant a data quality loss.
- The tool is rather complex to use.

At first sight, the results of the FLOW assessment appear extremely positive. However, when you calculate the benefit for one extra cyclist, it does seem reasonable:

Total cost-benefit/year	149,964.197 Euro
number of extra cyclists thanks to campaign	905
Cost-benefit per cyclist/year	165 Euro

17.3. Conclusion and lessons learned

Pisa wants to increase the share of cycling and walking in the city not only among citizens but also among the many students and tourists.

Due to the lack of proper data to use as input for the FLOW assessment tool, the results are probably not very precise. The positive outcome on the CBA is however in line with our expectations. Increasing the percentage of cyclists will reduce the number of people driving their car, and by consequence decrease time spent in traffic and kilometres driven. With proper data, the tool would be a very valuable tool to show and discuss results and support decisions.

It does make sense to collect before and after data, not only to use the tool, but also and maybe more importantly to show results after the measure has been implemented.

For the past several decades, the present administration of Pisa Municipality has taken action to promote sustainable mobility while at the same time limiting the number of private cars that circulate in the city. Many streets and squares were closed to traffic, many cycle paths were created and many bike-racks were installed, A Bike-Office was also created. As a result, the cycling and walking culture in Pisa has increased significantly, and the majority of all decision makers (and stakeholders) are aware of the mobility revolution that has begun and needs to continue. The administration has involved citizens in a public consultation via social media in 2016 in order to better understand the needs and the perceptions of citizens about mobility.

Mobility aspects for the current administration are a priority due to the strategic position of the city in the region (motorway, inland waterways, airport and People Mover, and the railways system) and development in terms of public investments driven by the Tuscany Region. Consequently, decongestion in particular in the city centre is a priority in a city that has always had a culture of cycling but now suffers ever-increasing numbers of tourists, workers and students.

18. Action plan and outlook

18.1. Short-term planning

In the short term (5 years), the city aims to continue creating more space for cycling and to improve the infrastructure and equipment available in order to improve cyclists' safety and comfort. With this aim in mind, it will be necessary for the city to work on the following:

- Traffic calming measures to ensure the safety of vulnerable road users (including cyclists) and to reduce traffic congestion. These measures will give space to cyclists without the need for specific investments in the cycling sector but also, when necessary, infrastructural facilities, facilities and specific structures for the bike, such as: bike lanes, underpasses and footbridges, specialised traffic lights; depots and rental centres, facilities and services to favour the intermodal transport for passengers in order to favour intermodality between bike-bus-boat.
- The completion of the cycle path along the left bank of the Navicelli Canal on the Aurelia side as scheduled. A preliminary measure for the promotion of river tourism which, through electric boats, will also makes possible to transport the bicycles on board, thus offering the possibility of mooring at any time and accessing the cycling routes that run along the banks of the waterways.

For the City it is an important element due to the fact that from 2018 the Pisan water circuit will be reactivated with the opening of the Pisan dock that will connect the Arno river and the Navicelli canal to the sea, allowing to reactivate tourist routes and sustainable river-maritime mobility for passengers and goods.

The FLOW communication campaign will also be used to inform citizens about the short-term planning about cycling in the city. In 2019, several infrastructural works will be completed to assure full accessibility by bike in the urban area. Another public consultation process will also be conducted in 2019. Considering the lessons learned from the previous public consultation, the results and feedback received will very likely show that cycling has continued to increase.

18.2. Long-term perspective

Pisa's long-term (10 years) goal is to identify measures to stimulate behaviour change in citizens' mobility habits, starting from the improper use of the car to greater use of the bicycle.

Pisa's experience as a FLOW Exchange City has increased the city's knowledge about other best practices in term of taking a multimodal perspective on congestion, solutions to increase the numbers cyclists and pedestrians and solutions to try to change citizens' mobility behaviour.
Pisa's cycling safety communication campaign developed in FLOW is the first city campaign on safety and theft, and it will allow the city to continue to work on this topic in order to meet the following goals:

- the organisation of specific campaigns for the promotion of cycling in the city addressed to vulnerable target groups (migrants, low-income, disabled) to communicate the positive impact of cycling
- the identification of specific measures to encourage the modal shift of the use of the bike with the bus and boat and/or related with carpooling and car sharing measures in order to reduce congestion. This will mean setting several restrictive measures for private cars in a progressive way.
- Implementation of road education projects and promotion of sustainable mobility in schools to show the attractive role of walking and cycling
- the provision of incentives for employees of public entities based in the City (5 universities and 1 hospital of national relevance) and companies that want to increase their employees' use of the bike for home-work journeys. These measures can be extended also to private companies located in the industrial area adjacent to the city centre, where approximately 1,600 people work in the 25 shipyards of super yacht construction
- the identification of actions for the development of the use of bicycles for home-school trips
- development of the inland water circuit with the development of a metro water system that allows access to cycling and tourist routes

In short, the main challenge we anticipate facing is the identification of new problems and new solutions to for continuing to improve cycling conditions in Pisa. FLOW has allowed the administration to identify two main problems to address systematically using the previous experiences of other cities.

The main success factors:

- The awareness of the administration
- The stakeholder engagement

We will consider the campaign a success if it achieves the following:

- the campaign will change the mobility behaviour of citizens to encourage more cycling, with a specific focus on some target groups that represent the most active segment of the citizens who would be most likely to cycle
- the campaign would enable a more accurate analysis of problem and identifications of solutions, while also giving more attention to citizens' feedback on an online web page that will be active during and after the campaign.
- It will also allow for the collection of more data

19. Introduction to Ploiesti

Ploiesti Municipality, the capital of Prahova County, is located in the south of Romania, 60 Km North of Bucharest, the capital of Romania. The municipal economy is characterized by the concentration of large and very large businesses. A highly qualified workforce, the availability of production facilities and the proximity to Bucharest are all incentives for foreign investors to come to Ploiesti. Small and medium private businesses provide employment opportunities for local workers who became redundant after the privatization of large industries. A well-represented SME sector would promote social stability in the municipality. It is not only a heavy-industrialized centre, but also an important road and railway hub.

Image 4: Ploiesti (Source: www.ploiesti.ro)

Reference year		Past	Present (latest available data, 2011)	Projection
Population		NA	209945	NA
City area		NA	58 km^2	NA
Population density		NA	3620 /km^2	NA
Modal split	**Walking**	NA	26,40%	NA
	Cycling	NA	0,90%	NA
	Public transport	NA	38,75%	NA
	Private car & Motorbikes	NA	33,95%	NA
Motorization (cars / 1000 inhabitants)		NA	335	NA
Number of car parking spaces		NA	3021	NA

Table 16: City data for Ploiesti

20. Local context conditions

20.1. The problem

The following main issues can be considered in Ploiesti mobility. Both cycling and walking infrastructure are insufficient. Infrastructure provision has not kept up with vehicle-fleet growth, causing extensive travel delays. Congestion also wastes fuel, increases air pollution, reduces public transit efficiency and spurs aggressive behaviour. The number of parking spaces are limited.

The automobile dependency increases many costs: higher vehicle expenses, reduced travel choices, increased road and parking facility costs, congestion, accident damages, and a variety of environmental impacts. Ploiesti as other cities are expanding as land becomes scarcer. This is both a cause and consequence of the rising use of the personal car. In the same time increased traffic goes hand in hand with more accidents. 65% of the EU population is exposed to unacceptably high sound levels – most of this stemming from urban traffic, which is also the case in the city.

Parking is one of the most important issue of the urban transport planning. In the same time it has an impact on urban planning and an active interaction with public transport. In this way, parking (both for cars and bikes) must be seen as a key element of urban mobility planning. Ploiesti city started to manage public parking spaces through settlements and parking fees in the central area. Nevertheless, a fee system for different areas has not been implemented yet for the whole city.

In the downtown area, shopping and pedestrian area is separated from Republicii Avenue, the main road N-S axis of the city. The connection of the two fronts of the boulevard is carried out through crosswalks located at intersections and pedestrian underground passage. Facilities for biking - In 2006, in the framework of CIVITAS - SUCCESS project, a Strategic Traffic Plan for alternative transport in Ploiesti was developed. This Plan provided the first strategic framework on alternative transport (walking and cycling). Following this project there were built trails and bike lanes on Bucharest Avenue, Independence Avenue and Post Street. Since then cycle paths network has not been extended. Pedestrian circulation is often embarrassed by cars stationed. Crossings over the railway also has no facilities for pedestrians (no sidewalks, no adequate signaling), and, if any, is in a bad shape.

There are two bike rental centers in Ploiesti, one at the entrance of Youth Park, where bicycles can be rented for short periods and one at the entry in the student campus on Bucharest Avenue. These work only in the summer. Bike rental center in the student campus (50 bicycles) was implemented through the project studentObike - first national project of free bicycle rental for students.

20.2. The vision

In Ploiesti city, the quality of public spaces is affected by the excessive presence of vehicles in motion or stationary due to mobility with a high share of cars. Therefore, increasing the quality of urban space and quality of housing depends fundamentally of reshaping mobility downwards car use and encouraging alternative modes of travel: public transport and non-motorized travel: pedestrian and cycling.

The Vision of Mobility Development in the Area of Growth Pole Ploiesti in the period 2016-2030, according to SUMP is “Implementing an efficient, sustainable, integrated and safe transport system to support economic and social development”. The operational objectives are the following: encourage cycling, implement bicycle lanes, increase the safety of cyclists and pedestrians, improve pedestrian crossings, improve intermodality.

It is necessary to gradually implement a package of consensual measures that should aim, among other things, at improving the infrastructure for pedestrians and cyclists: expanding the dedicated lanes network for bicycles, widening the sidewalks, creating streets, markets and areas of priority (pedestrian / "shared-space") and bike-sharing services.

In order to encourage cycling, to reduce traffic, but also for creating a more pleasant and healthier environment, the main objectives in SUMP are: 1) Creating a coherent bike network between major traffic generators points (the central area, parks, stadiums, intermodal points, student campus, residential areas, commercial areas); 2) Improvement / rehabilitation of existing bike lanes to the appropriate standards

Image 5: Cycle paths in Ploiesti (Source: PMUD Ploiesti/ SUMP Ploiesti)

20.3. Scope of activities in FLOW

20.3.1. Local FLOW activities

The local activity of Ploiesti in the FLOW project is implementing a policy reshaping mobility to be aimed at changing the structure and hierarchy modal, limiting car access in certain areas (downtown area, historic, small centrality neighborhoods) to recover and reallocate significant resources of public space for users of non-motorized, outdoor activities, art and urban green infrastructure, effects of increasing environmental quality, comfort and safety of travel and reduce pollution.

It is necessary a gradual implementation of a consensual package which must aim, among others:

1. Creating an alternative mobility car use offer, satisfactory and attractive
2. Improving the coverage of public transport level and the accessibility to the stations
3. Improving the infrastructure for walking and cycling: extending the cycling path network, enlarging the sidewalks, designing new roads, squares and areas for pedestrians/ with reduced traffic/ or "shared- space"
4. Renting Bikes Services and bike-sharing, renting cares services and car-sharing, taxi services

Together with creating a package of disincentives measures in relation to cars

1. Limiting and upper charging the parking on street
2. Limiting speed travel on secondary and local collectors (III and IV category streets)

Creating conditions of transport modality transfer from car to alternative transport (public transport, walking, cycling, taxi) through a strategic system of intermodal transfer points which includes transfer parking spaces for cars and bicycles (park & ride and bike & ride), public transport stations, places for renting bikes or taxi cars.

Using the recovered public spaces resources (by limiting using vehicles and reducing the motorization index in the future) in order to improve the quality of public spaces and urban landscape by increasing plant species (trees planted along major roads/boulevards, squares, etc.), urban art and street furniture functional and aesthetic.

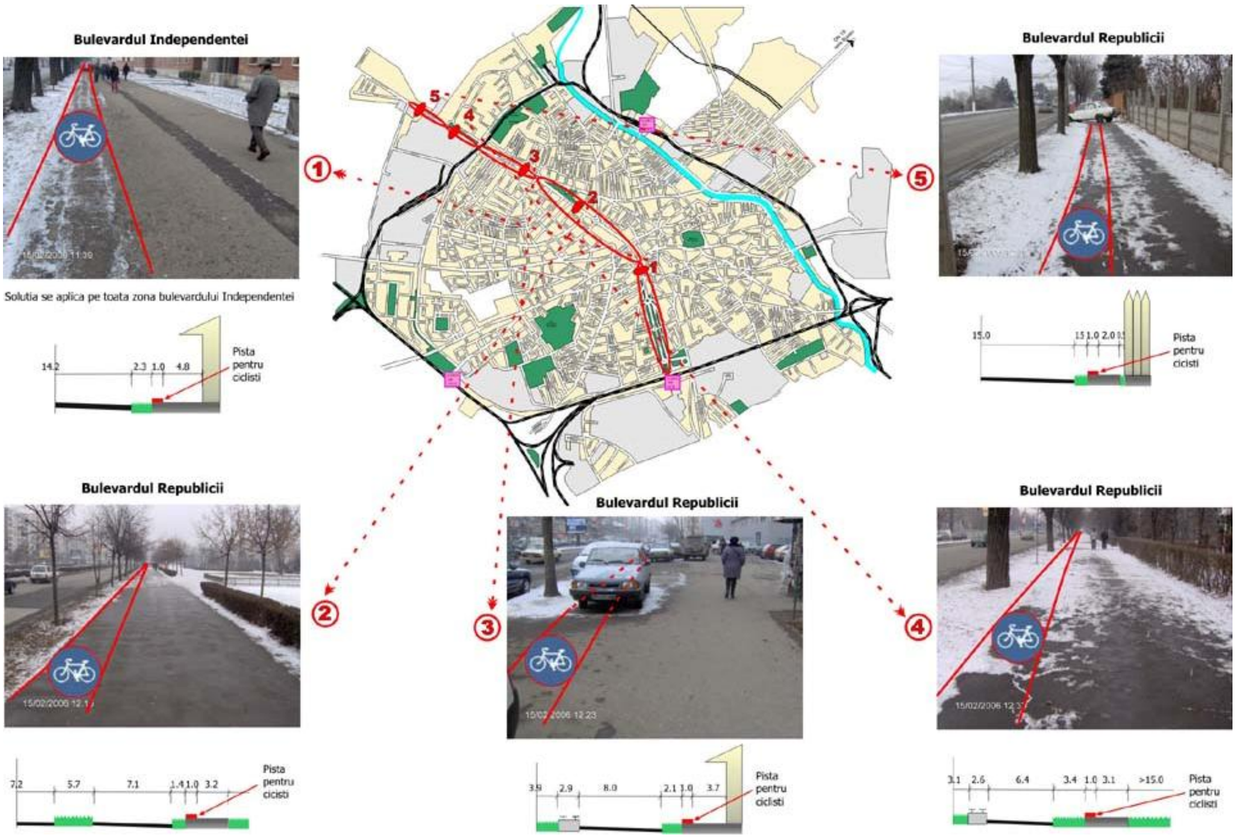


Image 6: Cycle paths on South-North course in Ploiesti (Source: Alternative Transport Strategy - Success Project - CIVITAS II Initiative)

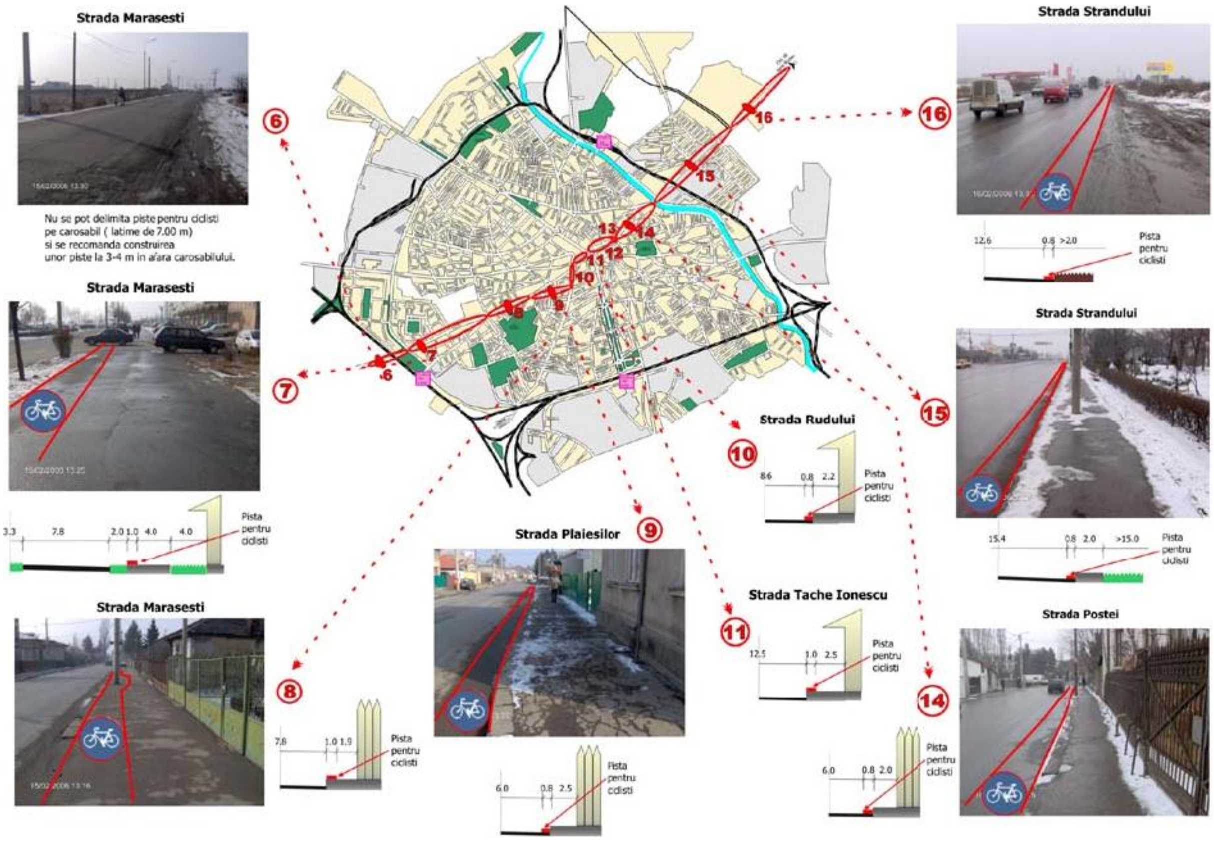


Image 7: Cycle paths on East-West course in Ploiesti (Source: Alternative Transport Strategy - Success Project - CIVITAS II Initiative)

Site 1 – Planting streets of "shared-space"

Site name	Planting streets of "shared-space"
Site size	N/A
Network size	~ 2,650 km (str. Ulierului, str. Grivitei str. Constanta, Str. Bibescu Voda Street. General Traian Mosoiu str. Basarabililor str., Paris, str. Romana (partially), Avenue Theatre Toma Caragiu, str. Al. I. Cuza, free parking Blvd. Omnia. Republicii street)
Enhancements aimed at through the measure	Creating a complex with quality public spaces by expanding the area with priority to pedestrians (and cyclists) in the center of Ploiesti:
Indicator(s) of prime interest	Junction capacity for all modes

Table 17: Overview of FLOW activities in Ploiesti

The (re)organization of streets is characterized by:

- modification of share of the resources allocated to different categories of users of public space: pedestrians, cyclists, cars and motorists, activities taking place outdoors, in favour of non-motorized users
- change of the priority of traveling in space for non-motorized vehicles
- limiting the speed of vehicles arrangement of space traffic calming function

The effects of the implementation will be:

- Improving safety and comfort of non-motorized users (pedestrians and cyclists)
- Increased functional and aesthetic quality of public community spaces
- Discouraging car use (with all the positive effects associated)

Organizing streets and urban public squares in a "shared-space" type is the materialization of a recent new philosophy of (re)development and use of public spaces which moves the focus predominantly from the priority given to vehicle to a common use of public space, with various degrees of advantages and priority for pedestrians. This model applies especially in urban areas with a high volume of pedestrian trips (commercial areas, residential areas etc.) and/or resource-limited street space.

General characteristics of this model of organization of public space are:

- Traffic calming and speed reduction through specific arrangements;
- Change travel priority for non-motorized trips; loss priority for vehicles while preserving their access (on a lane indicated by texture and colour all over pavement);
- Allocating a higher share of space for pedestrians, cyclists and activities use public space (cultural events, exhibitions, terraces etc.)
- Improved accessibility of public space for non-motorized trips, including PRM by planeizarea public space (eliminating level differences) and the elimination of priority given in this space vehicles; Improved accessibility of public space for non-motorized trips, including PRM level by filling gaps and eliminate the priority given in this space to vehicles;
- Eliminating signalling, traffic lights, regulations movement within the zone.

20.4. Key stakeholders

In order to improve the citizens' life and to solve the community's issues Ploiesti Municipality developed several projects in the last decade. Within the framework of these projects strong cooperation relations were developed with local authorities like Prahova County Council as well as with entities like Intercommunity Development Associations – Ploiesti Prahova Growth Pole and Ploiesti Prahova Energy Efficiency and Renewable Energies Agency. There were also developed public-private partnerships whenever it was necessary.

Key stakeholders involved have interest in the development of transport measures: local authority, public transport company, local NGOs, Cycle/walking groups, citizens. Of particular interest are all forms of cooperation that clearly transcend common practice, showing one or several of the following characteristics:

1. Voluntary participation of stakeholders (sectoral, administrative);
2. Broad involvement of citizens and civil society;

Involvement of private sector organisations (NGOs).

21. Applying the FLOW Methodology and impact assessment tool

21.1. Introduction

Ploiesti applied the FLOW methodology, but they have limited data available, since most of the design and planning is still on-going. Based on some estimates Ploiesti applied the Impact assessment which resulted as negative BCR, so based on these assumptions the proposed measures are not economically viable.

21.2. Applying the FLOW Methodology in your local context

Roadway Segment Density	**Inputs**		**Result of density calculation**
	1	**2**	
Transport Mode	traffic volume (veh/h/ln, ped/h)	average travel speed (km/h)	density per mode (veh/km)
car	300	40	8
public transport	20	40	3
cycle	20	22	1

Pedestrian Density	**Inputs**			**Result of density calculation**
	Density Look-up (ped/sq. m)	Efffective sidewalk width (m)	Meter/km	density per mode (*ped/km*)
pedestrian	3,00	1,50	1000	*4500*

Table 18: FLOW Multimodal Calculation Procedure results for Ploiesti - Density on Roadway Segment in Avenue Theatre Toma Caragiu, str. Al. I. Cuza, free parking Blvd. Omnia. Republicii street segment

21.3. Use of the FLOW impact assessment tool

During this period, traffic studies are being prepared for the areas to be rehabilitated through the projects:

- Growth of traffic mobility through the northwest multi-modern terminal, including parking spaces for automobile and bicycle transport modes
- Road / street network modernization: Widening Cantacuzino street to 4 lanes and and rehabilitation of Cantacuzino street
- Insurance of traffic mobility by extending the road and public transport between the South railway station and the west West railway station

So we do not have at this time detailed data as they should to be filled in the excel table.

Indicators

Number	Target System	Scope	Indicator	Transport mode MT	Transport mode NMT	Result: Value without measure [per annum]	Result: Value with measure [per annum]	Result: Difference [per annum]
1	Public Financing	costs of (new) infrastructure	**investment costs** [EUR/year - annuity]				5 530 802	-5 530 802
2			**operating & maintenance costs** [EUR/year]				0	0
3a	Traffic Perfor-mance	travel time related	**total travel time** [person-h/year]	X	X	3 729 920	3 642 880	87 040
3b			**total travel time** [ton-h/year]	X		0	0	0
4	Environment	GHG emission & local air pollution	total direct **CO_2 emission** [t/year]	X		0,000	0,000	0,000
5			total direct **NO_x emission** [t/year]	X		0,000	0,000	0,000
6			total direct **PM emission** [t/year]	X		0,007	0,007	0,000
7		noise pollution	marginal costs of **noise** over a day [EUR/year; -]	X				0
8		land consumption	sealed surface: **total new / deconstructed traffic area** [-]	X	X	0		0
9	Society	traffic safety	number of **persons killed** [no./year]	X	X	0	0	0
10			number of (seriously & slightly) **injured persons** [no./year]	X	X	0	0	0
11		health	**health benefits** based on a reduced probability of death for people who cycle/walk [no./year]		X	0,000		0,0000
12		increased access	**accessibility** - increased access of non-motorized residents' to amenities (e.g. jobs) [-]		X	4		4
13		social interaction	**separation effect** [-]		X	2		2
14	Private Business	vehicle operating costs	**vehicle operating costs** [EUR/year]	X	X	4 635 370	3 823 134	812 236
15		energy consumption	total final **energy consumption** [kWh/year]	X	X	24 320	24 320	0
16		(monetary) attractiveness	commercial attractiveness: **increased retail rents** [EUR/year]		X	0		0
17			residential attractiveness: **increased residential rents** [EUR/year]		X	0		0

Table 19: Indicators used in the impact assessment for Ploiesti

Weighted Benefit Analysis											
Target System	**Scope**	**Number**	**Indicator**	**Value without measure [per annum]**	**Value with measure [per annum]**	**Difference**	**Lower boundary**	**Upper boundary**	**Utility points (linear)**	**Weighting factor**	**Weighted result (Benefit)**
public financing	costs of (new) infrastructure	WB1	**investment costs** [EUR/year - annuity]		5 530 802	-5 530 802			#ZÉRÓOSZTÓ!		##########
		WB2	**operating & maintenance costs** [EUR/year]		0	0			#ZÉRÓOSZTÓ!		##########
transport network performance	travel time	WB3a	**total travel time** [person-h/year]	3 729 920	3 642 880	87 040			#ZÉRÓOSZTÓ!		##########
		WB3b	**total travel time** [ton-h/year]	0	0	0			#ZÉRÓOSZTÓ!		##########
environment	GHG emission & local air pollution	WB4	direct **CO_2 emission** [t/year]	0	0	0			#ZÉRÓOSZTÓ!		##########
		WB5	direct **NO_x emission** [t/year]	0	0	0			#ZÉRÓOSZTÓ!		##########
		WB6	direct **PM emission** [t/year]	0	0	0			#ZÉRÓOSZTÓ!		##########
	land consumption	WB7	sealed surface: total new / deconstructed traffic area [-]	0		0			#ZÉRÓOSZTÓ!		##########
society	traffic safety	WB8	number of **persons killed** [no./year]	0	0	0			#ZÉRÓOSZTÓ!		##########
		WB9	number of (seriously & slightly) **injured persons** [no./year]	0	0	0			#ZÉRÓOSZTÓ!		##########
	health	WB10	**health benefits** based on a reduced probability of death for people who cycle/walk [no./year]	0		0			#ZÉRÓOSZTÓ!		##########
	increased access	WB11	**accessibility** - increased access of non-motorized residents' to amenities (e.g. jobs)	2		2			#ZÉRÓOSZTÓ!		##########
	social interaction	WB12	**separation effect** [-]	1		0			#ZÉRÓOSZTÓ!		##########
private business	vehicle operating costs	WB13	**vehicle operating costs** [EUR/year]	4 635 370	3 823 134	812 236			#ZÉRÓOSZTÓ!		##########
	energy consumption	WB14	final **energy consumption** [t/year]	24 320	24 320	0			#ZÉRÓOSZTÓ!		##########
	(monetary) attractiveness	WB15	commercial attractiveness: **increased retail rents** [EUR/year]	0		0			#ZÉRÓOSZTÓ!		##########
		WB16	residential attractiveness: **increased residential rents** [EUR/year]	0		0			#ZÉRÓOSZTÓ!		##########
Sum of Benefits											##########

Table 20: Weighted benefit analysis results for Ploiesti

Cost-Benefit Analysis

Result	
(Reference year: measure fully accepted)	
Sum of all Benefits	812 257
Sum of all Costs	5 530 802
Benefit-cost ratio - BCR	0,15
Benefits-Costs [EUR/year]	-4 718 544

Costs

Target System	Scope	Number	Indicator	Result [EUR/a]
public financing	costs of (new) infrastructure	C1	Investment costs	5 530 802
		C2	Operating & maintenance costs	0
Sum of Yearly Capitalised Costs				5 530 802

Benefits

Target System	Scope	Number	Indicator	Value without measure [EUR/a]	Value with measure [EUR/a]	Result - Benefit [EUR/a]
transport network performance	travel time	B1	total travel time costs over all transport modes per year	0	0	0
environment	GHG emission & local air pollution	B2	total direct CO_2 emission costs over all transport modes per year	0	0	0
		B3	total direct NOx emission costs over all transport modes per year	0	0	0
		B4	total direct PM emission costs over all transport modes per year	589	568	21
society	traffic safety	B5	total personal costs of fatal accidents over all transport modes per year	0	0	0
		B6	total personal costs of accidents with injuries over all transport modes per year	0	0	0
	health	B7	health benefits based on a reduced probability of death for people who cycle/walk	0		0
private business	vehicle operating costs	B8	total vehicle operating costs over all transport modes per year	4 635 370	3 823 134	812 236
	energy consumption	B9	total final fuel/energy consumption costs over all transport modes	2 286	2 286	0
	(monetary) attractiveness	B10	Commercial attractiveness: total increased retail rents	0		0
		B11	Residential attractiveness: total increased residential rents	0		0
Sum of Benefits						812 257

Table 21: FLOW Impact Assessment Cost-Benefit Analysis results for Ploiesti

21.4. Conclusion and lessons learned

The roadmap identifies the generic activities and tasks (sub-activities). The Roadmap ensures consistency in the application of project management deliverables, activities and tasks. Building on the lessons learnt, this roadmap takes a wider look at developments in the transport sector, at its future challenges and at the policy initiatives that need to be considered.

Demand management and land-use planning can lower traffic volumes. Facilitating walking and cycling must become an integral part of urban mobility and infrastructure design. Rising traffic congestion is an inescapable condition in our city. Commuters are often frustrated by policymakers' inability to do anything about the problem, which poses a significant public policy challenge. Walking and cycling are seen as a potential solution.

The tool is very useful, but for us is quite difficult to complete it since we do not have all the required data; we do not have all the statistics to help us fill it in and to give us the right solutions or a clear, comprehensive perspective.

The first thing many people think of when it comes to congested roadways is delay. During the morning commute there is additional stress because delays caused by traffic can make people late for work. And at the end of the day, the afternoon rush hour is again a frustrating time because the workday is done and people want to get home to relax, and traffic is preventing it. These delays are the effects most people feel because they are universal to everyone who has to maneuver through congested roads. Walking and cycling are seen by decision makers in Ploiesti as a solution to traffic congestion and they are trying to find solutions to create more space for them, together with other measures not only for reducing traffic congestion, but also to reduce pollution.

Therefore, the FLOW impact assessment tool was useful to evaluate the current state, even with the poor data we have had.

22. Action plan and outlook

22.1. Short-term planning

We should take into account that socio-demographics, land use, and transportation are intricately linked. The integrated urban modelling systems need to consider several important issues: connecting long-term and short-term choices, demand-supply interactions. We should ensure that traffic in neighbourhoods includes larger sidewalks, bicycle routes, and traffic calming and traffic safety features that benefit walking and cycling; the length of cycle lanes will be increased through integrated projects to be implemented through the Regional Operational Program 2014-2020

Congestion may be solved through:

- Reconfiguration of the streets - all the streets to be rehabilitated have bicycle tracks
- Creation of dedicated public transport lines (compulsory measure in projects financed under the POR 2014-2020)
- Extending the street tram at the western exit part of the city (the Cantacuziono street will be rehabilitated by a project that will be submitted for financing through the Regional Operational Program 2014-2020, there already exists a technical project)
- The project linking the western part of the city to the south (POR 2014-2020) will decongest the city centre
- There will be two multimodal terminals in the north and west part of the city, which will be provided with park-and-rides facilities and bike sharing system.

The concrete activities that will be done through three main infrastructure projects to be submitted this year:

- Extending the street tram at the western exit part of the city (the Cantacuziono street will be rehabilitated by a project that will be submitted for financing through the Regional Operational Program 2014-2020, there already exists a technical project):
- The project linking the western part of the city to the south (POR 2014-2020) will decongest the city centre – Libertatii
- There will be two multimodal terminals in the north and west part of the city, which will be provided with park-and-rides facilities and bike sharing system – The project for multimodal Gageni will be

submitted this year, the project for the multimodal West will be submitted in the next programming period.

In the frame of Gageni project, the municipality will solve some mobility problems through the following activities:

- Construction of end-of-line busses and intermodal transfer for trams, buses, minibuses and maxi-taxis;
- Creating a traffic management system for public transport vehicles running on Gageni Street.

Cantacuzino project has also has activities that intend to solve mobility problems:

- Reconfiguration of the Cantacuzino street;
- Construction of intermodal transfer station for buses, trolleybuses, minibuses and maxi-taxis;
- Construction / upgrading of passenger waiting stations for public transport with buses and trolleybuses;
- Creating the traffic management system for public transport in Ploiesti;
- Planting trees / shrubs along bicycle tracks and pedestrian tracks and park & ride parking areas to reduce CO2 emissions;
- Construction of two bike rental points.

Activities through Libertatii project:

- Depoului street modernization;
- Reconfiguration of the road infrastructure on Depoului Street and Libertatii Street;
- Construction of intermodal transfer station for buses and electrical buses, trolleybuses, minibuses and maxi-taxis in 1 December Market;
- Construction / modernization of passenger waiting stations for public transport by buses and trolleybuses on Depoului and Libertatii streets;
- Construction of bicycle rental points at intersections with Bobalna and Macazului streets;
- Extending the traffic management system for public transport vehicles running on Depoului and Libertatii streets;
- Planting trees / shrubs along bicycle tracks and pedestrian tracks and park & ride parking areas to reduce CO2 emissions;
- Construction of a park & ride parking space in the West Railway Station area;
- Purchase and installation of recharging stations for electric buses.

All these projects fall within the Specific Objective 4.1 of ROP Axis 4, namely: "Reducing Carbon Emissions in City Districts by Investments Based on Sustainable Urban Mobility Plans".

22.2. Long-term perspective

Provision of pedestrian facilities will encourage walking, thereby reducing short trips by cars, which run mainly with the engine cold and contribute significantly to the emissions of air pollutants. Some facilities (i.e. traffic calming bands, flags) can lead to acceleration and/or braking with small and local (very localised) concentrations of pollutants in the air.

Ploiesti also aims to reduce noise by providing pedestrian facilities to help reduce car traffic over short distances. Some facilities (i.e. traffic calming bands, flags) can lead to acceleration and / or braking with small and local (very localised) reduction of noise.

Steps will also be taken to minimise the negative impact of the above-mentioned projects to be developed in future phases by implementing appropriate safeguards. Reducing the number of cars currently circulating in the city will benefit human health by lowering the levels of air and noise pollution. Furthermore, improving conditions of travel for pedestrians will increase road safety and reduce accidents, especially those involving pedestrians.

23. Introduction to Tallinn

The City of Tallinn is the capital of Estonia and the centre of culture, economy and higher education in the country. With its 448,722 (01-12-17) inhabitants and 159 km² Tallinn is also the largest city in Estonia. Since the restoration of independence in 1991 Tallinn has experienced large changes. First the economic downturn and then the rapid economic growth have imposed large structural changes on the city and its transport system. The number of private cars has been growing rapidly and the collective transport network has not developed at the same pace as private modes. The resulting massive shift to private car use has worsened the city environment dramatically. In the meantime, the old part of the city has been designated a UNESCO world heritage site, so it is essential to mitigate damage to this area caused by traffic congestion. A considerably large amount of motorised traffic passes through the city centre each day. The geographical peculiarity and town plan – the city is butterfly-shaped – favours it.

Figure 11: Photo of Tallinn (Source: http://www.theweek.co.uk/82570/mini-metropolis-a-guide-to-tallinn-estonia)

Reference year	Past 2013	Present 2017	Projection for 2030
Population	417,987	448,722 (01-12-17)	No numbers available. SUMP is in preparation (due end of 2018) and will contain projection
City area	159 km²		
Population density	2,628/km²	2,813/km²	See above

Modal split **(number of commuters)** **Source: Statistics Estonia; Labour force Survey, testmoney - based**	**Walking**	23.89%		See above
	Cycling	0.53%		See above
	Public transport	25.55%		See above
	Private car	48.84%		See above
Route km of:	**Cycle routes**	218	263	See above
	Bus, trolley, tram	763	838	See above
	Urban rail: train	28	28	See above
	Road	1,014	1,027	See above
Number of car parking spaces (Paid parking places in Old town, City Heart and City Centre (managed by municipality)		6,240	5,800	See above

Table 22: City data for Tallinn

24. Local context conditions

24.1. The problem

Tallinn faces a number of mobility-related challenges. Although the growth of car use has slowed down in recent years, Tallinn still faces congestion. At the same time, the bicycling culture in the city is underdeveloped, with a modal share of 0.53%. This is due in part to the fact that most of the cycle paths are built or planned in the suburbs with no connections to the city centre. To improve this situation, the city intends to develop its cycle path network. A third challenge is that since the introduction of fare-free public transport in 2013, the modal share of walking has decreased.

Regarding cycling, Tallinn lacks:

- A safe, continuous, illuminated and maintained cycle path network

- A sufficient amount of safe and comfortable parking possibilities in public spaces / near destinations
- Safe and comfortable parking facilities at apartment buildings and residential areas
- Modern information services to support bicycle use: electronic maps, apps and services
- A bicycle sharing system

Regarding walking, Tallinn lacks:

- A high quality dense sidewalk network for everyday trips, not just for recreation. This means:
  - Accessible/comfortable street design for walking and attractive public space
  - A safe walking environment by design
  - Limited car traffic with reduced speed to minimise its negative impacts (safety issues, environmental issues)
  - Attractive places / destinations in public space that create a sociable place

24.2. The vision

The modal share of cycling is quite low. At the same time, private car ownership is increasing. There is limited space in the city centre, which, especially during the peak hours, does not support the high volumes of motorised traffic. This results in more frequent traffic congestion.

In order to improve the situation, Tallinn has developed a policy document called the Tallinn Development Plan 2014–2020. In order to reduce car use, the document states that there is a need for competitive alternative modes of transport. There is a need to open up urban space and improve its accessibility for people who choose to travel by public transport, by bike or on foot.

According to the new Tallinn Cycling Strategy 2018-2027, there will be annual plans developed for building the bike lanes and cycle tracks, conducting the campaigns and measuring the city's performance on developing cycling in Tallinn. The Tallinn Cycling Strategy has set the following goals:

1. To increase the modal share of cycling by 2027 to:

- 11% of all movements
- 25% of home to school movements

2. To improve the network of cycle lanes and paths by 2027:

- 75% of households are located no more than 500m from the main cycling network
- 75% of public buildings are located no more than 200m from the main cycling network

3. To improve the cycling lanes around the schools by 2027:

- 1km range around schools the cycling conditions are safe and cycle friendly

4. To improve the cycle parking conditions in residential areas and in the city centre, by ensuring enough safe and comfortable bike parking places by 2027.

5. To connect at least 80% of the leisure cycle lanes with the main cycling network by 2027.

Apart from developing the cycling infrastructure, one of the city's main priorities is also to improve the quality of public transport. So far, the city has created bus lanes to ensure public transport competitiveness in terms of travel time. There has also been a shift in parking policies as the parking fees are increased. In addition, Tallinn has considered implementing a congestion charge. However, due to the legal restrictions, it has not been successfully implemented. Currently, the SUMP for Tallinn is under development.

24.3. Scope of activities in FLOW

24.3.1. Local FLOW activities

In order to increase the share of walking and cycling, Tallinn will start a communication campaign to promote biking to work / school.

Campaign name	Communication campaign "Bike to Work / School"
Campaign size	All the city and Harju county around the city (200 km^2)
Enhancements aimed at through the measure	Increase the number of people using a bike to commute to work or school. Currently about 1.5% of people commute to work by bike (about 3,200 people). The number of cycling pupils/students is more or less the same. The aim of campaign, as a minimum, is to double these numbers.
Indicator(s) of prime interest	% of cyclists among employees and school children

Table 23: Overview of FLOW activities in Tallinn

<u>Target groups:</u>

The campaign has two main target groups: employees and students who commute daily during peak hours and whose trips are less than 5 km long. The distance of up to 5 km is optimal for cycling, normally a 20-minute trip (15 km/h). Increasing the share of cycling during peak hours will positively affect the cycling modal split and environment.

Home-work/school commuting make up a significant portion of daily movements during working hours (from 07:00 to 09:00 and 16:00 to 18:00). Employees have the greatest tendency to use the car, primarily due to higher incomes. Students differ from jobseekers in several aspects: as a rule, less frequent and less habitual car use. Many students in Tallinn are new urban residents who still have no firm mobility habits in the city.

Campaign messages:

I - The idea of a bicycle and its benefits to society: the bicycle is fast, flexible, favourable, cool and healthy.

- Fast: cycling is the perfect transport mode for trips between 1-5 km. Within this range the urban environment is usually accessible the fastest from door to door with a bike.
- Flexible: you can get around everywhere, you can park your bike almost anywhere, you can take it almost anywhere.
- Favourable: bikes are available in a wide price range, they are durable and will not lose their price quickly. There are very minimal maintenance costs for using a bike, special equipment is not required for biking.
- Cool: an active and healthy lifestyle is cool.
- Healthy: cycling is healthy for the biker and for others. Cycling has no harmful effects on the urban environment, does not create noise or emissions. The bicycle is much less dangerous to others than the car.

II - The regularity and wide availability of biking.

- The bike is common and is suitable for everything: for everyday trips to the office, meetings, transportation of goods, carriage of children, shopping, visits, leisure and sports.

Objective:

To increase the share of bicycle in movement:

- To increase the percentage of people cycling to work from 1.5% to 2.5%
- Overall, to increase the modal share of cycling from 0.53% to 2%

Responsible for conducting the campaign:

Tallinn Transport Department, Tallinn City Municipal Engineering Services Department, employers, non-governmental organisations.

Period:

2018 – 2020

Available data:

	2010	2011	2012	2013	2014	2015	2016
% of people cycling to work	0.8	1	1.1	0.6	0.9	1.2	1.5
Average distance home-work (km)	NA	5.3	5.2	NA	5.3	6.6	7.8
Average time spent (min)	NA	19.8	22.5	28.1	16.9	23.6	25.5

Table 24: Available data for home-to-work trips (Source: City of Tallinn, 2018)

The usual practise in Tallinn to secure budget for such a campaign is to first make a general proposal at the level of detail provided above, and then once the budget is formally approved, the detailed communication campaign will be developed and agreed upon. At the time of completing this roadmap, the budget was not yet approved. Therefore, the tentative plan for how the campaigns will be conducted are as follows:

1. Specific workplaces and schools will be recruited for targeted campaigns.
2. The campaign will use the different communication channels: Tallinn TV, radio, internet (social networks, Tallinn website), newspapers (especially newspapers of city's districts), outdoor campaign, competitions with prizes for the winners, etc.
3. During the 2-year period there will be 4 rounds of 6-week campaigns: 2 in spring and 2 in autumn.
4. The campaigns will be evaluated by ex-post surveys and by using the data of cycle counts during peak hours.

24.4. Key stakeholders

The main stakeholder organisations responsible for deciding, planning, implementing and paying for the communication campaign will likely be:

- Tallinn Municipal Services Department (City Government) – responsible for the coordinating all the campaign and public tender procedures
- Tallinn Education Department (City Government) – responsible for cooperating with schools
- Schools (managements) – responsible for support actions
- Tallinn City Enterprise Department (City Government) – responsible for cooperating with the companies in city
- Estonian Employers' Union – responsible for support activities with the companies
- Estonian Urban Cyclist Union – responsible for support actions
- Marketing companies – responsible for providing the communication actions

25. Applying the FLOW Methodology and impact assessment tool

25.1. Applying the FLOW Methodology in your local context

In general, it is not possible to apply the FLOW methodology to a campaign. As Tallinn's campaign is not limited to a specific area in the city, it is not possible to measure the impact of the measure (bike to work/school campaign) on congestion in a specific area. Furthermore, Tallinn did not use a model to assess the 'Bike to work/school' campaign and therefore has no data available to use as input for the FLOW methodology.

25.2. Use of the FLOW impact assessment tool

Input

The data available to assess the bike-to-work/school campaign was limited. Since the campaign has not been executed yet, there is no real data available in terms of after data. For this estimated data was used. The objective of the campaign is to double the number of people cycling to work and school, which was used as the basis for the estimated data.

The campaign also targets car users rather than public transport users, therefore in the after data, the gain in cyclists is considered to be 100% at the cost of car users. It is very likely that in practice, the bike-to-work/school campaign may also convince public transport users to shift to bike riding.

The table below shows the used data for the FLOW impact assessment tool.

2017	car	bike	PT	walking
modal split	48,84%	0,53%	25,55%	23,89%
number of people to work	294883	3200	154264,2	144241,5
average travel distance (km)	15	7,8	12	1,5
average travel time (min)	20	25,5	25	10
total travel distance/peak hour (km)	4423245	24960	1851170	216362,3
total travel time/peak hour (min)	5897660	81600	3856604	1442415

After campaign	car	bike	PT	walking
modal split	48,31%	1,06%	25,55%	23,89%
number of people to work	291683	6400	154264,2	144241,5
average travel distance (km)	15	7,8	12	1,5
average travel time (min)	20	25,5	25	10
total travel distance/peak hour (km)	4375245	49920	1851170	216362,3
total travel time/peak hour (min)	5833660	163200	3856604	1442415

Table 25: Data used in FLOW assessment tool for Tallinn

<u>Output</u>

According to the FLOW impact assessment tool, the cost-benefit analysis is very positive.

Cost-Benefit Analysis

Result	
(Reference year: measure fully accepted)	
Sum of all Benefits	721,451
Sum of all Costs	50,008
Benefit-cost ratio - BCR	14.43
Benefits-Costs [EUR/year]	671,444

Costs

Target System	Scope	Number	Indicator	Result [EUR/a]
public financing	costs of (new) infrastructure	C1	Investment costs	50,008
		C2	Operating & maintenance costs	0
Sum of Yearly Capitalised Costs				50,008

Benefits

Target System	Scope	Number	Indicator	Value without measure [EUR/a]	Value with measure [EUR/a]	Result - Benefit [EUR/a]
transport network performanc	travel time	B1	total travel time costs over all transport modes per year	0	0	0
environment	GHG emission & local air pollution	B2	total direct CO_2 emission costs over all transport modes per year	0	0	0
		B3	total direct NOx emission costs over all transport modes per year	0	0	0
		B4	total direct PM emission costs over all transport modes per year	561,845	465,019	96,826
society	traffic safety	B5	total personal costs of fatal accidents over all transport modes per year	0	0	0
		B6	total personal costs of accidents with injuries over all transport modes per year	0	0	0
	health	B7	health benefits based on a reduced probability of death for people who cycle/walk	13,510		13,510
private business	vehicle operating costs	B8	total vehicle operating costs over all transport modes per year	4,603,880	3,992,765	611,116
	energy consumption	B9	total final fuel/energy consumption costs over all transport modes	0	0	0
	(monetary) attractiveness	B10	Commercial attractiveness: total increased retail rents	0		0
		B11	Residential attractiveness: total increased residential rents	0		0
Sum of Benefits						721,451

Table 26: FLOW Impact Assessment Cost-Benefit Analysis results for Tallinn

We experienced a few challenges in using the FLOW Impact Assessment Tool:

- Today only very limited data is available. Tallinn has planned to collect more data in the next periods, as indicated in Cycling Strategy.
- Today no transport model is available. So far the city has ordered different modelling from research companies and this is quite expensive. In the near future, the City of Tallinn plans to purchase its own model or to sign a contract for longer period modelling.
- Many of the available data had to be extrapolated or recalculated which probably meant a data quality loss. We are currently working on increasing the quality of the data collected.
- The tool is rather complex to use. As we have now a new employee working exclusively on cycling and walking in Tallinn, we anticipate that this problem will be solved in the near future.

25.3. Conclusion and lessons learned

The main lesson learned during this project was that you can have many good ideas but for analysing the possible impacts and implementation of the new measures you need a lot of data as well. Unfortunately, the City of Tallinn does not have enough data. We are also missing the modelling experience concerning walking and cycling.

Walking as a measure has not been taken into account as a part of multi-modal issue before. Cycling as an important measure in fighting against congestions has received more and more attention. The best proof is the preparation of the new Cycling Strategy which was completed in 2017. To prepare this document a lot of different stakeholder groups (transport specialists, city officials, cycling communities, students, etc.) were involved. Putting walking and cycling on an equal level with motorised transport was understandable as an indispensable behavioural pattern and did not raise objections.

Regarding the FLOW tools, in our opinion, the best results will be achieved by using the macroscopic modelling or microscopic modelling tools. Unfortunately, City of Tallinn has not used these models before and we could not use these solutions during the FLOW project. Despite this challenge, we did use the FLOW Impact Assessment Tool and these results will likely help us in continuous planning procedures of walking and cycling measures.

Our advice to other cities is: collect more and more different data for using different tools in order to get the best results.

26. Action plan and outlook

26.1. Short-term planning

In the short term (5 years) Tallinn aims to:

- Increase the length of cycle lanes by 50 km,
- Increase the number of bike rental stations by 50,
- carry out raising awareness campaign once a year.

Depending on the needs, FLOW tools might be used.

Depending on when these measures will be implemented, they may have synergistic effects with the cycle to work/school campaigns and thereby boost the campaigns' effects. In the coming months, the budget and detailed plan for the campaigns will be agreed upon. Tallinn aims to use the campaigns as an opportunity to collect more data about people's behaviour, needs and attitudes towards cycling through e.g. ex-ante and ex-post surveys and cycle counts during peak hours.

26.2. Long-term perspective

In the long term (10 years) the city of Tallinn has to carry out our ambitious main road measure in the city centre and probably this will be a good example for next similar developments. In this case we will get the necessary political support and can start planning for the next similar projects for creating better conditions for walking and cycling in our city.

Nevertheless, Tallinn has quite good cycling infrastructure. So far, the city of Tallinn encounters the following challenges:

- Increasing the cycling and walking modal share among work commuters
- Increasing cycling and walking modal share among pupils

Tallinn managed to

- Extend bike lanes through the city centre
- Increase the number of bike parking and bike rental stations

The “success” of the FLOW-related measure in Tallinn is defined by:

- Repetition of our campaign measure,
- Starting the modelling of walking or cycling,
- Better data collection.

27. Introduction to Thessaloniki

Thessaloniki is the second largest city of Greece and the administrative, financial and cultural centre of Northern Greece. The city is the capital of the Regional Unity of Thessaloniki and of the region of Central Macedonia and spreads over an area of 3.683km² with a population of 1,110,312 inhabitants (data source: National Census 2011).

The city is located at the western side of the Regional Unity of Thessaloniki, at the head of Thermaikos Gulf. It is built on the slopes of Kedrinos Hill surrounded to its north by the forest of Sheikh Sou. The coastline at the south as well as the existence of a mountainous bulk at the north, led to the inordinate growth of the urban sprawl (butterfly shape) at the eastern and western areas of the city. Despite the fact that the population of the city is over 1 million inhabitants, the width of the city centre is only 1.7 Km.

The wider area of Thessaloniki is articulated in three big sub areas:

- Thessaloniki metropolis: a cohesive department of the greater area that constitutes the backbone of the residential region
- The suburban area: an area that surrounds the cohesive department where various suburban settlements are established
- The remaining wider Thessaloniki area where, besides settlements and extended suburban residential areas, large cultivated agricultural territories are developed.

Considering the Metropolitan area, one of the main characteristics of its spatial structure is the monocentric character, which is attributed to the intense concentration and clustering of mainly commercial enterprises in the city centre. However, during the last years a growth of central operations outside the Metropolitan area and the city centre is also observed.

Reference year		Past (2001)	Latest (2011)
Population Regional Area (Core city area)		954,027	1,110,312 (789,191)
Regional area (Core city area)		3.683 km² (111,703) km²)	
Population density		259/km²	301/km² (9939/km²)
Modal split	**Walking**	4% (Data source: 2011)	
	Cycling	2% (Data source: 2011)	
	Public transport	23% (Data source: 2011)	
	Private car & Motorbikes	71% (Data source: 2011)	

Table 27: City data for Thessaloniki

28. Local context conditions

28.1. The problem

Thessaloniki's main mobility problem is the lack of alternatives to private car. At present, the only available mode of public transport is the urban bus. The main metro line and its extension to Kalamaria, the eastern part of the Metropolitan area, are expected to be operational by the end of 2019/ beginning of 2020. Until then the heavy dependency on private car and bus will continue. The linear shape of the urban sprawl results in heavy congested linear traffic axis to and from the city centre. The financial crisis ameliorated the effects of congestion as people became more reluctant to use their private cars due to the increased financial burden. However, as the economy warms up congestion is expected to deteriorate. Bicycle could be an alternative as the city has the additional advantage of an extensive waterfront that is accessible only to cyclists and pedestrians, nevertheless due to the lack of an extended bicycle network the waterfront is mainly used for recreational purposes.

28.2. The vision

The vision of the Municipality of Thessaloniki, which covers the core city area and is considered as the first among equals in comparison with the other municipalities, is to increase the modal share of bicycles, especially for non-recreational purposes i.e. education, work etc. The municipality adopted an ambitious programme to extend the existing 12km of bicycle network to 72km of different types of bicycle network. The municipality is preparing in parallel its first SUMP. The extension of the bicycle network and the increased support to bicycle use are going to be integral parts of the SUMP that is under development. Moreover, the strategic SUMP for the metropolitan area of Thessaloniki that TheTA developed in 2014 was the first SUMP in Greece and it introduced the extension of bicycle network and the development of a metropolitan bicycle way as one of its twelve core measures.

28.3. Scope of activities in FLOW

28.3.1. Local FLOW activities

The scope of TheTA's FLOW activities was to assess the impacts of the newly proposed extensive bicycle network scheme by the Municipality of Thessaloniki by utilising the existing VISSUM model that TheTA developed for the assessment of the Metro's extension line to Kalamaria.

TheTA decided to code into the model the part of the existing network that is connected and adds to the functionality of the new cycle network that will be constructed in the first phase of the of the Municipalities' extensive bicycle network programme. The parts of the network that were coded in the VISSUM model can be seen in Image 2. In this not so clear map provided by the Municipality, one can see the existing bike network marked in red, the network already planned for construction marked in green and the future network marked in light blue.

Image 8: Existing and proposed bicycle network that was coded in the VISSUM model (Source: Municipality of Thessaloniki)

Site 1 – New cycle route at Kleanthous St and Papafi St

Site name	New cycle route at Kleanthous St and Papafi St
Site size	A segregated cycle lane from the main road traffic running on part of both streets
Network size	2.5km
Enhancements aimed at through the measure	Code the network in the existing VISSUM model in order to assess its impact
Indicator(s) of prime interest	Comparison between existing model (without cycle network) and with new scheme model scenario (with cycle network model).

Table 28: Overview of FLOW activities in Thessaloniki for Site 1

The purpose of coding the new bicycle lane scheme is to assess its impact to congestion.

Site 2 – Cycle route at Ag.Dimitriou St and Kaftanzoglou St and Leoforos Stratou Ave.

Site name	Existing cycle network at Ag.Dimitriou St and Kaftanzoglou St and Leoforos Stratou Ave.
Site size	Two existing cycle lanes at level but segregated from the main road traffic
Network size	3.4 km in total
Enhancements aimed at through the measure	Code the network in the existing VISSUM model in order to assess its impact
Indicator(s) of prime interest	Comparison between existing model (without cycle network) and with new scheme model scenario (with cycle network model).

Table 29: Overview of FLOW activities in Thessaloniki for Site 2

The existing network that was coded in Thessaloniki's VISSUM model has a total length of 3.4 km. The cycle network was imported by editing the attributes of the respective links and reducing their capacity. Details of the methodological approach are presented in the section "Applying the FLOW Methodology and impact assessment tool". The import of the existing cycle network served two main goals:

1. Coding the part of the existing cycle network that is expected to function complementary with the proposed new cycle route scheme.
2. Include an existing part of the cycle network in the model where surveys can be conducted and then import the results in the model for calibration purposes.

Image 9: Existing cycle lane at Ag.Dimitriou St. in Thessaloniki (Source: Google, Street View)

28.4. Key stakeholders

The key stakeholders that can influence policies regarding bicycle usage, priority measures or actual physical infrastructure development in Thesaloniki's regional unit are presented in Annex A. Among them the respective Sustainable Mobility Departments of all 14 municipalities that constitute the regional unit, are the decisive ones. TheTA and the Regional Department of Transport are the stakeholders assigned with the role to coordinate and match the municipalities and their local policies in order to maximise the benefits for the regional area.

29. Applying the FLOW Methodology and impact assessment tool

29.1. Introduction

The key stakeholders that can influence policies regarding bicycle usage, priority measures or actual physical infrastructure development in Thessaloniki's regional unit are presented in Annex B. Among them the respective Sustainable Mobility Departments of all 14 municipalities that constitute the regional unit, are the decisive ones. TheTA and the Regional Department of Transport are the stakeholders assigned with the role to coordinate and match the municipalities and their local policies in order to maximise the benefits for the regional area.

29.2. Applying the FLOW Methodology in your local context

The corridor of St.Dimitrious St. was selected for applying the FLOW Methodology. Using the FLOW Methodology Calculation Spreadsheet the "Network Delay" was calculated for the St.Dimitrios St. corridor which is highlighted in Image 4.

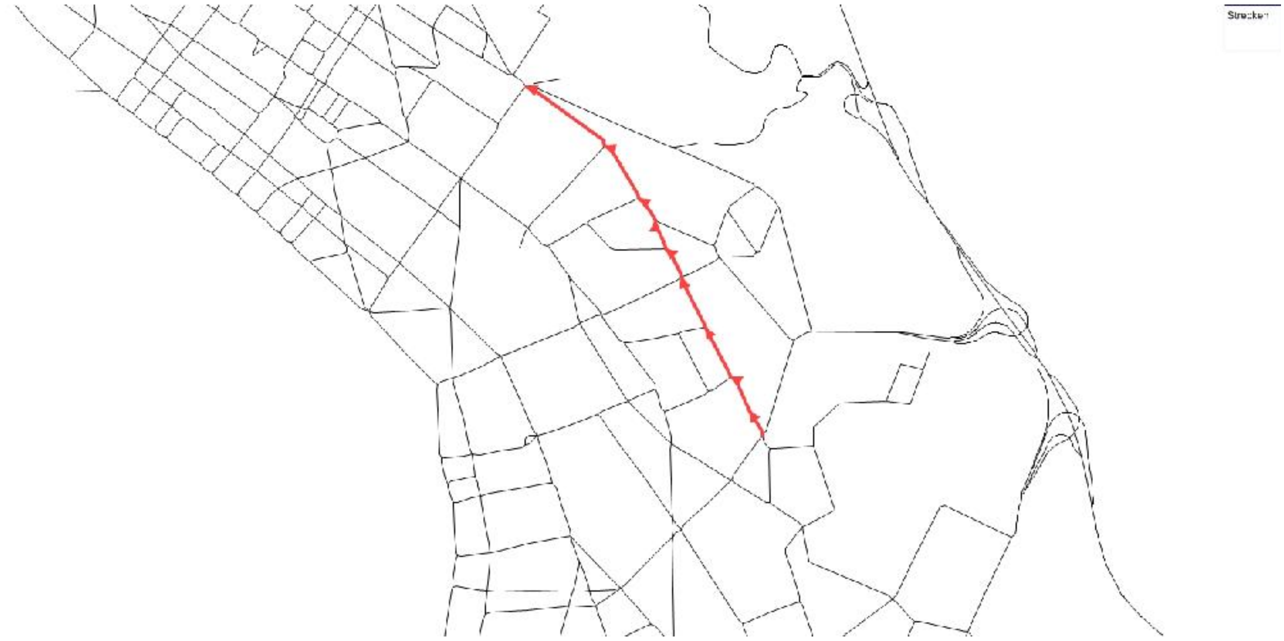


Image 10: St.Dimitrios St. corridor in Thessaloniki, highlighted in VISUM (Source: TheTA)

The results from the spreadsheet are also displayed. The Corridor Delay of the St.Dimtirios St. segment was selected to test the FLOW methodology. The car was set to priority factor 1 (lowest) while public transport (Busses) were set to a priority factor of 2 and bicycle and walking were given an equal priority factor of 3. This demonstrates the clear priority of the Municipality to enhance non-motorised transport. The overall aggregated weighted result gives a clear indication of the corridor delay with a single number, therefore the Corridor Delay KPI is considered an easy to use indicator which clearly demonstrates the overall delay taking also into account policy priorities.

Corridor Delay	**Input**			**Result of delay calculation**			**Result of transformation**	**Result of aggregation**
	1	**2**	**3**	**4**	**5**			
transport mode	priority factor (-)	vehicle occupancy ratio (pers/veh)	decisive traffic vol. (veh/h/ln; ped/h)	actual travel time (s/pers/ln, s/pers)	minimum travel time (s/pers/ln, s/pers)	mean total delay per mode (s/pers/ln)	traffic volume (pers/h)	mean delay (s/pers)
car	1	1,2	1260	1309	145	1164	1512	**389**
public transport	2	40	15	1209	145	1064	600	
cycle	3	1	200	0	0	0	200	
pedestrian	3	1	1500	0	0	0	1500	

Corridor: **St.Dimitrios St, Thessaloniki**

Table 30: FLOW Multimodal Calculation Procedure results for St. Dimitrios St, Thessaloniki

29.3. Use of the FLOW impact assessment tool

The results of the impact assessment and the cost-benefit analysis that derived by utilising the FLOW impact assessment tool for our cycling measures demonstrate an overall negative result in terms of the BCR. However, it should be considered that there were certain categories of benefits that were either underappreciated or not at all acknowledged due to the lack of available data.

The net sum of benefits is fundamentally negative as it can be seen in the screenshot from the FLOW impact assessment tool. In comparison, costs are quite low hence the reason for the negative BCR must be sought at the underestimation of the benefits related to health, energy consumption and accident reduction. The lack of suitable available data lead to either not assessing those benefits at all or systematically underestimating them.

Country	Greece

Cost-Benefit Analysis of a Cycling or Walking Measure

Result	
Sum of all Benefits	-72.963.738
Sum of all Costs	2.531
BCR	-28.832,84
Benefits-Costs [EUR/year]	-72.966.268

Weighted Benefit Analysis of a Cycling or Walking Measure

Weighted result (Benefit)	
Sum of Benefits [Utility]	#DIV/0!

Qualitative Evaluation of Measure Compared to Case "Without Implementation of Measure"

Number	Indicator	Weighted result (Benefit)
Q1	Sealed surface: total new / deconstructed traffic area	1
Q2	Accessibility - increased access of non-motorized residents' to amenities (e.g. jobs)	4
Q3	Separation effect	2

Overall Evaluation of Measure

Table 31: FLOW Impact Assessment Cost-Benefit Analysis results for Thessaloniki

The conclusion derived from the process of utilising the FLOW Impact Assessment Tool is that it is a very useful and quite user-friendly tool as long as the necessary data input is available. The lack of suitable data input hindered the whole effort and severely affected the results. Finally, once again the necessity for an agreement over homogeneous, standardised and common set of KPI's and transport data collection techniques has arisen.

Thessaloniki's approach

The first task was to decide the extent of the bike network that should be coded in TheTA's existing model. We asked the municipality to provide us with a map of the existing network with the addition of any extensions that will be constructed in the near future (Image 2).

The decision was to code the existing and the eastern part of the bike network which is planned for construction. The method was to code the bicycle network in the form of reduced capacity to our existing road network. Approximately 30 links where edited with a 25% reduced capacity on average on both directions. The edited links are the ones highlighted with bold line in the screenshot (Image 4).

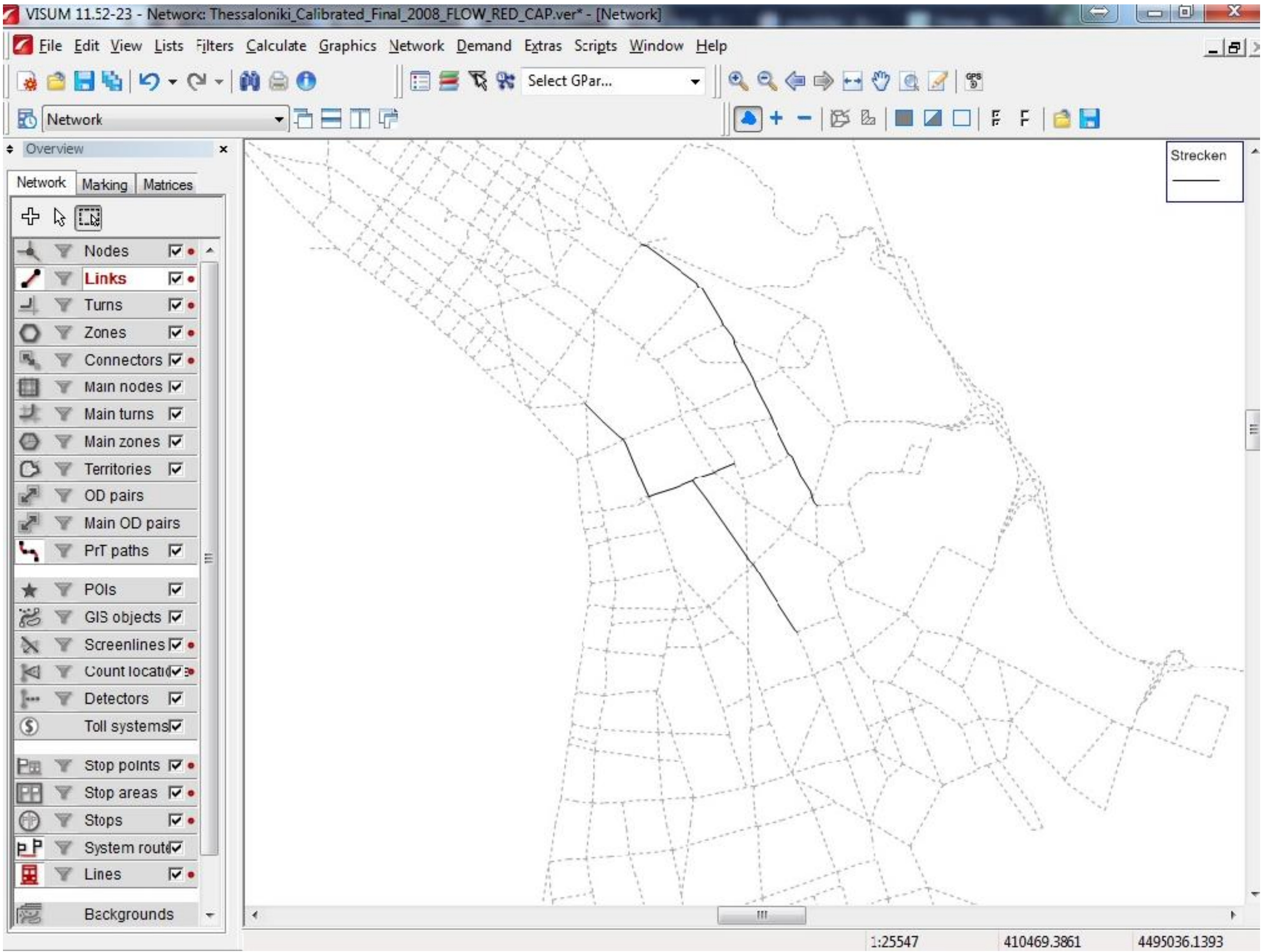


Image 11: Edited network in Thessaloniki with reduced capacity (Source: TheTA)

The second task was to calculate the number of bike trips that utilise the part of the network where cycle lanes were added. Using the calibrated model from 2008 that did not included bike as a mode we displayed the flows on each link after the assignment was concluded. Three representative links from the bicycle network were selected, the ones with the greater flows.

The flow bundle tool was used for each one these three links. The flow bundle process is displayed for one of the three links (link 4364) in Image 5.

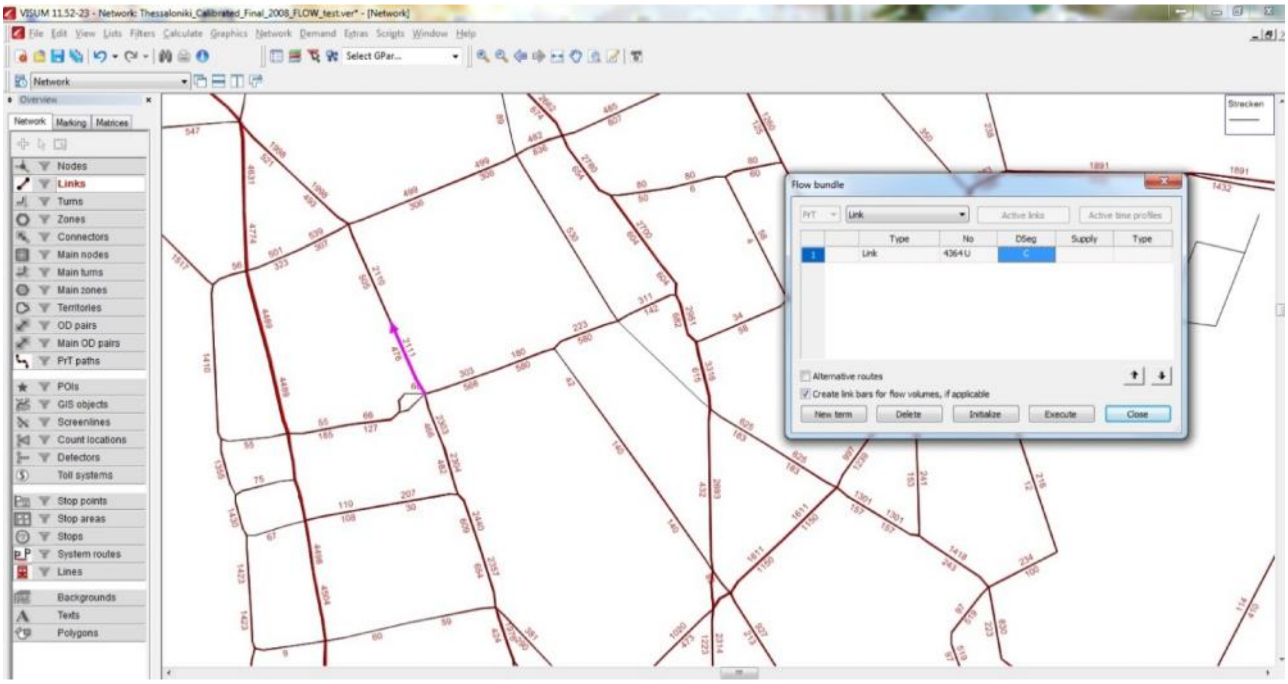


Image 12: Flow bundle for link 4364 in Thessaloniki (Source: TheTA)

After the flow bundle process finished using the “save demand matrix from route volumes” procedure a matrix was created with all the OD pairs using this link. The same methodology was followed for the other two links resulting in three OD matrices. The OD matrix for link 4364 is displayed in Image 6.

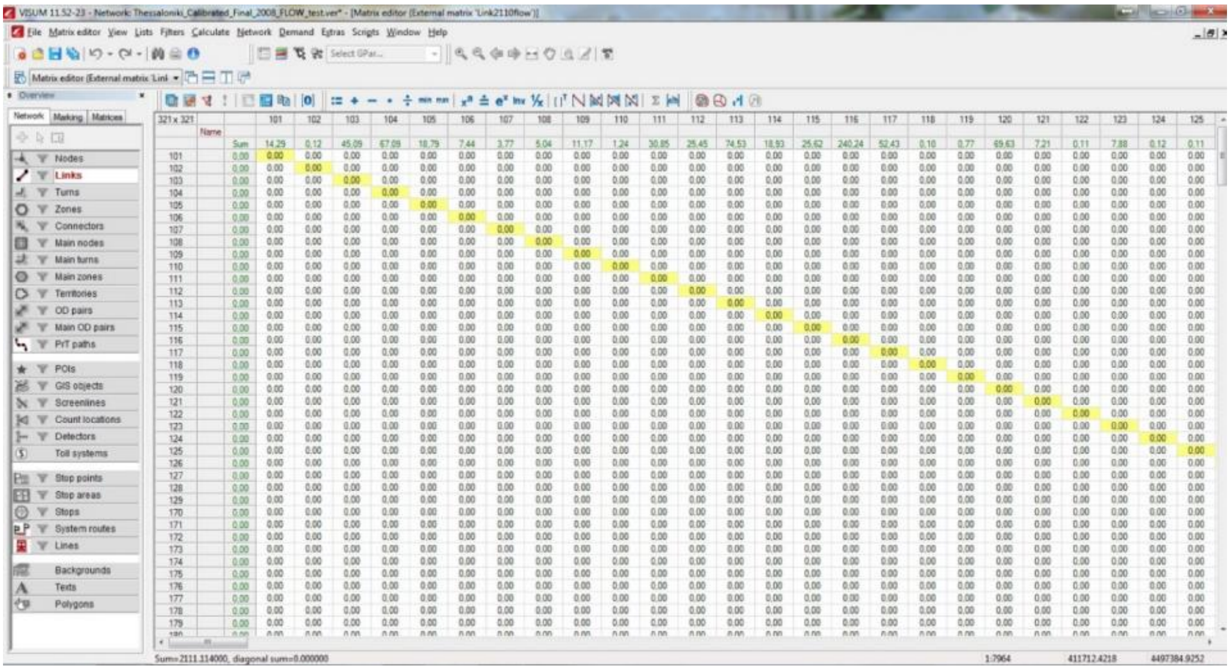
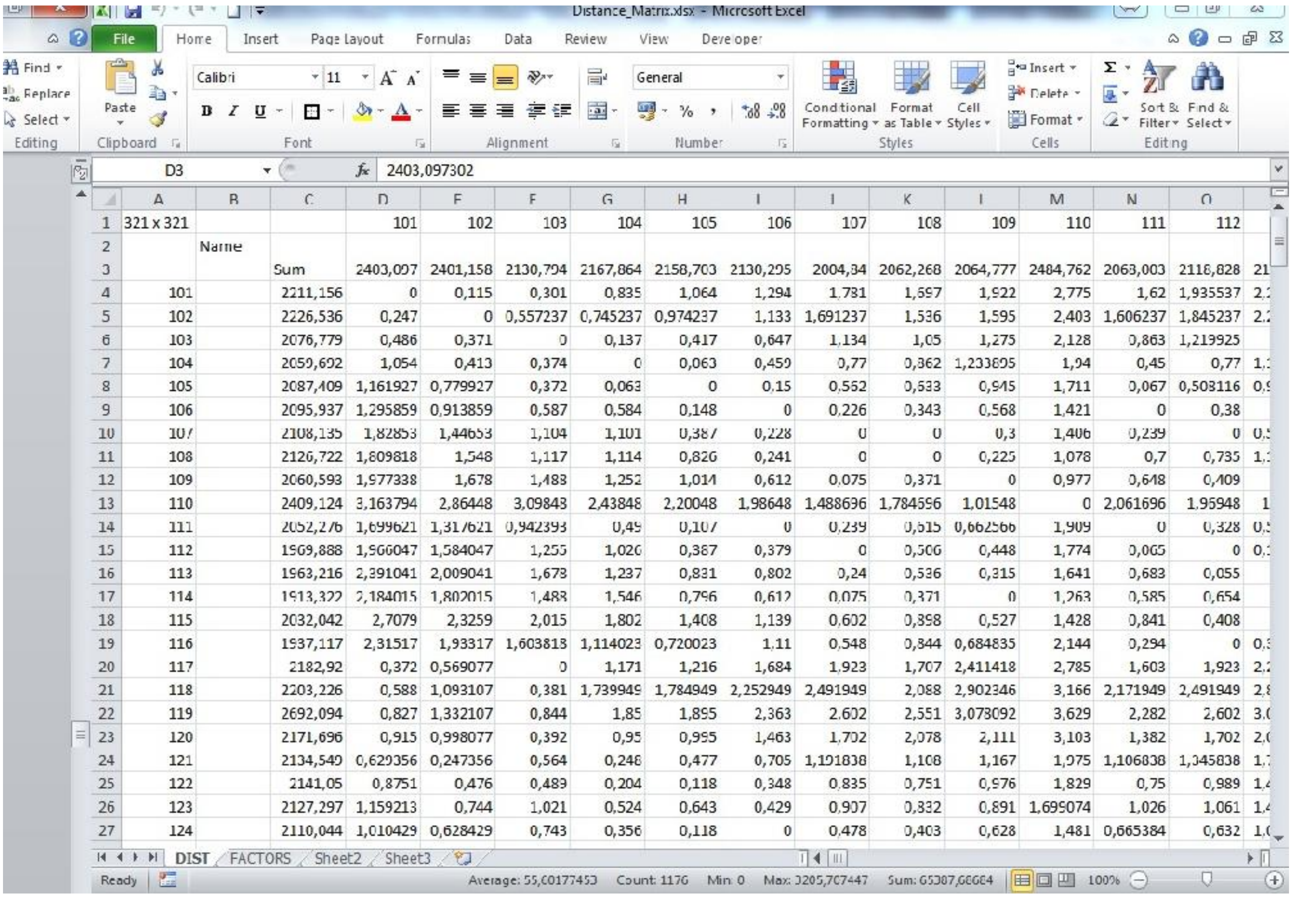


Image 13: OD matrix from flow bundle process on link 4364 in Thessaloniki (Source: TheTA)

The OD matrix has 321x321 OD pairs (the existing model has 321 zones) and 2110 vehicle trips in total.

The three matrices from the selected links where combined resulting in a matrix that contained all the vehicle trips using the selected links. To convert those into person trips, the matrix was multiplied by a 1.2 factor which is the average car occupancy in Thessaloniki. The outcome of this process was named matrix “A”.

From the existing model a matrix with all the OD pair distances was exported (Image 7).



321 x 321			101	102	103	104	105	106	107	108	109	110	111	112
	Name													
		Sum	2403,097	2401,158	2130,794	2167,864	2158,703	2130,295	2004,34	2062,268	2064,777	2484,762	2063,003	2118,828
101		2211,156	0	0,115	0,301	0,835	1,064	1,294	1.781	1,597	1,922	2,775	1,62	1,935537
102		2226,536	0,247	0	0,557237	0,745237	0,974237	1,133	1,691237	1,536	1,595	2,403	1,606237	1,845237
103		2076,779	0,486	0,371	0	0,137	0,417	0,647	1,134	1,05	1,275	2,128	0,863	1,219925
104		2059,692	1,054	0,413	0,374	0	0,063	0,459	0,77	0,362	1,233895	1,94	0,45	0,77
105		2087,409	1,161927	0,779927	0,372	0,063	0	0.15	0.552	0,533	0,945	1,711	0,067	0,503116
106		2095,937	1,295859	0,913859	0,587	0,584	0,148	0	0.226	0,343	0,568	1,421	0	0,38
107		2108,135	1,82853	1,44653	1,104	1,101	0,387	0,228	0	0	0,3	1,406	0,239	0
108		2126,722	1,809818	1,548	1,117	1,114	0,826	0,241	0	0	0,225	1,078	0,7	0,735
109		2060,593	1,977338	1,678	1,488	1,252	1,014	0,612	0.075	0,371	0	0,977	0,648	0,409
110		2409,124	3,163794	2,86448	3,09843	2,43848	2,20048	1,98648	1,488696	1,784596	1,01548	0	2,061696	1,95948
111		2052,276	1,699621	1,317621	0,942393	0,49	0,107	0	0.239	0,515	0,662566	1,909	0	0,328
112		1969,888	1,966047	1,584047	1,255	1,026	0,387	0,379	0	0,506	0,448	1,774	0,065	0
113		1963,216	2,391041	2,009041	1,678	1,237	0,831	0,802	0,24	0,536	0,315	1,641	0,683	0,055
114		1913,322	2,184015	1,802015	1,488	1,546	0,796	0,612	0.075	0,371	0	1,263	0,585	0,654
115		2032,042	2,7079	2,3259	2,015	1,802	1,408	1,139	0.602	0,398	0,527	1,428	0,841	0,408
116		1937,117	2,31517	1,93317	1,603818	1,114023	0,720023	1,11	0.548	0,344	0,684835	2,144	0,294	0
117		2182,92	0,372	0,569077	0	1,171	1,216	1,684	1.923	1,707	2,411418	2,785	1,603	1,923
118		2203,226	0,588	1,093107	0,381	1,739949	1,784949	2,252949	2,491949	2,088	2,902346	3,166	2,171949	2,491949
119		2692,094	0,827	1,332107	0,844	1,85	1,895	2,363	2.602	2,551	3,078092	3,629	2,282	2,602
120		2171,696	0,915	0,998077	0,392	0,95	0,995	1,463	1.702	2,078	2,111	3,103	1,382	1,702
121		2134,549	0,629356	0,247356	0,564	0,248	0,477	0,705	1,191838	1,108	1,167	1,975	1,106838	1,345838
122		2141,05	0,8751	0,476	0,489	0,204	0,118	0,348	0.835	0,751	0,976	1,829	0,75	0,989
123		2127,297	1,159213	0,744	1,021	0,524	0,643	0,429	0.907	0,332	0,891	1,699074	1,026	1,061
124		2110,044	1,010429	0,628429	0,743	0,356	0,118	0	0.478	0,403	0,628	1,481	0,665384	0,632

Image 14: OD distance matrix for Thessaloniki (Source: TheTA)

The distance matrix was then used to create a factor matrix for each OD pair based on the assumption that bike trips follow the distribution displayed on Table 1.

Table 32: Factors for bike modal split according to trip distance

Distance	0-10 km	10-20 km	➢ 20 km
Factor	10% of total trips	5% of total trips	0% of total trips

Matrix “A” was then multiplied by the factor matrix resulting in a matrix that represents the person bike trips of the network. This matrix was divided by 1.2 to convert into a vehicle trip matrix named “B”.

This matrix was subtracted from the original model’s vehicle trip matrix resulting to a new OD matrix that did not include bike trips. This total number of bike trips that was subtracted from the original number of 75911 vehicle trips was 365 veh. trips.

The new reduced OD matrix was assigned to the network with the reduced capacity due to the introduction of the bike lanes. The summary statistics regarding public transport (which is TheTA’s focus) from the two runs are displayed in Images 8. From the comparison between the summary statistics is clearly demonstrated that there are benefits from the implementation of the bicycle lanes for the public transport network. For example the comparison for the mean journey times demonstrates that on average there is a two minute gain for the mean journey time for public transport.

SCENARIO	Without Cycle Lanes	With Cycle Lanes
Mean Journey Time	38.23 (Min)	36.16 (Min)
Total Journey Time	30216 (Hours)	28442 (Hours)
Mean Journey Distance	5.754 (km)	5.533 (km)
Total Journey Distance	270735 (km)	260363 (km)

Table 33: Comparison between two scenarios in Thessaloniki, summary PuT statistics

29.4. Conclusion and lessons learned

The experience of participating in FLOW allowed TheTA to enhance its capacity on transport modelling and revitalise its 2008 macroscopic model. The practice of using VISUM to assess cycling and walking schemes can prove really valuable towards achieving the holistic approach on transport that constitutes our organisation’s vision.

Data availability constitutes a significant barrier in our effort to provide all the necessary input for applying the roadmap and especially for utilising the FLOW impact assessment tool. Once again, the issue of common KPIs and standardised methodologies of collecting and keeping data, emerges.

The other local stakeholders that were involved and provided part of the data were keen to participate in the whole process and eager to see the results of the implementation of the FLOW methodology. There was a degree of disappointment with regards to the actual results since, as analysed previously, in this document there were certain aspects of benefits that were severely underestimated due to the lack of the necessary data input.

Based on our experience a field that would be worth investigating is how to maximise the use of new technologies in data gathering and afterwards how to interrogate in a suitable and optimum manner all the collected datasets and databases.

Overall, the experience of participating in FLOW was really beneficial for our organisation, it allowed for knowledge and skill enhancement and it added arguments in our constant effort towards providing sustainable mobility services to our citizens.

30. Action plan and outlook

30.1. Short-term planning

The next step will be to initialise TheTA's involvement with microscopic modelling by trying to model major interchanges where users will need to switch or transfer from one mode to the other with or without their bikes.

The Authority needs to obtain the necessary software tools to run such simulations (microscopic modelling software packages) and develop its knowledge in order to utilise them. In this effort the FLOW methodological approach and guidance may prove rather helpful.

30.2. Long-term perspective

Project FLOW allows the revival of the TheTA's neglected VISSUM transport model. Furthermore, it provides an opportunity for the Authority to enhance its knowledge on modelling and benefit from European best practises. Finally, FLOW's approach adds to TheTA's holistic approach towards mobility providing the Authority with an additional tool to assess and plan transport schemes.

Applying the full FLOW methodology initially for the test scheme covered by this report and at a second stage for Thessaloniki's whole cycle network is one of TheTA's goals regarding FLOW project. Acquiring plans regarding cycle from all other 13 municipalities of the Regional Unit is also a prerequisite for the further enhancement of the benefits from TheTA's involvement in FLOW project.

Annex A – Key stakeholders

Greater Manchester

Stakeholder identification for FLOW City Manchester				
Stakeholder category	Name of organisation and if possible contact person	Details/Comments: Describe briefly what this stakeholder does, why they are important and how their role could changes over time	Influence (high/ medium/ low)	Stake (high/ medium/ low)
Project team – planning and implementation				
Districts (local Authorities)	Transport Strategy Group	TSG is the umbrella forum at which transport strategy issues across Greater Manchester are discussed with transport planning officers from the 10 local authority districts.	Medium	Medium
Districts (local Authorities)	Manchester City Council	Sponsor for the Chorlton Cycleway scheme. They work closely with TfGM to implement	High	High
Cycling Commissioner	GMCA (Greater Manchester Combined Authority)	Emergent stakeholder with significant responsibility for active mode promotion within Manchester.	High	High
Transport Agency	TfGM	Internal stakeholders within projects development, transport strategy, highway forecasting and the cycling and Walking teams.	High	High

Izmir

Stakeholder identification for FLOW City IZMIR				
Stakeholder category	**Name of organisation and if possible contact person**	**Details/Comments: Describe briefly what this stakeholder does, why they are important and how their role could changes over time**	**Influence (high/ medium/ low)**	**Stake (high/ medium/ low)**
Project team – planning and implementation				
Transportation Planning	**Transportation Planning Department of the Greater Municipality of Izmir,** **Mert Yaygel (director)**	Plans and implements possible flow-related projects in coordination with other stakeholders. Initiates the planning process, oversees the development and implementation of the projects.	**High**	
Transportation Planning	**Cycling and Pedestrian Accessibility Unit,** **Ozlem Taskin Erten (coordinator)**	**Provides input on cycling and pedestrian accessibility-related know-how and feedback on the planning and implementation of projects**	**High**	**Medium**
Transportation Planning	**Transportation Planning Design Development Unit,**	**Provides project design development and construction-related documentation for the planning and implementation of projects**	**High**	**Medium**

	Fatma Garip Dilber (coordinator)			
Cooperation partners				
Urban Traffic	**City Traffic Monitoring Department** **(M. Ali Bodur, Director)**	**Provides traffic-related feedback and consultation in the development and implementation of projects, such as signalization, signage, right-of-way etc.**	**Low**	**Medium**
Construction	**Technical Services Department of the Greater Municipality of Izmir** **(Murat Varlıorpak)**	**Oversees and realizes the construction of the projects, manages post-construction activities such as repair etc.**	**Medium**	**Medium**
Outside influencers				
Planning	**Chamber of Urban Planners**	**Provides feedback and support on urban-related issues.**	**Low**	
Architecture	**Chamber of Architects**	**Provides feedback and support on architectural-related issues.**	**Low**	**Medium**
NGO	**Cycling Societies (several)**	**Provides feedback and support on cycling-related issues.**	**Low**	**Medium**

Örebro

Stakeholder identification for FLOW City Örebro				
Stakeholder category	Name of organisation and if possible contact person	Details/Comments: Describe briefly what this stakeholder does, why they are important and how their role could changes over time	Influence (high/ medium/ low)	Stake (high/ medium/ low)
Project team – planning and implementation				
Municipal unit	City planning dpt. Örebro municipality	Responsibility for urban planning and traffic planning Also responsible for the street project Hertig Karls Allé along which there will be a new bicycle lane.	High	High
Municipal unit	Technical dpt. Örebro municipality	Responsible for the building and maintains of the cities infrastructure.	High	High
Cooperation partners				
Private company	Sweco	The Company how made the traffic model and traffic analysis of the street	Low	Low
Private company	WSP	The Company how is responsible of producing the building plans for the street.	Medium	Medium
Outside influencers				

Local government	Örebro Kommun, city planning department	Have the overall say and responsible for the budget on the project.	High	High
Regional government	Region Örebro	Representatives of companies take part in the project, as they are the ones how plans and operates the city- and regional buses.	Medium	Medium

Pisa

Stakeholder identification for FLOW City Gdynia				
Stakeholder category	**Name of organisation and if possible contact person**	**Details/Comments: Describe briefly what this stakeholder does, why they are important and how their role could changes over time**	**Influence (high/ medium/ low)**	**Stake (high/ medium/ low)**
Project team – planning and implementation				
Local Public Authority	**SpA Navicelli** **Marilena Branchina**	**Public company in charge of the management of the integrated transport at local level (included the inland waterways) and responsible for research and development of European projects.**	**High**	**High**
Local Public Authority	**Pisamo SpA** **Marco Bertini**	**Public local agency for transport-responsible of the implementation of measures, informatics skills and technology regarding the local transport**	**High**	**High**
Cooperation partners				
Private company in transport sector	**Kiunsys srl** **Paolo Lanari**	**InesCloud platform and Tap&Park application in use to the city. Kiunsys is the local technical and informatics expertise in order to define and develop and customize IT tools applied to mobility**	**Medium**	**Medium**

Private company in the ICT sector applied to transport sector	**Cubit scarl** **Marco Magnarosa**	**Local expertise in terms of ICT solution and applications, partner of Kiunsys**	**Medium**	**Medium**
Outside influencers				
Research centre	**National Research Council**	**Developer of IT solutions for cycling, i.e. bike-use-map based on real observation of local trips made with GSM localisation**	**Medium**	**Medium**
Research centre	**University of Pisa**	**Developer of IT solutions and provider of expertise in transport sector**	**Medium**	**Medium**
Associations	**FIAB-Local associations for cycling**	**Influence the change of behaviours, cooperation to set new measures, experiment new policies**	**Medium**	**Medium**
Other public institutions	**Schools**	**Influence the change of behaviours, cooperation to set new measures, experiment new policies**	**Medium**	**Medium**

Ploiesti

Stakeholder identification for FLOW Exchange City XY					
Stakeholder category	Name of organisation and if possible contact person	Details/Comments: Describe briefly what this stakeholder does, why they are important and how their role could changes over time	Influence (high/medium/low)	Stake (high/medium/low)	Influence -Interest Matrix (see figure below this table) (A,B,C,D)
Project team – planning and implementation					
Local authority	Ploiesti Municipality – International Department	As local authority, Ploiesti Municipality aims to develop projects in order to grow the community under the principles of sustainable development strategy.	High	Low	B
Local authority	Technical Direction	Providing specific information and expertise on PT and road	High	Medium	B
Local Transport Company	Express Passenger Transport Ploiesti	Providing specific information and expertise on PT	High	Medium	B

Cooperation partners					
NGO (local authorities association)	**Intercommunity Development Associations – Ploiesti Prahova Growth Pole**	**Goal: to facilitate cooperation between the member local authorities in order to administrate their community according to the sustainable development principles, respectively:** **-social progress according to the community needs;** **-protecting the environment;** **- rational use of resources.**	**Medium**	**Medium**	**B**
NGO	**Ploiesti Prahova Energy Efficiency and Renewable Energies Agency**	**Mission:** **-promoting energy efficiency and alternative energy sources;** **-implementing projects within energy efficiency field;** **- informing, training, disseminating and raising awareness campaigns in energy efficiency and**	**Medium**	**Medium**	**B**

		alternative energy sources field.			
University	Petroleum and Gas University of Ploiesti	Involved in the teaching of the next generation transport planners	High	High	B
Outside influencers					
County government	Prahova County Council	Mission: to administrate the Prahova County. Ploiesti city is the capital of Prahova County.	Medium	Medium	B
Politicians	Mayor of the city	Representing the final decision maker	High	Low	B
Politicians	Local Council	Mission: to administrate the Ploiesti city	High	Low	B
Private investors	Urban developers	Have some lobby power	Low	Low	A

Tallinn

Stakeholder identification for FLOW City Gdynia				
Stakeholder category	**Name of organisation and if possible contact person**	**Details/Comments: Describe briefly what this stakeholder does, why they are important and how their role could changes over time**	**Influence (high/ medium/ low)**	**Stake (high/ medium/ low)**
Project team – planning and implementation				
Department of the City Government	Tallinn Municipal Services Department	Responsible of building and maintaining the city roads. Managing body of the Tallinn Cycling Strategy.	High	High
	Tallinn City Planning Department	Responsible of designing the streets.	High	High
	Tallinn Transport Department	Responsible of planning the urban traffic. Managing body of the city's public transport system.	High	High
	Tallinn Environment Department	Responsible for reducing the greenhouse gas emissions, developing green areas in the city.	Medium	Medium
	Tallinn City Enterprise Department	Responsible for bike sharing system and tourism in the city.	Low	Low
	Tallinn City Council Office	Decision making body of the City Government, responsible of the financing of the projects.	High	High

	Tallinn District Administrations	Responsible for the district specific decision making and development.	Medium	Medium
	Tallinn Education Department	Responsible for the schools' campaigns and awareness raising in the city.	Medium	Medium
	Tallinn Sports and Youth Department	Responsible for providing good sporting and leisure conditions for citizens in the city.	Medium	Medium
Cooperation partners				
Private companies	Bikeep, Ridango, etc.	Providers of requested devices and infrastructure	Low	Low
Outside influencers				
National Government	Estonian Ministry of Economic Affairs and Communication	Responsible for financing the nationwide projects.		
National Government	Estonian Road Administration	Responsible for collecting and analysing cycling safety and accidents and building and planning the regional cycling infrastructure. Conducting the nationwide campaigns mainly on road safety including cycling safety.		
NGO	Estonian Urban Cyclist Union	Cyclist organisation	Medium	Medium

NGO	**Initiative Cyclicious Estonia**	**Cyclist organisation**	**Medium**	**Medium**

Thessaloniki

Stakeholder identification for FLOW CityThessaloniki				
Stakeholder category	**Name of organisation and if possible contact person**	**Details/Comments: Describe briefly what this stakeholder does, why they are important and how their role could changes over time**	**Influence (high/ medium/ low)**	**Stake (high/ medium/ low)**
Project team – planning and implementation				
Metropolitan Area Authority	**TheTA S.A.**	**Authority responsible for planning, monitoring and deciding any measures, policies, decisions etc. related to public transport in the regional unity of Thessaloniki. Implementing measures or policies to enhance intermodality is also included among the authorities main tasks.**	**High**	**Medium**
Municipal unit (Municipality of Thessaloniki)	**Department of Sustainable Mobility of the Municipality of Thessaloniki**	**Unit responsible for designing and implementing bicycle schemes in Thessaloniki** **Also unit responsible for developing SUMP at municipal level**	**High**	**High**
Municipal units (other 13 Municipalities of Thessaloniki's regional unit)	**Respective departments of all other 13 municipalities**	**Same as above**	**High**	**High**

Operator	**OASTh, bus operator**	**Only available public transport operator at present.**	**Low**	**Medium**
Regional Unit	**Thessaloniki's Regional Transport Department**	**Responsible for the main transport policy aspects in the Region**	**Medium**	**Medium**
Cooperation partners				
Initiative	**SKG bike project**	**Help make Thessaloniki the next best place in Europe for using a bicycle**	**Low**	**Low**
Outside influencers				
Schools	**---**	**Representatives of schools taking part in cycling campaign for schools**	**Low**	**Medium**
Informal group		**Representatives of groups taking part in cycling campaign for citizens**	**Low**	**Medium**

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