

## **Sustainable Mobility in Cities: Reducing the Carbon Footprint of Transportation in Tübingen**

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### **1 ABSTRACT**

The on hand paper describes an approach that aims to reduce the carbon footprint of transport in the city of Tübingen (Germany) to 50 percent until 2030. While the total amount of carbon emissions in Germany has been decreasing in past 20 years, the transport sector has still raised its percentage. Moreover the mobility needs of our society have grown notably.

The author describes insights of a model project taking place in Tübingen. Tübingen is a mid-sized city located in South Germany near Stuttgart with about 85.000 inhabitants. Already today Tübingens transport system and the mobility of the inhabitants are exemplary in terms of sustainability (e.g. modal split, distances). However the local city council is ambitious to pass a resolution and implement applicable measures to reduce the greenhouse gas emissions.

Within this project, different strategies of urban and regional development, transport planning as well as technical approaches will be described and assessed concerning their efficiency by using transport models and computation tools. In several workshops including local stakeholders these strategies are being adopted and assumed regarding efficiency and acceptance to meet the -50 percent goal. At the end the city council is going to discuss the results and decide a masterplan with innovative measures for a sustainable mobility in Tübingen. After a successful pilot project the measures will be implementes and the experiences will be carried out to other cities in Germany and Europe.

### **2 INTRODUCTION**

Over the past decades the consumption of resources and greenhouse gas (GHG) emissions has raised dramatically. In 2007 the transport sector caused more than 25 percent of the annual GHG emissions in fuel combustion of the European Union, whereas 94 percent were caused by road transportation. While in Germany the total amount of emissions has been decreasing between 1990 and 2004 the transport sector's has still amplified [UNFCCC (2007)]. In the first place the reason for this development was the growth of the transport volume during the 1990s [Kolke et al (2003), p.1]. Even though there was no significant raise of the transport volume after 1999 latest studies assume in a Business-As-Usual-Scenario for 2030 that a considerable raise of the transport volume and consequently no significantly reduction of carbon dioxide (CO<sub>2</sub>) in the transport sector are expected [Zimmer (2008), p.1]. Usually, CO<sub>2</sub> is used synonymously as an indicator for GHG as it has by far the biggest share in the total amount.

The mitigation of GHG emissions is one of the great challenges cities have to cope with at the beginning of the 21st century. Even in consideration of the expected technological progress in vehicular technology the headline goal of creating liveable, healthy and prosperous cities for everyone leads to the necessity of changing the way urban transportation is practised in most cities today. Today, more than 74 percent of the population in Europe live in cities. The process of urbanization is still going on worldwide. This means, that new solutions for future mobility in an urban context need to be found. [Beckmann (2009) p.71]. The case study is supposed to make an example, how climate protection in the transport sector can be implemented by achieving co-benefits for the city and its citizens. The project takes part in Tübingen because a lot effort in terms of climate protection has ben taken by this city already and the next step for further GHG mitigation needs to be found.

For Tübingen, a mid-sized city in Southern Germany with about 85.000 inhabitants, a model project is implemented in which an over-all-streategy aiming towards sustainable mobility for the city region will be developed in cooperation with local stakeholders. The pilot project is initiated in cooperationwith the Federal Environment Device within the scope of the initiative for climate protection program of the ministry

The objective of the case study is the design of a masterplan that is supposed to be implemented continuously during the next two decades. To avoide contraproductive effects of particular measures and to

exploit the potentials of generating synergies an integrated communal concept for climate protection is necessary. The preparation and implementation of these integrated concepts require diverse cooperations between different actors (politics, administration, economy, non governmental organisations, civil society, etc.). Especially the acceptance in public is seen as a key issue for the success of ideas and strategies in transportation planning [Beckmann (2009) p.74]. During the process of finding a suitable strategy different forms of participation will be implemented. At certain stages of the project the city council is going to discuss and resolve certain milestones of the project. Finally the council is going to decide a master plan including innovative concepts for a sustainable mobility over the next 20 years. An associated participation of local stakeholders and the support of political opinion leaders are considered to be a substantial need for the realisation of substantial strategies.

The headline goals of the concept have already been resolved:

- Climate protection: 50 percent less CO<sub>2</sub> emissions of the transport sector.
- Improve the accessibility of targets in everyday life for everyone.
- Improvement of the urban and residential quality (eg. noise, pollution, housing environment, maintenance, space consumption).
- Strengthening the local economy and research in the city centre, city districts and outskirts.
- 50 percent less fuel consumption.

The concept “Mobility 2030 Tübingen” will contain a package of measures in order to the addressed actors and the time frame of their intended implementation. As every city has got its individual characteristics of the transport systems the concept for Tübingen will not be applicable to other cities. The methodology, the principles of the process and certain experiences can be helpful to other cities on the way to sustainable mobility. After a successful implementation it can make a good example of sustainable mobility whilst taking the climate protection goals into account.

The impacts of many transport planning measures have not been evaluated satisfyingly yet. One reason for that is that the effects of single actions can hardly be pointed out as always interferences occur between them and other changes within a city and the surrounding region. Consequently the effects differ from one city to another. The traffic impact of classic instruments in transport planning, mostly infrastructure, operating and pricing, can be simulated by using transport models such as VISUM, emme or TransCAD. During the last years the meaning of soft measures has increased in communal transport planning. While these instruments of information, communication and marketing have become more important in practice, it is not possible to simulate their impacts by using transport models. Also scientifically underrepresented are the effects of regional and urban planning on the mobility behaviour of people. It is obvious that there is a strong relation between the qualities of an area a person lives and her transport modal choice but the importance of the meaning for mobility behavior cannot be proved by debatable studies yet.

### **3 THE CARBON FOOTPRINT OF URBAN TRANSPORTATION**

Scope of the study will be the everyday mobility of citizens, a field which can most likely be affected by communal measures. By realising this project the city of Tübingen is going to make an example how sustainable mobility can be realized in a way that delivers a benefit in lifequality to the municipality and the citizens in social, economical and ecological dimensions.

The starting position in Tübingen is relatively good as the city is already known for its green attitude. An active civil society, a mayor from the green party and the majority of the city council members (also from other parties) are basically willing to campaign for environmental issues. Already now, there has been a lot of progress in terms of actions for sustainability in the city.

As described in the previous chapter the energy consumption for personal mobility needs to be reduced significantly to meet global targets on climate reduction. The requirement for systemic and target-orientated activities in climate protection is the evaluation of GHG emissions. The implementation of a continual measuring enables a quantitative validation of the benefits through energy and climate related policies.

To figure out the bottom line of CO<sub>2</sub> -emissions in transportation different computation tools are available. Some of them are based on the consumption of resources by a certain population (e.g. ECO<sub>2</sub> Region by

Climate Alliance - Alianza del Clima [ECOSPEED]) while others use consumption data of households (e.g. R.E.A.P. by The Stockholm Environment Institute [SEI]).

Furthermore there are a few tools available which have a territorial reference (mobilev by the Federal Environmental Agency of Germany). The last mentioned tools use data of transport models as an input in combination with national statistics. For this reason it is possible to simulate a change of the situation by using these tools. Most models work with data from national statistic which can be specified by local references.

In case of Tübingen the choice for the applied approach was made through the scope of the study which is the municipal boundary. By using a transport model based tool it is possible to calculate the emissions in a certain area whereas consumption bases tools are not able to do so. In Tübingen this fact is of particular importance because there is a high number of daily commuters from the region. In fact, the number of commuters coming into the city every day corresponds to one quarter of the population.

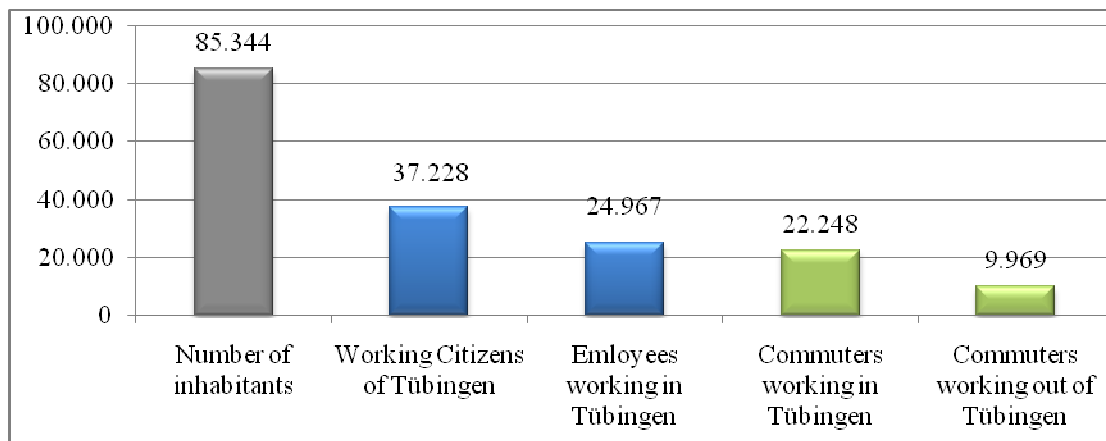


Figure 1. Commuters to and from the City of Tübingen, 2008 (source: Land Statistical Office Baden-Wuerttemberg)

The chosen method uses the demand data of a transport model in combination with an environmental computation tool. As there is only a network model of motorised individual transport available the emissions of public transportation will be calculated based on the fuel consumption of the vehicle fleet.

Basically the computation tool uses the length of a street section in the network model in combination with the traffic volume on this particular section. To enhance the accuracy of the bottom line certain characteristics of each street section will be considered. The longitudinal slope of a streetssection, the frequency of stop and go and other properties are used to describe a section. Furthermore the structure of the local vehicle fleet can build another data input. In this way it is possible to achieve a preferably precise result. The database the software uses for vehicle related emissions is taken from The Handbook Emission Factors for Road Transport (HBEFA 3.1) [INFRAS 2010]. In the end, of course the accuracy of the calculation depends on the quality of the available transport model.

#### 4 REDUCTION OF GREENHOUSE GAS EMISSIONS IN URBAN TRANSPORT

Cities are the key for climate protection on the local level. The maxim by taking action for climate protection is the triad of

- avoiding transportation,
- changing the modal split and
- making transportation more efficient.

By doing so the mobility for economy and society has to be at least maintained. At the same time it needs to cause less traffic or (by a more efficient use of resources) make the necessary traffic as environmental compatible as possible [Deutscher Städtetag (2008) p.12].

To reduce the emissions of the transport sector it needs to be explained briefly, how transportation comes off. Based on the 4-steps-algorithm of network modelling transportation is a product of four factors:

- Trip generation describes the number of people covering a distance between two points. This factor depends on the necessity or the need of doing an activity like going to school, walking to the bakery or driving to the sports club.
- Trip distribution means the length of the trips being done.
- Transport mode choice considers the way of travelling, eg. by car, bus or by foot.
- Trip assignment.

The factors Trip generation, trip distribution and mode choice have relatively strong impacts on the GHG emissions in the transport while trip assignment mainly affects the local emissions like noise and particles. Nevertheless the route choice also makes an impact on the global emissions as the consumption of fuel depends on the fluency of traffic. In this study it is not going to be specified in particular as the scope is more on a strategic level. But of course, sustainable transportation aims to enable a fluently transportation in the city as it is.

Of special interest concerning the GHG bottom line is the technology used in transportation. In context of mobility in a city the emissions of motorized individual traffic deliver by far the biggest share within the transport sector. During the last years climate protection became a topic of public attention. Meanwhile the CO<sub>2</sub>-emissions of cars became an indicator discussed in media and politics. In midyear 2009 a CO<sub>2</sub>-related tax has been introduced by the German government. As resolute by the European Commission in 2007, the maximum emissions for produced cars within the EU must not exceed 120 g/km from 2012. At the moment the average amount of newly registered cars is about 154 g/km (April 2009, [Deutscher Bundestag (2009)]).

On the local level there are a couple of instruments to regulate emissions, like the city toll in reference to the particulates a car emits or restrictions to reduce noise immissions. Concerning the emission of GHG there are no direct instruments for local transportation planning available in Germany. Still there are options to promote the preference of smaller engine vehicles e.g. in terms of user advantages.

In summary, it can be statet that cities are supposed to use their communal planning authority for the purpose of a transport-saving landuse and economical development. Particular focus should be on

- internal development before external development,
- stronger integration of transportation and town planning,
- improving public transport within the city and to the surrounding region and
- promoting bicycle use.

The measures of a consequent parking management should be implemented and the activities of administration and economy in mobility management supported [Deutscher Städtetag (2008) p.12]. To figure out, where to potentials for the above mentioned measures are, a division of study areas will be made. Therefor the areas of the transport model will be aggregated and so a first overview of different approaches for CO<sub>2</sub> reduction can be given.

In the next step, different scenarios on the development of transportation will be developed to see what is necessary to achieve the 50 percent goal. Therefor a Business-As-Usual Scenario will show, what is going to happen if no further action is undertaken.

#### **4.1 Detection of Mitigation Potentials**

In order to reduce the GHG emissions in transportation the current transport needs to be analysed. Based on a suitable structured transport analysis the potentials of mitigation can be defined. In case that a transport model is available, it has shown to be useful to determine study areas of a relatively homogenous urban structure. Indicators to use for the division of these areas can be density, land use, location, connectivity, etc. (depending on the individual characteristics of a study area. The division of the network model should be used as a baseline. The new devision is a very helpful step to simplify and better understand the given situation. After that the transportation volume within and between these new areas can be presented in a transportation demand matrix. Figure 2 displays the division of the new areas in Tübingen as well as the daily driven kilometers by car.



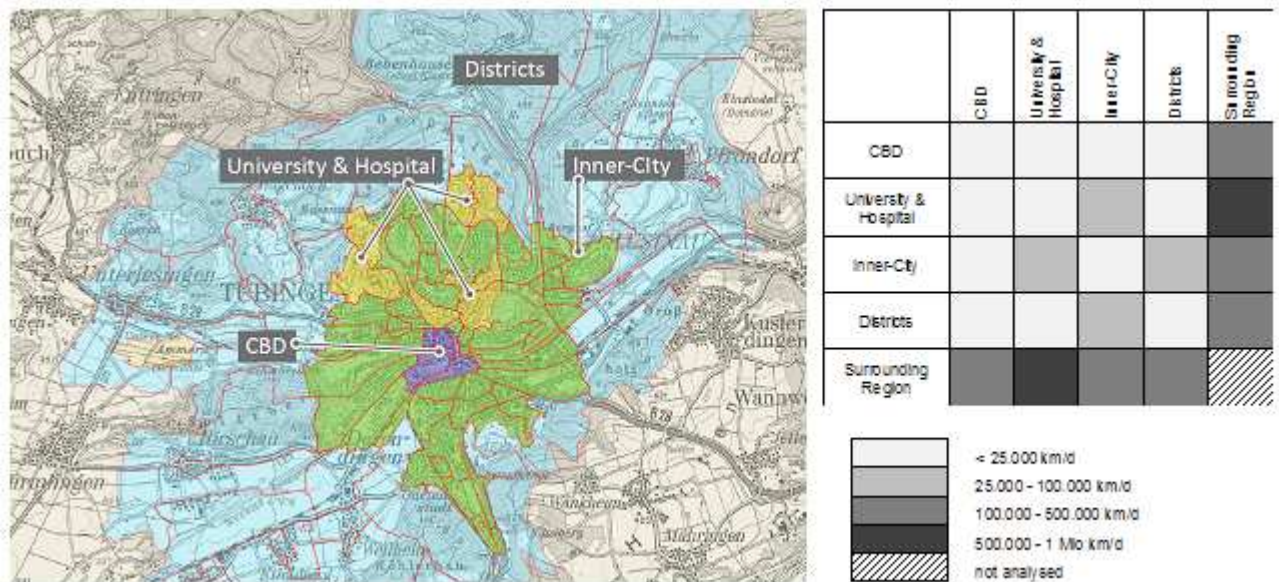


Figure 2. Division of study areas in Tübingen (map) and Transportation Demand Volume (matrix)

This matrix displays distinctly that most car traffic is caused by passengers travelling between the city and the surrounding region. Also clear from the transportation demand matrix is that there is a significant high number of commuters travelling to and from the university and the hospital. These facilities are the most important employers and both of them cause a lot of additional traffic eg. trips for education or visiting. Based on this matrix it is now easier to assume the impact of different measures in the next step by defining on which connection a measure has potentially the highest effect. For example the promotion of walking would show an impact on the domestic traffic within the areas.

The evaluation of additional data material gives indication about the mobility behaviour of the inhabitants. As to be seen in Figure 3 the modal split based on a household survey confirms that the shifting potential can be found in the regional traffic. While there is a comparatively environmental friendly modal share in the domestic traffic the internal-external trips are by far mostly done by car. Additionally the distance of the internal/external trips corresponds more than four times the distance of trips in the domestic traffic (24 km to 4,9 km) [SVT (2008)].

Even though the share of cycling and walking comes to 48% there is still a certain potential for the promotion of unmotorized transport on short distance as to see in Figure 4. Every fourth trip by car is shorter than 2,5 kilometers and more one third of all car trips are shorter than 5 kilometers. These potential need to be discovered and form the strating line for the measure development. Two components of the process to design a master plan will be described in the following chapter.

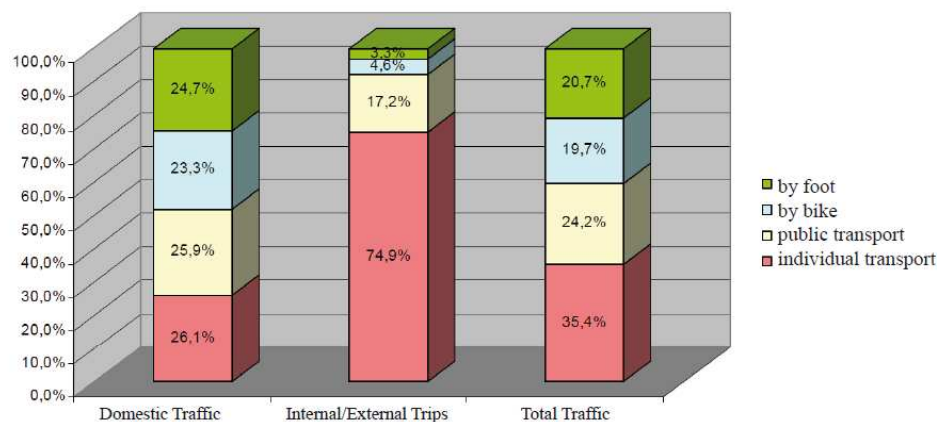


Figure 3. Modal Split in Tübingen (source: Householdsurvey by SVT Tübingen, 2008)

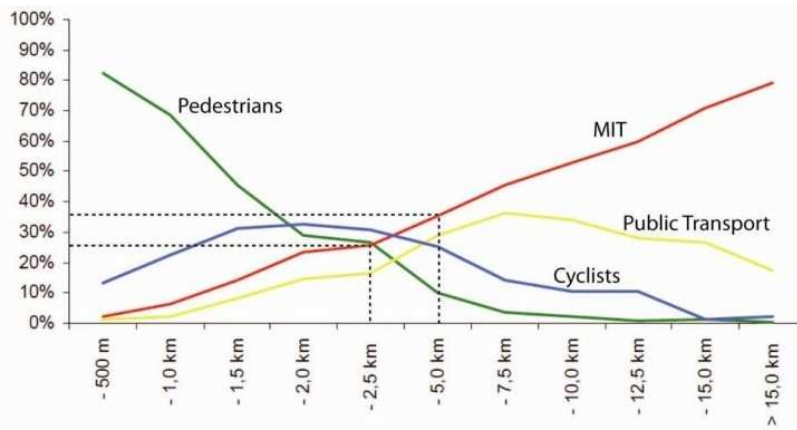


Figure 4. Trip distance and transport mode in Tübingen (source: Householdsurvey by SVT Tübingen, 2008)

### 4.2 Scenario 2030

The applied method to figure out what is necessary to meet the 50% goal is a scenario technique with a given target value. At first a “Business-As-Usual” scenario will be defined which describes what happens without taking any additional action until 2030. Therefor national and if available local or regional prognosis about demographic development, trends in mobility and the proposed technological progress are considered. Figure 5 shows the key data of different scenarios.

	Trip generation	Trip distribution	Mode choice	Technology	CO2 Mitigation
Business-As-Usual	+10%	+20%	0	-20%	≈ +10%
Promotion of Ecomobility	+10%	+20%	-15%	-20%	≈ -10%
Electric Mobility	+10%	+20%	-15%	-50%	≈ -40%
Goal: Sustainable Mobility (-50%)	0%	-10%	-15%	-50%	≈ -50%

Figure 5. Overview on Scenarios for Sustainable Mobility 2030 in Tübingen

Looking at the trip generation amongst experts the assumption obtains that the number of activities per day will increase (and as a consequence the number of people travelling grows). At the same time the trip distribution is increasing. Between 1982 and 2002 the distance of the way to work has risen from 9,6 km to 15 km which is more than 50% [INFAS (2004)]. In shopping traffic the development was similar with nealy 50 percent growth. Leisure traffic which is usually claimed as one of the main reasons for the growing volume of motorized individual traffic has nearly remained constantly [Bracher (2009)].

The main reasons for the increasing mobility will also in the future be the economical growth and the increasing individual motorisation [BMVBS (2007)]. Poor spatial planning and urban sprawl are further reasons for an increasing demand for mobility [WWF (2008) p.23]. The demographic change will have a cushioning effect indeed but it will be over compensated by the mobility growth within age and lifecycle groups [BMVBS (2007)].

In the Business-As-Usual Scenario it is assumed that the mode choice does not change within the next 20 years. Even though car-share in the modal split in urban transportation has been decreasing in the last years this trend does probably not continue over a long period. The use of cars might grow within the next year as it is assumed that the car density will become higher. Furthermore the possession of a driving license will increase especially in the elderly age group which might lead to a growing car usage. In consequence it is to take action just for keeping the modal split at the recent level. In theBusiness-As-Usual-Scenario that minimum initiative is assumed.Looking at the technological dimension of transportation the most prognosis show a decreasing consumption of fuel will occure highly propable as a result of technological progress. Already by now, the automotive industrie offers cars in different categories including family vans with not more than about 120g CO2/km. The reaction to the risen interest for environmental friendlier vehicles by the car producing industry is rather tentatively. This development might be reasoned in the fact that a higher profit is achievable for larger engine types. Witin the scope of the economic stimulus package, the German government is investing 500 million Euros for the promotion and market implementation of electric mobility

between 2009 and 2010. Although, the share of electric cars will probably not exceed 10% of the car fleet in Germany in 2030. By taking into account the electricity mix proposed then, a significant reduction of GHG emissions is not to be expected.

Summarizing the four scenarios it shows that only an integrated concept that affects all crucial factors of transportation can achieve this aim. For the concept Mobility 2030 Tübingen this means that a combination of regional and urban development regulations, suitable transportation measures and technological approaches has to be conceived.

### 4.3 The Key Factors to Sustainable Mobility

The finding that the strategy has to work on all these levels leads to the question: “How can a systemic change to sustainable mobility be achieved?”

How can the trip generation be kept on the present level? This question needs to be discussed controversially. On the one hand of course it is desired that people take part in social activities, interact with one another and not at last to create urban culture. In consequence, there is no potential of mitigation by reducing the number of trips is not desired as it would mean an asocial progress. But, on the other hand some undesirable ways could be saved without a loss in life quality. For one person it can be the way to the greengrocery, the post office or an agency. Many trips are made due to inconvenient alternatives in ecomobility such as certain pick-up and delivery services. A possible way to avoid these unpleasant trips can be the promotion of telematics, e.g. homeoffice or e-learning. Another option is a smart coordination of trips through better information and communication.

How will it be possible to shorten the travelled distances?

These approach leads to a city of short distances. Therefor instruments in urban and regional planning have to be implemented. The design and location of spaces and sites affect strongly on the mobility behaviour. With the aims to provide shorter distances for everyday life, suburbanisation needs to be retarded by expanding the slightly visible trend of reurbanisation. Mixed structures and attractive open spaces promote the use of sites in the neighbourhood by walking or taking the bicycle. Also the requirements for good service in public transport are significant better in dense structures. So, rather than realising new developments on the outskirts for housing, recreation or shopping, the focus has to be on internal development. Therefor it seems necessary to promote mixes uses also for existing areas. A definition of quality standards for urban districts and passing a resolution about it would allow the implementation of a blanket upgrading.

How can the choice of the transport mode be influenced?

This question has been discussed in transportation planning over the last 25 years in Germany. There are lots of measures known to attract the transport modes of ecomobility and to give restrictions on the individual car-use. Figure 6 shows a number of measures and their effects on the modal choice. It has been proved in many cities and regions that a combination of push- and pull-measures is significantly more effective than just enhancing the transportation supply and its quality. In classical transportation planning the focus was on hard measures which are more infrastructure-orientated. Within the last years soft policies have gained in importance such as information, communication and coordination.

How can energy friendlier technology be promoted by communal planning?

At first, there are no instruments in transport planning that have a direct relation to the CO<sub>2</sub>-emissions of cars. But the local authority has got some flexible instruments that can be referred to the GHG emissions of vehicles like parking advantages or pricing concepts. With these instruments smaller engines or alternative driving systems can be promoted. To enable electric driving, a special infrastructure for recharging needs to be provided. The requirements for the installation of electric recharging facilities are being researched and tested at the moment (e.g. STROPA-project [IMOVE (2009)] ).

**measures with push-effects**

area-wide parking management, parking space restrictions in zoning ordinances, car limited zones, permanent or time-of-day car bans, congestion management, speed reductions, road pricing ...

**measures with pull-effects**

priority for buses and trams, high service frequency, passenger friendly stops and surroundings, more comfort, park-and-ride, bike-and-ride ..., area-wide cycle-networks, attractive pedestrian connections ...



**measures with push- and pull-effects**

redistribution of carriageway space to provide cycle lanes, broader sidewalks, planting strips, bus lanes ..., redistribution of time-cycles at traffic lights in favour of public transport and non-motorized modes, public-awareness-concepts, citizens' participation and marketing, enforcement and penalizing ...

Figure 6. Push- and Pull Measures (Source: Hartmut Topp, free translation)

## 5 DRAWING UP A CONCEPT FOR SUSTAINABLE MOBILITY

The goal of 50 percent reduction needs an integrated concept that is supported by local decision makers and the involved stakeholders. Therefore a process with the involvement of non-governmental organisations, the city council and representatives of the local economy is substantial for successful realisation.

The project in Tübingen includes three interactive workshop sessions, each one on a certain topic. Furthermore experts contribute input to the workshops on their field of experience. Substantially for the implementation of the plan is a political resolution of the master plan and the contained measures. The assessment of the potential in reducing carbon emissions will be done by using different methods as it will be explained the following chapter.

### 5.1 The Assessment of Mitigation Potentials

The measures to be assessed are deduced from the insights of the analysis, the results of the workshops and the experiences of the involved experts from the Federal Environment Agency and the further experts involved in the project team. The catalogue which is being worked out at the moment will include a wide range of approaches and measures concerning spatial structure, transportation supply, transport management, information and communication. As already mentioned the described study has got an emphasis on the GHG emissions of fuel consumption in transport. For the measure assessment the energy consumption for the realisation of an action will not be considered in the carbon footprint as the frame of this study does not include life-cycle-analysis.

As already mentioned the possibilities of valuating policies can be differently accurate due to the kind of instrument. We defined three different groups that can be described as follows:

- The first group includes a range of measures that can be evaluated in a transport models. Depending on the quality of the input data and assumptions the model contains an estimation of traffical impact can be done relatively solid. Some examples of actions that can be simulated in models are land use development, demographic change, road pricing, speed regulations and parking systems or service improvement in public transport.
- The second group covers measures that have been realized in other cities but cannot be put into a transport model. About some of these actions evaluation data is available; others can only be assessed by experts. The effect of these mostly soft measures can sometimes be hard to figure out as there is always an interference with other actions or developments. For example mobility management, actions of information and communication belong to this group. The only option to rate the impact of these measure on a certain city as e.g. Tübingen needs an assessment by experts by the comparison between the impact to different cities with similar characteristics.
- On the third group are new and innovative ideas that haven't been realized yet or there has just a little experience been made with. These measures can only be assessed in discussion with local



stakeholders and mobility experts. But the reliability of the statements does not have any foundation. They are based on a good understanding of transportation and mobility behavior by a group of experts. Within this project a sort of Delphi-Process to assess the impact of different measure is going to take part at the end of Marc 2010. The participants are experts form different backgrounds that are active in several field of transportation all over Germany.

## 5.2 Political Resolution

Both the participation of local stakeholders and the preparation of the political decision makers are important. We try to deliver early and complete information on the process to all relevant persons. Before the discussion about the project comes up in public and politics it is useful to deliver the right information early. Therefore the involvement of representatives of the civil society, the city council and local stakeholders into the process is necessary. For this reason a project advisory board has been constituted in Tübingen. In the advisory board 30 representatives have the possibility to participate in the progress. The represented groups are in this committee are (partial):

- Mayor of Tübingen
- Leader of the Public Transport Company
- Representatives from the city council (by different parties)
- Important employers
- Local economy
- Non-governmental organization (German association of traffic participants, General German Automobile Association, General German Cycling Association).

In this way input can be brought into the project by stakeholders and at the same time information on the process can be taken out to different institutions. Thereby a lot of local groups and institutions can indirectly take part in the project and the project team gets feedback on the developed ideas. Figure 5 shows the organization chart of the project and displays the different ways of cooperation.

The important milestones of the project will be discussed by the city council such as the heading goals for sustainable mobility, different scenarios how to reach them and finally the measures for implementation. The resolution by the council is a requirement for the realisation of the strategy and the following projects. Particularly important to achieve political acceptance for the concept is to create an understanding for the necessity of action. Especially when it comes to unpopular measures (usually restriction for car use), decision makers need to know what the co-benefits for the civil society and the city are. For this reason the clarification of the gain in all dimensions of sustainability is essential. By only showing the environmental impact on GHG emissions a political acceptance will be hard to reach. And in the end the realisation of the concept needs communal investment wherefor justification and a strong argumentation are necessary.

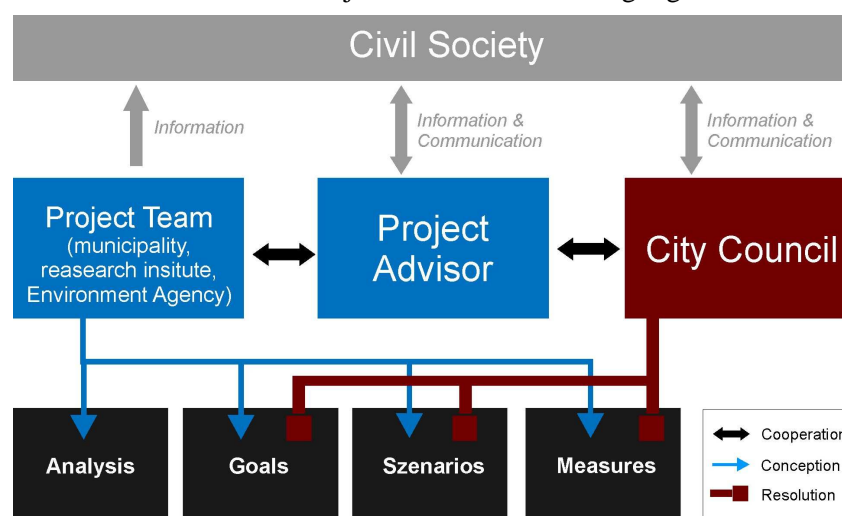


Figure 7. Organization Chart of the project Sustainable Mobility 2030 Tübingen.

## 6 CONCLUSION

The idea of achieving sustainable mobility in cities is not a new one. Several concepts to reduce the environmental impact by transportation are already existant. Mobility and transportation are closely related with space and time, communication, environment, energy, economy and lifestyle which are cross-linked with each other. These complex interrelations lead to the finding that there is not a formula for sustainable mobility [Topp (2004) p.14]. Every town, every region and country needs a concept that is aligned with the issues of local relevance to improve the transportation system, enhance life quality and keep the local identity.

We have models and tools to simulate the impact of certain measures. They can contribute to effective policymaking but they can also lead to poor decisionmaking if policymakers cannot assess the quality of a given application. Moreover many policies and especially innovative concepts cannot be simulated in a model. It needs experience and a solid understanding of transportation systems to assess what a measure can achieve.

Basically clear is that only an integrated approach of urban and regional planning, transportation planning including push- and pull-measures can lead to success. The requirement for the implementation is political support and encouragement for the matter of sustainable transportation. Different forms of participation can help to achieve a better understanding about and higher acceptance for the policies.

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