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Study Bicycles on Board

Bicycle transport

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Bicycles on Board

Integration of bicycle transport in Public Transport, a study in the framework of the 2MOVE2 CIVITAS Plus II

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Figure 1: Bike on board

Abstract

This study is executed in the framework of the CIVITAS project 2MOVE2 Plus II, coordinated by the city of Stuttgart.

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Utrecht- Stuttgart, January 2016

Project Partners

Organization	Country	Abbreviation
Landeshauptstadt Stuttgart	DE	LHS
SSP Consult, Beratende Ingenieure GmbH	DE	SSP
Statutární Mesto Brno	CZ	SMB
Ayuntamiento de Málaga	ES	Malaga
Dopravní podnik města Brna, a. s.	CZ	DPMB
Universität Stuttgart	DE	USTUTT
Tel Aviv-Yafo Municipality	IS	Tel Aviv
Technion – Israel Institute of Technology	IS	Technion

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Summary

It is widely recognized that public transport combined with cycling in before and after transport is an ideal combination. In many countries cyclists are an important feeder of public modalities. In a country like the Netherlands some 33% train passengers come by bike. The ideal combination lies in the fact that bike and public transport combine short (bicycle) and long distance (public transport). As a consequence of this insight public transport operators nowadays play an important role in promoting and facilitating cycling to and from their public transport lines. The strength of the combination is increased by measures such as implementation of parking facilities for bicycles at stations and bus stops, participation in public bike systems and allowing carrying bicycles on public transport modes.

This study is limited on products and services for carrying complete bikes on urban and regional transport modes. Folding bikes and disassembled bicycles are not considered.¹ Different aspects in the process of promotion of carrying bicycles in public transport can be considered such as engineering, rules and regulations, and promotion measures.

Considering engineering or so called hardware measures, adoption in or outside the public transport vehicles can be made in order to carry the bicycles during the public transport trip. Capacity of number of bicycles, safety for passenger and vulnerable road users, operation time for loading and unloading are all part of considerations when evaluating and implementing different devices. Also cost aspects of investments are an important issue to be considered.

Rules and regulations are important to guarantee not only the quality of transport as a public service but also to arrange a balance between the limited space for passenger transport during rush hours and an optimal service to all public transport users carrying bicycles. Apart from quality and comfort considerations, safety aspects and balancing of interests of cyclists with parents with prams or wheelchair passengers have to be included when setting the rules.

Once the preparations of implementation of conditions in hardware as well as in regulation have been finished it is of utmost importance for the success of the overall operation to support this phase with a communication and promotion campaign. Campaigns are needed to achieve a change in travel behaviour. Most effective is a communication strategy directed to groups and persons who are open for changing their behaviour. A good combination of well designed hardware for carrying bikes in public transport together with clear rules and regulations and accompanied by a well- thought –out promotion and information campaign will most likely lead to a shift from car usage to cyclists carrying their bike in public transport.

¹ Disassembled bikes are considered as “normal” luggage and do not apply to special regulations. Folding bikes are not considered as they are normally not seen as bicycle but considered in the same category as luggage. This does not mean that all the advantages of the combination of cycling with public transport is not valid for foldable bicycles. It is rather on the contrary as folding bikes occupy less space in public transport vehicles, they might be seen as even more ideal for combination with public transport than conventional bicycles.

1 Introduction



It is now widely accepted that public transport and cycling are in most cases complementary partners in the multi-modal transport chain. This is a relatively new insight because previously cycling and public transport were seen as completely separated as not competing modes of transport. Nowadays many public transport operators in Europe include therefore cycling into their transport strategies and policies based on the understanding that both modes mutually benefit from mutual support.

Over short distances the bicycle is an effective and efficient mode of transport. Combining public transport with cycling enables people to travel from door –to–door over longer distances without using private cars. This combination broadens in this way the potential of both cycling and public transport. Combination of cycling with public transport also increases the catchment area of public transport lines or corridors.

Figure 2: Cycling can increase the catchment area of public transport (source: beca.com New Zealand)

There are different ways in which cycling and public transport combinations might be used:

- Cycling as part of a longer trip
- Carry the bicycle in one-way direction on public transport mode and cycle back. This might be the case in hilly surroundings or when weather conditions are not favourable for cycling
- Use the combination where safe cycling conditions are not available or where cycling is prohibited (tunnels, bridges).

The policies and measures taken to extend the combination of cycling and public transport should not be focused on shifting public transport users towards cycling but should be focused on a shift of car drivers to the attractive alternative of cycling and use of public transport. Policies for extension of combination of public transport and cycling can vary from creation of parking infrastructure around train or bus stations, the participation in public bike systems to allowing cyclists to use the same dedicated bus-lanes in some cities. Another synergy between cycling and public transport is the implementation of different technical solutions to the admission of bicycles in different types of public transport.

The basic idea behind the partnership between public transport and cycling is the acknowledgement that partners mutually benefit from cooperation. Most of public transport enterprise realize that an essential part of their passengers come by bicycle or are captive riders.

Subject of the study

The main focus of this study is on products and services allowing carriage of complete bicycles on local and regional public transport in urban regions in the European Union.

- Bicycle hire and bicycles as unaccompanied luggage as well as carriage of dismantled bicycles are not considered. Due to the relevant differences in the demand and supply of these services, they have to be considered as complementary and not substitutive.
- Regional railway services are not considered. This is mainly due to the fact that bicycle carriage on local and regional railway services is altogether satisfactory. Exceptions are a local issue that has to be handled with the regional transport authorities and railway undertakings involved.
- Infrastructural services at stations such as bicycle parking or public bike systems are also not considered. However, a clear separation among the different services is not always possible as access to platforms in station or bus-stops is essential for the success of measures implemented for extension of bicycles in public transport modes.

In this study different public transport and technical solutions for cycling are described in order to give an inspirational overview of real practices of combining public transport with traveling by bike. The examples are concise and focus solutions where bikes are loaded into or on the public transport modes. Integration measures of public transport and cycling such as creating parking facilities for bicycles near public transport stations are excluded from this study due to the limitations of the scope of this study.

In chapter 2 different hardware solutions will be described to show what possibilities exist to move bikes on board of different public transport modes. Hardware is defined as all kind of technical adoptions made on busses, trains or ferries as public transport modes. In chapter 3 the software framework will be described. This means that aspects of rules and regulations, legal issues, tariff conditions are described which can influence the potential of the integration of cycling with public transport. In chapter 4 the importance of marketing and communication measures are being treated while in chapter 5 the practices in other EU cities shortly will be described. The study finalizes with conclusions and recommendations for implementation in other cities to extend the combination of public transport and cycling.

2 Hardware solutions

Overview

Hardware in this study is defined as the devices attached to infrastructure in public transport modes like busses, trams, trains or ferries, which are part of common public transport. Hardware adaptations for including bicycles in the transport chain can be in- or outside the public transport vehicles. Hardware other than software is the technical measure taken to adapt the train, tram (trolley-) bus or ferry to make transport of bicycles feasible.

Different hardware solutions can be distinguished:

- Hardware adoptions outside the public transport vehicle
- Hardware solutions inside the public transport vehicle

The different types of adaptations have different consequences on scale of operation as well as on costs as well as on operational implementations. The operational implementations are described in chapter 3.

2.1 Trailer for bicycles

Trailers for bicycles are carriages or trolleys that are coupled to the back of the bus. There are many types, sizes and solutions of trailers for bikes. Usually, a trailer can carry up to 20 bikes. There are open and closed systems available depending on local situations.



Figure 3: Open bicycle trailer

The open as well as the closed trailer are used mostly in medium or long distance services.

This is due to loading and unloading characteristics:

- Large and safe loading and unloading space is needed
- Relative long time is needed for loading –unloading
- Loading and unloading has to be done by professional staff
- In practice, this means that trailers are used in services where tourism is the main target group.



Figure 4: Closed bicycle trailer

Another consideration for applicability of bicycle trailers is the length of the combination. As bus length mostly varies between 12-15 meters, the combination with a bus trailer can add some 6-8 meters. The total length of such a combination makes the manoeuvrability very complicated in urban situations.

A solution for the poor manoeuvring capacity of bus and trailer might be the use of a shorter unit. However, the cost/benefit relation of such combinations does normally not overcome the constraints of less capacity and still difficult versatility.

Type of trailer	Advantage	Disadvantage	Applicability
Closed	• High capacity number of bicycles • No negative impact on passenger capacity	Bad manoeuvrability No frequent loading /unloading	Long distance Tourism, regional
Open	• High capacity number of bicycles • No negative impact on passenger capacity	Bad manoeuvrability No frequent loading /unloading	Long distance Tourism, regional

Table 1: Advantages and disadvantages of bicycle trailers

2.2 Trailer and tram

Another device outside the public transport vehicle is the rack fitted to the cog railway in the city of Stuttgart. The cog rail line is an integral part of the public transport system. Passengers themselves have to load and unload the bicycles. Bicycles on the rack line are transported in this special wagon which is coupled to the uphill side of Stuttgart's cog rail. The capacity of the device, which is mounted in front of the tram, is 15 bicycles. The system is in function from April till November. The bicycles can only be taken uphill since the safety regulations require that the driver must have during the whole journey a visible contact with the rack. This would not be possible if the bicycles could be taken also downhill.



Figure 5: Trailer pulled by "Zacke" tram (Stuttgart, Germany)

2.3 Bicycle racks on buses' front side

A solution for transporting bicycles on busses can be the assembly of a rack on the busses. These racks can be mounted on the front or rear side of the bus and have normally a capacity of 2 or 3 bicycles per bus unit. Most experiences with bicycle racks are found in North America in cities like Vancouver and Portland (OR)². Also in the Russian Federation front side racks are in use in cities like St. Petersburg. Due to safety regulations in the European Union front racks are not allowed. The main reason for not allowing front racks is the estimated risk of pedestrian injury because of protruding parts on the busses. Research in the USA however shows that in fact no high accident risk is observed due to introduction of bike racks on front of urban buses.³



Figure 6: Front rack in St Petersburg

In spite of the negative perception on safety, certain positive aspects can be considered regarding the front side bicycle racks. One main item is the fast loading and unloading of the bicycle on the bus. Although 10 seconds is the time claimed for mounting the bicycle on the rack, even with double that time a good service can be delivered. Another positive aspect is the fact that the bus driver has very good visible control over the handling of the bike on the rack.

² About one third of public transport buses in North America have bicycle racks (Goldman and Murray 2011)

³ Bike Racks on the Front of Buses: Engineering and Road Safety Issues (M Paine 1997)

Loading Your Bike

1. Support your bike with one hand, then squeeze the rack's handle and pull the rack down to its locked, loading position.



2. Lift or roll your bike onto the rack, placing the front and back tires into the correct wheel slots closest to the bus. The front wheel slot is labeled.



3. Turn the handle by the front wheel slot until your bike's front wheel is secured in the wheel slot.



Figure 7: Instructions for loading the bike on front rack

2.4 Bicycle racks on buses' backside

In different European cities backside racks on busses have been introduced. Using racks for transporting bicycles in the transport chain allows the bicycle to be used on both sides of the journey and helps cyclists who endure mechanical failure, bad weather or barriers like tunnels and bridges. The backside rack is usually fixed to the frame of the vehicle using steel pins. It can be easily opened to the side to reach the motor of the bus if necessary.



Figure 8: Backside rack in regional bus in South Moravian Region (Czech Republic)

It is also very convenient to equip the bus with backside rack with a rear camera and LCD display inside the bus so the driver and passenger can see the bikes on the rack during the journey in the bus. Time to mount and secure the bike is normally estimated to be some 40 to 80 seconds. Due to the time needed for loading and unloading the bicycle, the transport operator should consider whether loading and unloading is allowed on all stops.



Figure 9: Mounting the bicycle on rack



Figure 10 : Rack on bus cross (Spain)



Figure 11: Bicycle rack for 4 bikes (Poland)

Cost of racks

Cost of racks on buses may vary for several reasons. One is production cost variation per country. Another reason is the performance of the different models. However in general it can be estimated that production cost of racks vary from 800-1200 Euros for a rack installed on the backside of a bus.

Type of rack	Advantage	Disadvantage	Applicability
Front rack	• Good visibility and control for bus driver • Fast load and unload (short stops) • Cheap solution • No negative impact on passenger capacity	• Not allowed in EU countries • Safety aspects for pedestrians • Limited capacity	• Medium and long distances • Urban use • Commuting and recreational use
Rear rack	• No control on loading/unloading unless camera device is installed • Relatively cheap • No negative impact on passenger capacity	• Longer loading/unloading • Limited capacity	• Medium and long distances • Urban use • Commuting and recreational use

Table 2: Advantages and disadvantages of different rack types

The CIVITAS 2MOVE2 Project in Brno

The Brno Public Transport Company (DPMB) started to analyse possible options of broadening the transport service for cyclists. DPMB already provided bike transport inside the vehicles, but the space for such transport is limited, especially in buses and trolleybuses. This kind of space in vehicles is shared with prams and people on wheelchairs, who always have the priority when entering the vehicle. Because of this prioritization conflict another option for bicycle transport had to be found. DPMB started to analyse also the solutions for bicycle transportation outside the vehicle. The possibility of a bike trailer was not chosen due to some negative aspects of this solution such as the need for a special license for driving buses with a trailer. There are also difficulties with manoeuvrability, reversing and also placing in depots. Therefore, DPMB started to consider installing the backside rack on selected buses.

Cyclists are one of the specific groups of passengers that DPMB wants to consider. The current state-of-the-art is that every passenger can carry a bicycle in all DPMB vehicles in inner tariff zones at any time. In 2002, DPMB started the operation of two bus lines (C1 and C2) with buses that were modified to carry more bicycles than regular buses. The lines were selected in a way that allows connecting central parts of the city with popular recreation areas located in the suburbs. But after one summer season the lines were closed due to low interest. One of the main reasons was the low frequency of service on lines C1 and C2. The second main reason was that the special buses dedicated to cyclists had an extra tariff, and regular tickets or passes were not accepted. These lines suffered a lack of passengers because most passengers used standard lines at regular tariffs; the lines were closed after one year and the modified buses were withdrawn.

Based on the vision to consider more the needs of cyclists as a specific target group of DPMB, several other options were analysed (such as reservation of special space and devices inside the busses). Finally, preference was given to install backside racks on busses. In the evaluation of the actual used busses it turned out that a rack could not be mounted. Therefore, in a new tender for 88 busses it was negotiated to include the possibility of installing back side racks for bicycles. The new CNG buses from the SOR manufacturer were delivered to DPMB in March 2015. The tender for backside racks was finished in March 2015.

The winner was the company Velorexport Žamberk that delivered and installed the backside racks at the end of May 2015. The start of the new service with backside racks on line 55 took place on line 13th June 2015.



Figure 12: Brno newly introduced Backside rack within CIVITAS Plus II 2MOVE2

2.5 Adaptations inside public transport modes

Apart from trailers and racks on buses there are options to permit bicycles inside the public transport modes. Most of the options here considered are options where bicycles are taken into the public transport mode and handled as personal luggage. Some public transport operators reconstructed their vehicles to carry a higher number of bicycles. These solutions can be applied to buses but also to trams and (regional) trains. Operators take out some seats for passengers and replace them by different type of devices as hooks, folding seats, or just more free space for bicycles, wheelchairs and prams. Depending on the type of device installed in the public transport mode, different capacity changes related to seated and standing passenger capacity will occur. Because of mixing with passenger transport also priority regulations for wheelchair passenger are to be considered. Another important issue is the accessibility of bus stops and train platforms.⁴

2.6 Accessibility of stations

If bicycles are allowed in train and metro systems the accessibility to the platforms is of utmost significance for the comfort of the user. Elevators and or moving staircases can help to overcome the barriers to the platforms. A cheaper solution might be found in the construction of "gutters" where the bicycles can be pushed along the stairs to and from the platforms. Also equalizing differences in altitude of platform and public transport floor level increases not only convenience level of cyclists but also of other public transport users (wheelchairs, parents with prams and others).



Figure 13: Not attractive access to platform for cyclists (photo: fietsbult.worldpress.com)



Figure 14: Bicycle stairway (source www.wn.de/Muenster)



Figure 15: Bicycle escalator (source rad-tourennet.de)

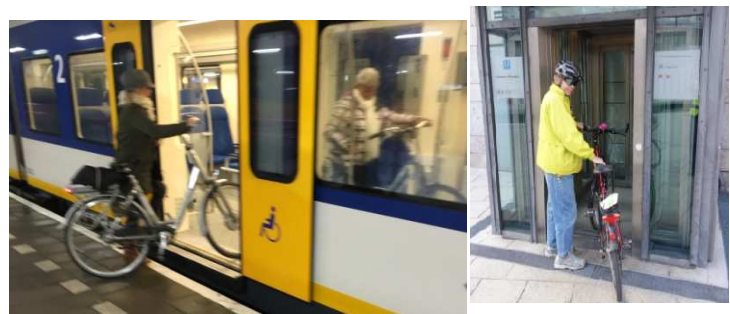


Figure 16: Escalators and equal floor levels improve convenience and comfort

⁴ Generally one bicycle reduces passenger capacity with factor 3-6, depending on standing or seated passengers (Mott MacDonald)

Allowing the use of escalators for bicycles is also a simple means to improve accessibility to and from platforms in different public transport modes.

2.7 Impact on capacity and safety

Depending on the type of application a different reduction of passenger transport capacity will take place. For this reason most public transport operators in Europe have chosen to limit the hours in which bicycles can be carried in public transport (see for more information chapter 3 rules and regulations). By limiting the hours in which it is permitted to carry bicycles in public transport, capacity and safety problems are avoided.

In general, capacity reduction depends not only on the sort of device and or the place reserved in train, tram or bus but also of the amount of cyclists who wish to enter the train. A survey conducted in Manchester resulted in reduction of passenger capacity from 206 to 200 when two wheelchair passengers were transported and a capacity of 195 when one wheelchair and one cyclist (with bicycle) were transported.⁵ As a general rule it can be estimated that for every 1 bicycle taken into train or tram a reduction of 3- 6 seated or standing passengers can be counted.

Regarding risk assessment the same study indicated that potential for passenger injury resulting from impact of incorrect stowage of bicycles which would hinder egress from the vehicles during operation and more important from emergency situation" has raised no fundamental objection. However clearly identified stowage locations and restraining equipment are required to reduce risk to passengers.⁶

2.8 Different types of devices in trains, trams and light rail systems

Creation of shared space

All kind of measures, which allow bicycles taken inside of the public transport vehicle, relate in some way to re-distribution of space. The simplest way is to create more free space for multiple users (standing passengers, bicycles, prams and wheelchairs).



Figure 17: Creation of shared space (Salzburg)

⁵ GMPT Metrolink 2009

⁶ Implications of carriage of bicycles on trams Mott MacDonald.

Bicycle held by hand by cyclist

In the situation (Figure 18) the bicycle is only allowed on the part of tram or train near the entrances. Same time it must not block the entrance. Because of risk of emergency stops, which might affect other passengers the cyclist passenger, should him/herself be near a post or other safe device to prevent falling. It is recommended to regulate the number of bicycles on a certain designated location in order to limit risks at emergency stops.

Helpful in risk assignment are the following signage:

- Identify which doors are to be used for cyclists loading and unloading
- Indicate priority levels of users
- Identify time periods
- Identify location where bicycle can be stowed

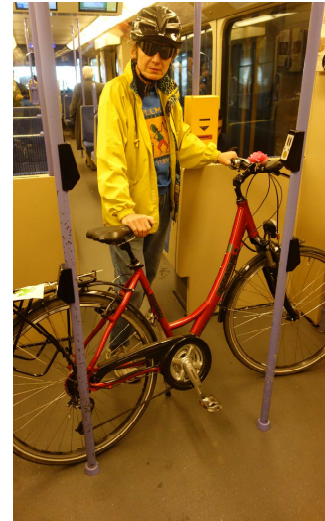


Figure 18: Bicycle held by cyclist. (Stuttgart)

Bicycles in fixed devices

In the case of figure 20 and 21 a type of device is used where the bicycle is stowed in a fixed way. The main difference is that the device used in figure 20 is located in a place more or less segregated from passenger transport, whereas in the situation of figure 18 passengers and cyclists are more mixed. In the latter case a more flexible use is possible which affects passenger capacity less in case of low bicycle use.



Figure 19: Segregated device for hanging Bicycle (Brno)



Figure 20: Mixed bicycle storage in train (Denmark)



Figure 21: Fixed device for bicycle segregated (the Netherlands)

Bicycle devices and space reserved for cyclists

As visualized in figures 18 and 19 more options are possible to create devices and space for bicycles in trams and trains. In figure 18 the space reserved for wheelchair passengers also can be used for carrying one or more bicycles. However in case a wheelchair passenger arrives priority has to be given and the cyclists need to leave the public transport vehicle or look for other available space. The advantage of this type of design is the division of bicycles and passengers.

The situation in figure 23 is almost similar to the situation in picture 24. In both designs folding seats are used which allow comfort to passengers when there is a small demand for bicycle transport. The flexibility also allows a high number of standing passengers. However the main and essential difference between option 23 and 24 lies in the sticker (picture 25), which gives priority to bicycles over seated passenger.



Figure 22: Mixed use for cyclist and wheelchair user (the Netherlands)



Figure 23: Bicycles allowed in mixed area. Priority not settled (the Netherlands)



Figure 24: Fixed device for bicycle, flexible chairs (the Netherlands)



Figure 25: Priority for bicycles (The Netherlands)

3 Rules and regulations (software)

Overview

There is a tension between the transport of passengers and allowing bicycles as luggage in public transport. Not only is there a negative impact on passenger capacity when allowing bicycles as luggage. There might also be a negative impact on stopping times for loading and unloading the bicycles. Also a negative effect of reduced flow of passengers can be a result of more bicycles in public transport.

On the other hand the positive impact of admitting bicycles in public transport is the increase of number of passengers using the public transport mode in before or after transport to or from their final destination. In order to limit negative effects of carrying bicycles in public transport transport companies apply all kind of rules and regulations.

 **Railway**

According to Mass Transit Railway By-Laws [Chapter 556B Regulation 4A](#), no person shall pass or attempt to bring, pass, drive or conduct any bicycle across the railways premises or any part thereof at any time.

Passengers who wish to carry bicycle on board MTR train services have to suitably handle the bicycle, for instance folding up the bicycle or removing the wheels of the bicycle and having them properly packed in order to ensure that it is safe and its compliance with the conditions of carriage of luggage (At present, any luggage with total dimensions (i.e. length, width and height) exceeding 170 cm or with the length of any one side exceeding 130 cm is not allowed to be carried into the paid area) before they can enjoy the train service.

To let passenger understand clearly the relevant conditions of carriage of luggage, MTR Corporation Limited has posted allowable size limits of luggage and the associated conditions at station concourse for the notice of the public.

Passengers travelling on the MTR trains with luggage (including folded bicycle) in compliance with allowable size limits should take care to avoid causing nuisance to other passengers.

Figure 26: Hong Kong regulation on carriage of bicycles

Access of bicycles in public transport is in general subject to various rules. Many transport operators have a document of “terms and conditions” in which the costumers are informed about all relevant aspects of travelling with the public transport operator. In general, these “terms and conditions” are available and visible in the bus, train, tram or other public transport modes in the local language. Depending on the international character of the transport modes some regulations might be visible also in other languages.

The most important issues described in the terms and conditions of transport operators are:

- Validation of tickets and time of validity
- Rules of behaviour in public transport (smoking, drinking and consumption of food)
- Warnings on bad behaviour and fines

In the case of taking a bicycle on board of a public transport mode the specific rules and regulations for carrying bikes on board are important. In the next part several aspects of rules and regulations will be treated.

3.1 Authorization for transporting bicycles

In general, carriage of bicycles inside busses is not allowed. The main argument lies in the fact that the interests of passenger safety, travel distances and physical circumstances are in contradiction with bicycles on board of busses. It is for this reasons that options as trailers and racks are mostly used for combining bicycle and public bus transport (see also chapter 1).

The combination of public transport modes as trams, (regional) trains and ferries with bicycle transport is now widely accepted. Nevertheless, there is a great variety of different treatments in European as well as among cities world-wide in treatment of bicycles in urban transport vehicles. The first rule in treatment of bicycles in public transport consists in defining bicycles rather as special luggage than as a vehicle. Like in aviation, luggage is more and more defined in measures of weight and dimensions. In contrast to prams and buggies bicycles are excluded from public transport in peak hours and often need a valid separate ticket. In order to make the best decision for the introductions of an enhanced bicycle transport service it is important to define factors that involve the form of service.

Category	Option	Remarks
Area	Network-wide	All lines throughout the city
	Part of the city	Selected area in the city
	Particular line	One or more lines that are often used by cyclists, can be especially equipped or modified vehicles
Tariff	Regular fare or reduced fare (for example ½ of regular fare)	Regular fare means standard fare for an adult passenger. Applied to the whole urban transport system
	Special fare for bicycles	Usually on special lines, other cases are not recommended
	Transport free of charge	For example for passengers that have season (prepaid) ticket (card)
Placement of the bicycle	Shared space	Place shared with other passengers
	Special place in the vehicle	Without seats, can be equipped with fixation systems
	Backside racks or front-side racks	
	Trailers	
Time regulation	24 hour a day/7 days a week	
	Only weekends	For leisure time cyclists
	Combination (weekends + selected time during work days)	To prevent overloading the vehicles with people with bikes
Transport Integration	Integrated into transport system	Unified tariff and all conditions
	Separated from transport system	Different conditions than other lines/operators in transport system

Table 3: Basic categories of guidelines

3.2 Time limits

Most operators use time windows to limit the friction between transport capacity of passengers and level of service to cyclists carrying their bike on the public transport vehicle. This results in prohibiting the transport of bicycles during peak hours or on certain days of the week. When tourist cycling is a main target group considerations of operating in summer period and or weekends might also be an option in time regulation.

3.3 Tariffs and ticketing



Figure 27: Different day tickets for bicycles (NL and DE)

Different approaches are used when it comes to ticketing and tariff definition for carrying bikes in public transport. The main criteria when defining the price of carrying the bike depends on the public transport mode and the travel distance. Another important factor is the “vision” of the transport operators in interaction with local or regional authorities on the importance of cycling in the local context.

The following concepts are most used:

- Carrying the bicycle is for free.
- This is most used in urban tram and some metro lines. Travel distances are mostly short. Bicycles may not hinder other passengers and the number of bike transport is relatively low. No specific places for bicycles are reserved. Bikes are near entrances.
- A ticket is needed for carrying the bike in public transport. Mostly used in (regional) trains. Mostly specific places are reserved for bicycles (front or end of trains).
- On most boat ferries bikes are allowed and a separate ticket is not needed.

3.4 Legal issues

An important issue when introducing bicycle transport in public transport is the settlement of legal liability. The central question is whether carrying a bicycle is an extra risk compared to “normal use” of public transport services. Risk assessment has indicated that the main risk when allowing bicycles to be taken in public transport modes results from the stowage of the bicycle and the risk of collusion between cycles and passengers, during both normal operation and in an emergency situation.⁷ Therefore rules and regulations about correct bicycle stowage should be clearly communicated to the public.

⁷ Mott McDonald, Implications of the Carriage of Bicycles on Trams 2009



Figure 28: Rights and obligations for passengers (NL)

Legal aspects to consider when informing passengers carrying bicycles in public transport modes are:

- Number of bicycles allowed at any time (this can only be defined when the stowage method is defined. See chapter 2.8).
- What are the possibilities for drivers and or ticket-conductors to enforce carriage rules (stowage and numbers)?
- In many cases bicycle stowage will use the same space dedicated for other priority users as wheelchairs and prams. How are conflicts managed? Priority rules need to be formalized in order to avoid conflicts between different interests. Normally, wheelchair users have first priority and buggy users second priority. Bicycles than would have third priority.
- As it is difficult to predict the number of priority conflicts, which arise from allowing bicycles in public transport modes, it is recommended to monitor possible conflicts in a trial period.

4 Information and marketing

Overview

Apart from implementation measures in hardware adaptations (chapter 1) and definition of rules and regulations (chapter 3) for setting conditions for integration of public transport and cycling, it is of utmost importance to include promotion and marketing measures in the inclusion of cycling in public transport modes. The impact of marketing measures often is underestimated or forgotten in the overall process of implementing measures to facilitate transport of bicycles in public transport. This is all the more unfortunate because with relatively small investment in marketing measures, a large effect is visible on the entire package of measures.

Information measures can be given in different forms and stages of travelling.

4.1 Preparing stage when travelling

Here it concerns information when orientating for travelling. Information can be given in several forms:

- on websites of the public transport operator,
- flyers concerning different cycling options for cyclist travelling with public transport
- information given by ticket vendors
- information given by ticket machines

4.2 Information during travel

When travelling with a bicycle there are all kind of regulations and rules which the traveller must follow. Therefore it is important that the traveller knows for reasons of safety as well as for not hindering other passengers where and when the bicycle is allowed in public transport.

Different information and information carriers can be used depending on the stage of travel.

On the platform of train station different ways are used to make clear which part of the train or metro is to be used by cyclists. One possibility is the illustration of wagons of the train and specifying where bicycle compartment is located. (see below figure 15)

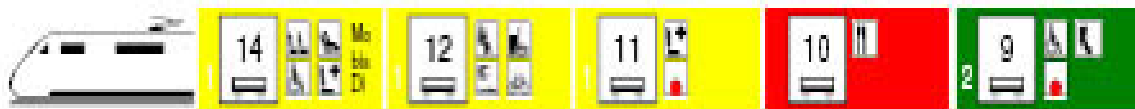


Figure 29: Coach # 12 is offering place for bicycles (source: Deutsche Bahn)

Another indicator are the signs on specific doors of trains or trams which indicate places reserved for bicycles and other devices like prams, buggies and wheelchairs. (See Figure 16)



Figure 30: Indicating specific bicycle facilities in public transport



Figure 31: Bicycle escalator Denmark (source: radtouren.net)

Also indications in stations help cyclist orientating where and how to move their bicycle on their way to and from the platforms.

Press releases as basis for articles in local papers can be very cheap and effective as marketing and communication tool. Also politicians or other key persons as examples can be a useful tool in a campaign.

Rad-Tourer macht Winterpause

Nahverkehr Die Bilanz der ersten Probefahrt des Busverkehrs mit Fahrradanhänger fällt positiv aus. Von Christine Bilger

Das Rad vom Bus bequem aus dem Kessel transportieren lassen, diesen Service der Stuttgarter Straßenbahnen (SSB) haben den Sommer über viele Stuttgarter genutzt. Bei dem Verkehrsbetrieb ist man mit der Probefahrt, die am 31. Oktober endete, sehr zufrieden, sagt die SSB-Sprecherin Birte Schaper. „Das Angebot wurde sehr gut angenommen. Vor allem in den Ferien waren wir gut ausgelastet“. Genaue Zahlen gebe es nicht. Der Zuspruch habe je nach Wetter geschwankt, berichtet Schaper. Wenig überrascht waren die Experten der SSB, dass die Passagiere den Rad-Tourer vor allem nutzten, um aus der Stadt hinaus zu kommen, bergab war der Anhänger meistens leer.

Der Rad-Tourer vom Rotebühlplatz in den Rotwildpark soll zwei Sommer lang probeweise pendeln, nach der Pilotphase soll dann entschieden werden, wie es weitergeht. In den Anhängern ist Platz für je 15



Platz für 15 Räder

Foto: Piechowski

Fahrräder. Wie bei der Zacke kann nur am Start und am Ziel be- und entladen werden.

Die SSB reagierten mit dem Rad-Tourer auf Nachfragen ihrer Kunden. Die seien immer wieder gekommen. Vor allem, da ja schon einige Beispiele im Bereich der gibt es ja schon einige Beispiele im Bereich des VVS existierten. Im Schwäbischen Wald bringt der Räuberbus Radfahrer an den Ausgangspunkt ihrer Touren. Und auch der Limesbus (beide fahren im Rems-Murr-Kreis) werde sehr gut angenommen.

Dass der Rad-Tourer im kommenden Frühjahr wieder starten wird, steht aufgrund der guten Erfahrungen für die SSB außer Frage. Der Fahrplan und weitere Informationen werden dann wieder auf der Internetseite des VVS (www.vvs.de) zu finden. Dort gibt es dann auch Informationsmaterial und weiterführende Links mit Ausflugstipps und Literatur für Radtouren im Rotwildpark. Die Haltestelle Forsthaus II liegt etwa auf der Höhe der Solitudebrücke, die über die Wildparkstraße führt. Von dort aus kann man die Umgebung erkunden und erreicht schnell die Wildparkseen oder das Schloss Solitude.

Figure 32: Stuttgart newspaper

As carrying bikes in public transport is restricted and in general subordinated to passenger transport, the instructions of the conductor or bus driver have to be followed. Education of public transport staff on rules and regulations combined with a positive attitude towards bicycles in public transport also have a positive impact on the success of extension of bicycles in public transport.



Figure 33: Bicycle friendly attitude of public transport staff. (Source: slovakrail)

4.3 Information during initial phase of implementation

When starting a project where on a public transport line bicycles are allowed it is important to include marketing measures to make this information well known to actual and potential public transport users. It should not simply be assumed that by taking hardware and software measures (as described in the previous chapters) acceptance and implementation will be a success.

Active marketing for the new measures of allowing bicycles in public transport are not only important to increase users of public transport to take their bikes with them and therefore increase potential of public transport users. Another important reason is also to inform in a positive way the “normal” passengers that the eventual hindrance of bicycles is allowed by the public transport company if use falls within the rules and regulations of the company.

In the BIKEBUS'ters project the Municipality of Aarhus in Denmark induced habitual motorists to cycle or take the bus between home and work. They were offered free bicycles, season ticket for the bus, rain clothes etc. The offer was made through local press and brochures for motorists. Almost ten times as many people applied as the 175 who participated in the project. Travel diaries showed that the project increased the bicycle share of all trips by almost factor 6. Car trips were more than halved.



Figure 34: Campaign Aarhus, Denmark

5 Practice in European cities, an overview

In the next part examples will be given from different European cities, which show concrete implementation of different kind of measures to facilitate carrying bikes on public transport vehicles. Most examples show how in different ways bicycles are allowed on bus, tram or train, other examples give more information about ticket systems and tariffs. To give a complete overview also an example of the combination of ferry transport and bicycle transport is included. The last example from the Netherlands shows that when large quantities of bicycles are used as before-transport to public transport, the only solution is to create enormous parking facilities around the public transport station as carrying the bike into the train is not a possible option any more.

5.1 Brno bike (Czech Republic)

Bicycle Rack

Brno is the second biggest city in the Czech Republic with about 380,000 inhabitants. It is situated in the South Moravia Region. Brno is the centre of the Czech court and is well known for its exhibition ground with lots of important fairs and also Grand Prix circuit. In Brno is also one UNESCO heritage building “Villa Tugendhat” and the well-known “Špilberg Castle” and St. Peter's and Paul's cathedral.

The actual share of bicycle transport in Brno is about 2% in the modal split. The main operator of public transport in Brno is Brno Public Transport Company Co. (DPMB). It owns about 750 vehicles (trams, trolleybuses, buses) and also six ships as touristic attraction on the Brno Lake.

Public transport in Brno is connected to the integrated transport system of the South Moravian Region; thus the rules for bicycle transport are subsided to the rules of the whole region. Bikes are allowed in all vehicles in the Brno inner tariff zones (100 + 101) and on selected lines in regional transport (buses in the summer season equipped with trailers – other operators). The national railway operator is also integrated into the transport system and allows transporting bikes in all its trains. In urban public transport vehicles the bicycle is categorized as small luggage. Passengers with prepaid ticket can carry the bike for free; other passengers must pay $\frac{1}{2}$ of the regular fare for adult passenger.

Passengers can transport bicycles 24 hours a day and 7 days a week. When boarding the vehicle, wheelchairs and prams have priority, but sometimes there are conflict situations when the bicycle is already in the vehicle and has a valid ticket. The technical solutions of most vehicles allow carrying maximum two bicycles.

In 2002 two special lines - C1 and C2 – were introduced for cyclists. They operated during weekends and connected the suburbs and the city centre. Specially modified buses operated on these lines and a special fare was collected. After one year of operation both lines were closed and the buses were withdrawn. The main problem was that the lines were not cost-effective and passengers were using standard lines at standard tariffs.

Within the CIVITAS 2MOVE2 Project, DPMB introduced a broadened service for passengers with bicycles in June 2015. In early 2015, five backside racks were bought that are in operation in the summer season on a regular line (No. 55). This line connects the PT terminal “Židenice, nádraží” with the very popular cycling area “Mariánské údolí”. The route of the line overcomes high hills. The tariff conditions are the same as in the whole transport system.



Figure 35: Backside rack on Bus (Brno)

5.2 Praha (Czech Republic)

Free bike transport

Praha (Prague) is the capital of the Czech Republic with about 1.2 mil inhabitants. Praha is located in the central Bohemian region. Praha is also the centre of all services, offices and courts. The city centre is also UNESCO heritage. The actual share of bicycle transport in Praha is about 1% in the modal split.

The main public city transport operator is Dopravní podnik hlavního města Prahy (DPP – Public Transport Company of the capital city Prague). It operates three underground lines, trams, buses, one funicular and one chairlift. The funicular and the chairlift have a touristic purpose (funicular leads from the city centre to “Petrín hill” and the short chairlift is situated in Praha Zoological garden).



Passengers can transport bicycles in the underground (only in the last carriage in driving direction), in trams (shared place with prams or with passengers on wheelchairs) and in the funicular (place signed with bicycle symbol).

Bicycle transport is for free. The regulation is applied in trams. Bicycle transport is not allowed on working days between 2 pm and 7 pm. Passengers can load the bike only on stops that are signed by bicycle symbol in the timetable.

5.3 Ostrava (Czech Republic)

Bicycles allowed without limitations

Ostrava is the 3rd largest city in the Czech Republic located in the Silesian region. It has about 300,000 inhabitants. Ostrava is located on flat ground and is one of the most industrial cities in the Czech Republic with lots of coal and steel mines and processing factories. The share of bicycle transport in Ostrava is about 1% in the modal split.

The main operator of city transport is Dopravní podnik Ostrava (DPO). It operates trams, trolleybuses and buses.

Bicycle transport is allowed on all lines non-stop without any limitations. Passengers can put the bicycle in a shared space with prams and passengers on wheelchairs. In one vehicle a maximum of one or two bicycles can be carried.

According to tariff the bicycle is considered as baggage, for bicycle transport ½ of the regular fare for adult passenger is paid. In the years 2004 – 2006 DPO introduced special bicycle lines (C1 and C2) that operated throughout the city during the summer season. On these lines one specially modified tram operated with fixation hooks for bicycles (as a reserve in the case of technical breakdown of the tram also one older bus was modified). After three years of operation these lines were closed because of low passenger interest. The main reasons for the failure have been long intervals between transport links and long travelling times compared to other lines.



Figure 36: Cyclotram in Ostrava

5.4 Olomouc (Czech Republic)

Bicycles prohibited

The city of Olomouc is located in central Moravia where about 100,000 people live. Olomouc is well known for its historical UNESCO centre, courts and fairgrounds. The local transport operator (DPMO) is part of IDS OK (Integrated transport system of Olomouc Region). The actual share of bicycle transport in Olomouc is about 6% in the modal split.

Bicycle transport in Olomouc is prohibited on board of public transport. In the past (around year 2006) one cyclobus line No. 31 was operated with a specially modified bus. The route led from the city centre bus terminal "Tržnice" to "Svatý kopeček" without any stop. "Svatý kopeček" is a hill near Olomouc with a famous church and zoological garden. Passengers had to pay the standard fare plus a special fare for bicycles. The line was quite popular, but it was closed after few years because of a decrease of passenger interest. The reason for this decrease was the opening of a new cycling path between "Svatý kopeček" and the city.

5.5 Plzeň (Czech Republic)

Bicycles allowed only during weekends

Plzeň is a city in the Western part of Bohemian Region. It has about 170,000 inhabitants. Plzeň is well known for its Pilsner Urquell beer brewery. In these days Plzeň is headquarters of Škoda Group factories. Only about 1% of Plzeň inhabitants use their bikes for everyday mobility. The local city transport operator is PMDP (Plzeňské městské dopravní podniky). It operates three tram lines, trolleybuses and buses.

Bicycles can be transported in all vehicles only during weekends. In one vehicle a maximum of two bikes can be transported. Bicycles are placed in a shared space with prams and wheelchairs and the full (adult) price for transport has to be paid (according to time of the ride). The driver has the right to refuse the passenger with a bike when the vehicle is full.

5.6 Ústí nad Labem (Czech Republic)

Cyclobus lines in summer

Ústí nad Labem an industrial city situated in the hilly north part of Bohemia with nearly 100,000 inhabitants. The share of bicycle transport in Ústí nad Labem is only about 0% in the modal split. The city transport operator (DPmÚnL) has a large trolleybus network, few bus lines and a new cableway between Forum shopping centre and "Větruše" hill.

Bicycles can be transported during working days between 7 pm and 7 am and non-stop during weekends. The driver has the right to refuse the passenger with bicycle when the vehicle is fully loaded or when the bicycle is dirty. For the bicycle transportation passengers have to use the "75 minutes" reduced fare (½) tickets.

Bike transport is also allowed on the cableway on all days. Passenger with bicycle must pay the full (adult) price for him-/herself + full price (adult) for the bicycle. In the summer season, DPmÚnL operates two cyclobus lines on the weekends. Both lines go twice a day and are provided by buses with cyclo-trailers. Tickets for these special lines are valid for bicycles too.

5.7 Liberec (Czech Republic)

Bus with trailer in summer season

Liberec is situated in the North Bohemia under "Jizerské Hory" mountains and has about 100,000 inhabitants. About 1% of them use the bicycle for their everyday mobility.

The public transport in the Liberec Region is integrated into the transport system IDOL. The biggest cities are Liberec and Jablonec nad Nisou. The main operator of PT is BusLine a. s. (private bus company) and DPMLJ - Dopravní podnik měst Liberce a Jablonce nad Nisou, a. s. (company owned by public sector). In Liberec two tram lines can be found and two intercity routes to Jablonec nad Nisou operated by DPMLJ. The rest of the public transport in the whole region is provided by buses.

According to the tariff conditions bicycles are considered as baggage, passengers pay $\frac{1}{2}$ of the regular (adult) fare for bicycles. Bikes can be transported mainly at special transport links on some lines in the summer season that are marked in the timetables by the bicycle symbol. These links are operated by bus with trailer and with a bicycle capacity of up to 25 bicycles. On other lines, the bicycles can be transported at all times if the technical solution of the vehicle allows carrying the bike and if the vehicle is not full of passengers. The driver has the right to refuse the passenger with bicycle.

5.8 Most and Litvínov (Czech Republic)

Tram for bicycles 24 hours per day use

The two cities Most and Litvínov are situated in the northwest part of Bohemia under “Krušné hory” mountains. These cities are well known for coal mining and chemical industry. Most has about 65,000, Litvínov about 25,000 inhabitants. The share of bicycle transport in both cities is between 0% and 1% in the modal split. The urban public transport operator in both cities is Dopravní podnik měst Mostu a Litvínova (DPmML) who operates four tram lines and buses.



Figure 37: Interior of cyclotram in Most

The tram is the main transport connection between both cities.

Bicycle transport is allowed in all vehicles 24 hours a day, 7 days a week. The driver has the right to refuse passengers with bicycles if the vehicle is full. Passengers have to place the bike in the shared space with prams and wheelchairs inside the vehicle and have to pay a discounted price for the bike (bike is classified as baggage).

From 1st May to 30th September a cyclotram is in operation during the weekends. It operates on line 4 between Most and Litvínov as a standard transport link, that is marked in the timetable. It can transport standard number of passengers and a higher number of passengers with bicycles (two Tatra T3 wagons, other trams 1 wagon). In the summer season, a bus with trailer is also operated reaching mountain localities near Litvínov. The bus starts in the morning from Litvínov, but one condition must be fulfilled, since the line is not included in the basic transport service: there must be at least five passengers for the departure of the bus. Despite this fact, the bus with trailer is popular during nice weather.

5.9 Zlín and Otrokovice (Czech Republic)

Bicycle transport is allowed everyday at all day times

Zlín is a city situated in the southeast part of Moravia. It is the birthplace of the world-wide known businessman Tomáš Baťa, the founder of the famous shoe brand “Baťa”. His influence is still clearly visible in Zlín, especially in the architecture of factories and residential buildings (Baťa's houses). Nowadays, about 75,000 people live in Zlín.

Otrokovice is a smaller city with about 18,000 inhabitants situated just next to Zlín. Both cities have a united public city transport. The local operator is “Dopravní společnost Zlín- Otrokovice” (DSZO). It operates several trolleybus lines including intercity line between Zlín and Otrokovice and supplementary bus lines. The modal share for cycling in Zlín is about 2%, in Otrokovice about 11%.

Bicycle transport is allowed everyday at all day times. Passengers pay ½ of the regular (adult) fare for the bicycle. When entering the vehicle, prams and people on wheelchairs always have the preference.

5.10 Salzburg (Austria)

Trolleybusses are customized to carry bicycles inside

Salzburg with about 150,000 inhabitants is the fourth biggest city in Austria. It is situated in the land Salzburg on the river Salzach. It is the birthplace of Wolfgang Amadeus Mozart. Salzburg has a very picturesque historic city centre with its landmark – the *Salzburg Fort* on top of the hill.

The city is well-known for its wide and functional trolleybus network. The trolleybus operator is the company Salzburger Lokalbahnen (SLB) that operates also suburban train lines, the funicular to the Salzburg Fort and *Mönchsbergaufzug* – a lift to the popular observation area. Supplementary bus lines in the city are operated by several private bus companies. Cycling is very popular in Salzburg because of a very good infrastructure and a quite flat geography (16% on modal share). All trolleybuses in Salzburg are articulated and customized to carry bicycles inside the vehicle at last door of the bus.

There are no seats around the last (usually 4th) door and the place is equipped by fixation systems.

According to this fact SLB always order trolleybuses with the motor on the 2nd axle in order to have wide space available around the last door. Bicycle transport is possible non-stop except in the morning times on working days (until 9 am). Passengers can carry the bicycle for free.

5.11 Innsbruck (Austria)

Bicycles are considered as baggage and can be transported non-stop and for free on all lines

Innsbruck is the capital of the land Tirol. It is situated on the river Inn in the middle of the Tirol Alps. With about 120,000 inhabitants it is the fifth biggest city in Austria. Innsbruck is very popular because of wide possibilities of summer and winter activities. The share of bicycle transport in Innsbruck is about 14% in the modal split.

The main public city transport operator is Innsbrucker Verkehrsbetrieb (IVB) that operates two tram lines in the city, one suburban tram line and one intercity tram line that leads through the beautiful Stubaital valley into the city Fulpmes. Also city and suburban buses are operated in Innsbruck. Bicycles are considered as baggage and can be transported non-stop and for free on all lines. Some buses are in the summer season furnished by additional equipment to transport a higher number of bicycles.

5.12 Stuttgart (Germany)

Different options for carrying the bike in public transport in one city

Stuttgart is the sixth biggest city in Germany with almost 600,000 inhabitants. It is the capital of Baden-Württemberg. In Stuttgart the headquarters of the car manufacturers Porsche and Mercedes-Benz are located.

In the Stuttgart public transport system bike transport is possible in different ways. The most common way is the transport in suburban trains (S-Bahn), which are provided by the regional transport organization VVS. The transport is free except for a time period between 06:00 a.m. and 08:30 a.m. (a ticket must be bought in this rush hour time).



Figure 38: Trailer pulled by "Zacke" tram in Stuttgart



Figure 39: Bike2go project (Stuttgart)

Special bike compartments provide an open space to park and fix the bike. The VVS in co-operation with the German Cycling Association (ADFC) offer also the purchase of a foldable bike. The urban light rail trains (U-Bahn) of the municipal transport company SSB also offer the possibility to transport bikes for free. The transport is only prohibited during rush hours (6:00 a.m. to 08:30 a.m. and 04:00 p.m. to 06:30 p.m.).

A very special offer is the bike tender of the rack-rail train (Zacke) which permits to take the bicycle uphill. Stuttgart has a share of bicycle transport of 5% in the modal split. Because of this low percentage, there is no significant number of bicycles transported in public transport. Additionally, Stuttgart provides cycling service stations at six intermodal points where commuters can store their bicycle and switch to public transport. As a consequence, for many commuters there is no need to take their bicycles in the trains or buses.

While the bike transport in trains is well developed in Stuttgart, the transport in buses is still expandable. In the city of Stuttgart the bike transport is not allowed at all, just some regional busses allow to transport maximum two bikes on one trip (special rules and time restrictions for every bus line). There is no special space for the bikes in the buses. The owner has to make sure to hold the bike tight during the drive, especially if the bus driver has to break immediately in certain situations. In case that a wheel chair driver or a person with baby carriage enters the bus, these passengers always take priority over the bike owner. Thereby a cyclist never has the guarantee of being able to transport the bike in a public bus. There are various reasons for not allowing this. First of all, the number of passengers in public transport in Stuttgart is constantly increasing and the buses are crowded not only during rush hours. In this situation, transporting a bike can affect the safety of the passengers.

On the other hand, there has to be enough space for baby carriages, wheelchairs and walker-rollators in the buses. The additional permit for bikes can cause conflicts between mobility-impaired persons and cyclists. The works council of SSB therefore does not agree in order to protect the bus drivers. Since August 2014, a remarkable innovation was implemented in one regional bus. The new system called "Fahrrad2go" offers a transport solution for up to ten bikes. Five bikes can be stowed inside the bus and five bikes outside in a special attachment at the end of the rear of the vehicle. This pilot project is one part of a climate protection project of the region, which focus on a better connection between different public transport systems. More distances shall be done by foot or bicycle instead by car to reduce CO₂ emissions as the main aim of the project.

The system, which costs 240,000 Euros, has been developed by master students of the University of Applied Sciences Esslingen. A hydraulic lifting gear was constructed, so also small persons were able to hook their bikes in. For such a construction the bus organization had searched previously, but could not find any German supplier offering such a product. Three international students from Colombia, Finland and Germany finally found a technical solution.

A very recent new service was introduced on the SSB bus line No. 92 which connects the city with the recreation area "Wildpark". Because of a huge demand of passengers that like to ride their bicycle in this area, the SSB transport company offers during the weekends a bicycle transport on this line. Passengers can place their bike on the special trailer "Rad Tourer" which is coupled in the back of the bus and has space for 15 bikes. This service is part of a pilot that will be realized in the summers of 2015 and 2016. After evaluating the performance and acceptance of this new service, the public transport operator SSB will decide if they will continue with the "Rad Tourer".



Figure 40: Rad Tourer in Stuttgart (source: K Gablenberger)

Bicycle transport is allowed in all vehicles 24 hours a day, 7 days a week. The driver has the right to refuse passengers with bicycles if the vehicle is full. Passengers have to place the bike in the shared space with prams and wheelchairs inside the vehicle and have to pay a discounted price for the bike (bike is classified as baggage).

5.13 Szczecin (Poland)

Bicycle transport is possible at any time and on all lines

Szczecin is the capital city of the Western Pomeranian Region in Poland. It has about 400,000 citizens. Szczecin is situated at the Odra River near the border with Germany. Szczecin is an important port in Poland.

In Szczecin trams and buses are operated. The coordinator of urban public transport is ZDiTM Szczecin. Trams are operated by the company Tramwaje Szczecińskie and buses by several private companies. Trams are the base of urban public transport. Nowadays they are quickly developing on the other bank of the Odra River into Osiedle Dabie. Passengers are allowed to transport bicycles. Bicycle transport is possible at any time and on all lines. The place is shared with other passengers on wheelchairs or with prams. New buses are equipped with a simple fixation pipe inside the vehicle. Bicycle transport is now for free. The modal share research in Szczecin has not been done yet.

5.14 Wrocław (Poland)

Bicycle transport is allowed during all day time in a shared space inside the vehicles

Wrocław is the capital city of the Silesian Lowlands Region in Poland with about 630,000 inhabitants. The share of bicycle transport in Wrocław is about 4% in the modal split. The only operator of urban transport in Wrocław is MPK Wrocław with a wide network of trams and buses.

Bicycle transport is allowed during all day time in a shared space inside the vehicles since 2010. In the same year eight buses were modified to carry four bicycles inside the vehicle. These buses are operated on lines in rural areas, starting in the inner city. Passengers have to pay 1.50 PLN for bicycle transport.

5.15 Warszawa (Poland)

Transport of bicycles is possible at any time and in all means of transport including suburban trains.

The capital of Poland has about 1.7 mil inhabitants. It is situated in the Masovian Region in the central part of Poland. Only about 1% of inhabitants use their bicycle for their everyday mobility. In Warszawa urban transport is coordinated by ZTM Warszawa. The urban transport service is provided by several companies. Nowadays there are two underground lines and a wide network of buses and trams. Transport of bicycles is possible at any time and in all means of transport including suburban trains. Places for bicycles are shared with wheelchair drivers and prams. The space is marked by the bicycle symbol in some vehicles. Bicycle transport on the lines of ZTM Warszawa is for free.

5.16 Bratislava (Slovakia)

Cyclists can enter the vehicle only with the driver's agreement when the vehicle is not full

Bratislava is the capital of Slovakia and has nearly 420,000 inhabitants. It is situated on the Danube River. The most famous landmark is Bratislava Castle. The share of bicycle transport in Bratislava is almost 0% in the modal split.

The only operator of urban public transport in Bratislava is Dopravný podnik Bratislava (DPB) that operates trams, trolleybuses and buses. In Bratislava an underground system should have been built, but the metro project was stopped. Nowadays Bratislava is broadening the radial tram network into Petržalka housing development. Bicycle transport in Bratislava is allowed on all lines 24 hours a day, 7 days a week and is for free. Passengers can enter the vehicles only through the door marked with the corresponding symbol and place the bike on a reserved place. If a tram train consists of two wagons, cyclists are only allowed in the first wagon. Cyclists can enter the vehicle only with the driver's agreement when the vehicle is not full. DPB also owns few bicycle trailers and operates them in the summer season on lines leading to rural localities. Bikes can be transported on these lines for free as well.



Figure 41: Bus with bicycle trailer in Bratislava

5.17 Košice (Slovakia)

Bicycle transport is allowed only from 1st June until 1st September during weekends and only on bus line No. 14

Košice is the 2nd biggest city in Slovakia with about 240,000 citizens. Košice is situated in the eastern part of the country about 100 km away from the Ukrainian border. The share of bicycle transport in Košice is about 3% in the modal split.

Dopravný podnik mesta Košice (DPMK) is the only operator of urban public transport with trams, buses and the last trolleybus line that is going to be closed in the near future.

Bicycle transport is allowed only from 1st June until 1st September during weekends and only on bus line No. 14 that leads from the city centre to Jahodná (popular leisure area in Košice). Cyclists have to pay 0.60 € for the bike and have the lowest priority when entering the vehicle and also during the transport. The driver has the right to ask the cyclist to leave the vehicle when a pram, passenger on wheelchair or passenger with dog want to enter. In one vehicle a maximum of 2 bicycles can be transported.

5.18 La Rochelle, (France)

Installation of bike bus

Since 1999, 2 bike-buses have been running during the summer between the city centre of La Rochelle and the Ile de Ré. This service is highly appreciated by the inhabitants as well as the tourists and there is a growing demand for its development.



Figure 42: Velobus (source: Eltis.org)

Objectives / Innovative Aspects

Extensions of the bike-bus service in La Rochelle. The bike-bus consists in combining two modes of transport, namely bus and bike and thus contributes to encourage intermodality. A bike-bus is an articulated bus equipped with 2 separate compartments: one for passengers (in the bus front) and one for bikes (in the rear). It enables users to easily reach a secure area for cycling, in the city or in the countryside. Preliminary contacts were taken with bus manufacturers to consider possible technical options to carry bikes within buses. A call for tender procedure was launched for the purchase of new vehicles equipped with specific facilities for bikes. But, as no tender was received, a new procedure for the transformation of buses was launched. One new bike-bus has been running since mid-July 2007 and the second one from July 2008. A specific livery was designed on the new bike-buses.

Results

- More passengers resorting to the bike-bus service - i.e. 32% increase of trips with or without a bike)
- Increased level of awareness for the bike-bus service• Very good level of acceptance among the general public: 97% among the 300 people surveyed thought that the possibility of taking their bike on a bus was a worthwhile initiative.
- Degree of satisfaction: virtually all users (99%) that took a bike onto the bus expressed their satisfaction. See more at: <http://www.eltis.org/discover/case-studies/extension-bike-bus-scheme-la-rochelle-france#sthash.rMEUv4xU.dpuf>

5.19 Düsseldorf (Germany)

Mobile in Düsseldorf: one ticket for tram + bus + car + bike

With a public transport ticket unique to North Rhine-Westphalia (Germany), Düsseldorfer Rheinbahn, Car2go and Nextbike want to combine different means of transport in the future. According to the Düsseldorf public transport company, the ticket, which will be available from March 1, offers access to trams, buses, cars and bicycles. Passengers will receive a smart chip card which will let them board any tram or bus, but which will also open up car sharing vehicles and unlock rental bikes. Besides unlimited bus and tram rides in the North Rhine-Westphalian capital, the monthly ticket includes 90 minutes of car sharing per month plus four hours of rental bike use daily for just under €75. Car2go, one of three car sharing operators in Düsseldorf, offers 300 smart fortwo, which can be found across the city and parked free of charge in any public parking lot. Nextbike provides 400 rental bikes at 50 stations. With the new ticket, passengers are free to choose the most suitable means of transport for any single trip.

This is the first offer of its kind in North Rhine-Westphalia. In Germany, similar offers are only available in Hannover and Berlin. However, the combination with rental bikes is rare according to a spokesman of the Association of German Transport Companies (VDV). See more at: <http://www.eltis.org/discover/news/mobile-dusseldorf-one-ticket-tram-bus-car-bike-germany-0#sthash.CoeNHwIQ.dpuf>



Figure 43: Tram Dusseldorf (source: Alexander Schnitz)

5.20 Amsterdam (Netherlands)

Water ferries for cyclists and pedestrians

In Amsterdam the Municipal Transport Company (GVB) apart from water ferries who also operates the Metro, tram and bus lines. The water ferries are at the backside of the Central train station, which operates as a transfer point for travellers. Some 5 ferry lines offer connection with different destinations on the other side of a broad canal (North Sea Channel)

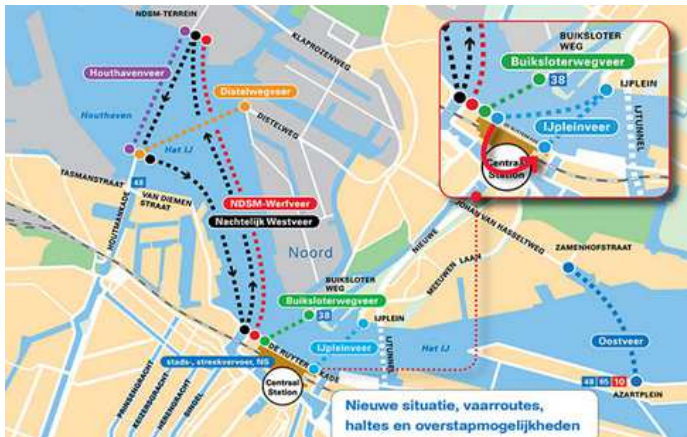


Figure 44: Water ferries at Central Station Amsterdam (source: GvB Amsterdam)



Figure 45: Ferry Amsterdam for pedestrians, cyclists and scooters

The frequency of the ferries is about minimal 5 times per hour and the operation time is 24 hrs. per day. The ferries are free of charge and use is allowed for pedestrians, bicycles, wheelchairs, scooters and small- motorized cars for wheelchair passengers. Because of the increasing demand for this service (about 10 % per year) the frequency of the service is adapted and more ferries are deployed in rush hours.

5.21 Amsterdam (Netherlands)

Bicycles in Metro system

Bicycles are allowed in the Metro lines in Amsterdam. This is only permitted outside peak hours. Peak hours are defined from Monday to Friday from 7.00-9.00 and from 16.00-18.30. The cost for taking the bike is not for free. A ticket has to be bought which has the same price as a passenger ticket.



Figure 46 : Bike and wheelchair in public transport Amsterdam. (Source pvda)

5.22 Utrecht (the Netherlands)

Integration of cycling in train station

Utrecht Central Station is the central railway station for the city of Utrecht and is the largest and busiest railway station in the Netherlands. Utrecht being located in the centre of the Netherlands, Utrecht Central station is also the most important railway hub with more than 900 trains leaving per day.

As about 20-30 % of all train passengers (approx. 60,000-100.000) come by bike to the station and 9 % of all passengers go by bike after their train travel it is impossible to offer a large scale facility for transport of bike on board of trains.

Therefore other solutions had to be found to make integration of public transport and using the bicycle in before and after transport. Therefore a combination of several solutions were implemented:

- Large scale parking facilities to avoid transport of bicycles into trains. (Utrecht is building a parking for 12,500 bicycles)
- A large-scale public bike system on more than 300 train stations nationwide.
- Integrated ticket system for bike parking, public transport use and public bike use nationwide.



Figure 47: Utrecht building the biggest bicycle parking in the world (source: tondejager.wordpress.com)

6.1 Conclusions and recommendations

Integration of bicycle riding and public transport has many benefits such as:

- Increasing the potential destinations available for cyclists
- Adding flexibility to users of public transport
- Offering a sustainable and attractive alternative for private car users
- Increase of catchment area around public transport lines
- Avoiding unsafe traffic situations for cyclists (tunnels, bridges)
- Extending recreational and touring opportunities for cyclists
- Improving access to public transport not only for bike riders but also for clients with wheelchairs and prams
- Facilitating intermodal transport chains from door to door.

In the variety of hardware options the **adaptations inside metro, (regional) trains and trams are the most viable**. However, due to capacity frictions between passenger capacity and space requirements for bicycles it is recommended to prohibit or limit carriage of bicycles in **peak hours**. In case of a low level of modal split for cycling or in cases with special demand due to geographical topography (hills, barriers) also racks at the back of buses might be a viable option to facilitate bicycle transport on public transport modes. In the case of high tourist demand also the option of bus combined with a trailer is a good option most suitable for longer distances and not many stops in between.

The **willingness of public transport companies** to include bicycles in their transport concept is an important factor when it comes to setting rules and regulations for transporting bicycles in public transport vehicles. The main line of argument is that bicycles are seen as extra luggage like wheelchairs or prams and therefore the transport of bicycles is seen as a resultant service. But because of their different characteristics compared to prams and wheelchairs a valid ticket and or time limitations for transport are commonly implemented.

It is recommended to **involve user groups and other interested stakeholders** in the process of implementation. These stakeholders are not only important sources of information but they can also support the phase of communication and marketing.

Marketing and communication measures should be an integral part of the implementation strategy when it comes to introduction of new conditions for integration of carrying bicycles in public transport. When the general public is not aware of new possibilities, the success of investments is at risk not because of bad created infrastructure and accompanying regulations but due to the lack of awareness of new options created for the potential users.

Transport of bicycles in public transport is an excellent solution as long as the intensity of use is of low level. In the case of high demand, solutions have to be found in another direction such as improvement of **parking facilities near public transport stations and bus stops** or, implementation of **public bike systems**.

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