



Muenster, Germany: An Example of Promoting Cycling in Cities – Components of a High Quality Bicycle Infrastructure

A Short Survey

Case Studies in Sustainable Urban Transport #2

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CONTENTS

1. Cycling in Muenster	1
2. Muenster's bicycle network	2
3. Components of Muenster's bicycle infrastructure	3
3.1 Cycle ways (primary network)	3
3.1.1 Cycle ways on sidewalk level	3
3.1.2 On-street cycle lanes	3
3.1.3 Cycle ways where bus operation is permitted	4
3.1.4 Bi-directional cycle ways	4
3.1.5 Muenster's "Promenade"	4
3.2 Intersections	5
3.2.1 Turn lefts – Indirect, Bicycle floodgates, Segregated turn-left lanes	5
3.2.2 Roundabouts	6
3.3 Meshed network of cycle paths (secondary network)	7
3.3.1 Restricted speed zones in residential areas	7
3.3.2 Bicycle streets	8
3.3.3 Pseudo one-way streets	8
3.3.4 Further measures to extend the meshing of Muenster's bicycle network	9
3.3.5 Measures to increase safety of cycling	9
3.4 Traffic management	10
3.4.1 Traffic lights and signage	10
3.4.2 Signposting system	12
3.4.3 Phased traffic lights	12
3.5 Services	13
3.5.1 Parking management	13
3.5.2 Bicycle station	14
3.5.3 Bicycle stores	15
4. Essentials for a high quality bicycle infrastructure	16
5. References	17

1. Cycling in Muenster

In the recent history of the German city of Muenster, the bicycle has always been one of the most common means of transport. After the Second World War when 90 % of Muenster was destroyed, political decision makers introduced revolutionary policies to meet the increasing demand for road space for cycling and motorised traffic. Separate bike routes were to be built on main thoroughfares, so that the multitude of cyclists no longer conflicted with the growing automobile traffic. In the 1970's, the mobility discussion was rekindled around issues concerning the preservation of people's quality of life and the environment. As a consequence, significant additional efforts were made in Muenster to promote the usage of the bicycle. Some of these efforts, which led to a huge success, were further extensions in the prevailing bicycle infrastructure, improvements in road safety, communication and outreach of the positive impacts cycling has on humans, and an increased level of health and cost savings. As it can be seen in Figure 1, from the year 1982 till 2007, while the proportion of Muenster's bicycle traffic increased from 29.2 % to 37.6 %, the proportion of motorised individual traffic decreased from 39.2 % to 36.3 %. In contrast to this, the average share of bicycle traffic in the rest of German cities was about 10.3 %, while 48.7 % was the share of motorised individual traffic (MID, 2008). When comparing Muenster with the German average, it becomes obvious that Muenster's preference to environmentally friendly means of transport, especially bicycles, had a significant impact on the growth of the sustainable transport modes. In fact, Muenster sets a standard in focusing on sustainable transport means.

This paper introduces Muenster's initiatives to promote cycling and outlines specifications and essentials of its bicycle infrastructure. The paper provides a case study and orientation for transport planners and policy makers who want to develop similar bicycle-based sustainable urban transport systems in their cities.

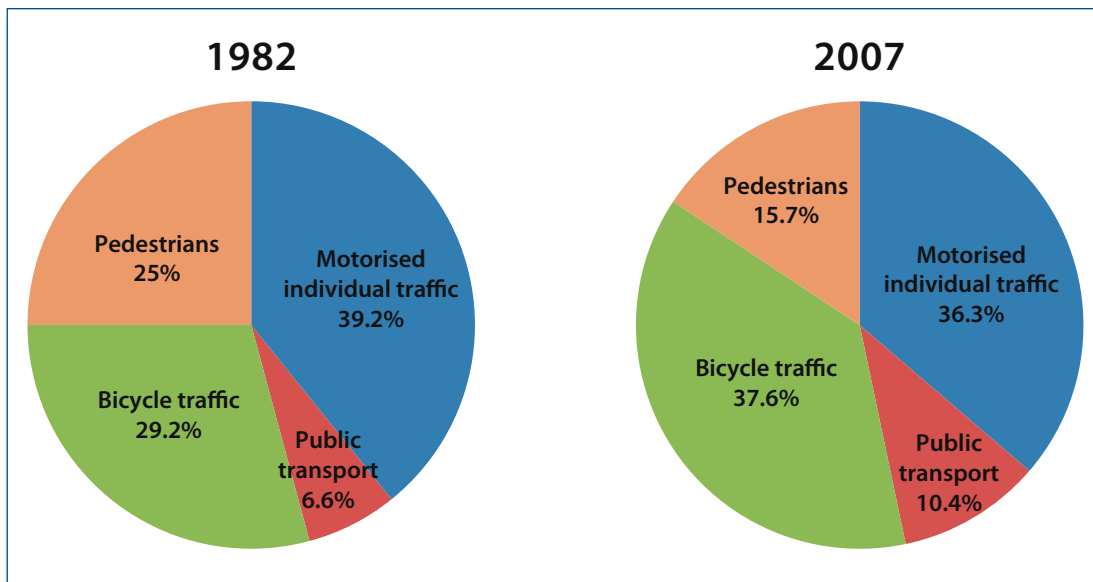


Figure 1
Travel modal split in Muenster: 1982 and 2007.
 (VEP Muenster 2025)

2. Muenster's bicycle network

Muenster's bicycle network can be divided into a primary and a secondary network. The following section describes the properties of each one in detail.

The so-called primary network is a system of continuously segregated dedicated cycle ways running along main streets and traffic axes. Although the construction of the primary network was started in 1948, it has only been completed recently. The primary network serves as a linkage between the adjacent villages, the outskirts and the city centre and connects all the important locations where inhabitants end up travelling on a daily basis. This primary network has been supplemented by several measures to improve the general cycling conditions during the eighties. The secondary network complements the primary, and is a network of grid-like cycle tracks which include traffic-calming in residential areas, linkages of lacks in the prevailing network, cycle paths and connections in parks and pedestrian areas. The main functions of the secondary network are the distribution of cyclists from the central locations and the possibility to take different shortcuts thus reducing cycle times.

A population of 280,000 inhabitants living in an area of 302 km² is served by a 275 km network of segregated bike routes. These are supplemented by over 300 km of agricultural routes, which are permitted for car-traffic and stretch across the farming and forested regions of Muenster.

Figure 2 provides a detailed view of both primary network (red marked lines) and secondary network (yellow lines and green lines) within Muenster's municipal area. Additionally it shows where Bike & Ride facilities (B+R) are located in that area.

After introducing some basic facts about Muenster's bicycle network, the following sections describe basic elements of the bicycle network and give more detailed information on certain components of the infrastructure.



Figure 2
The bicycle network of the municipality of Muenster in 2008.

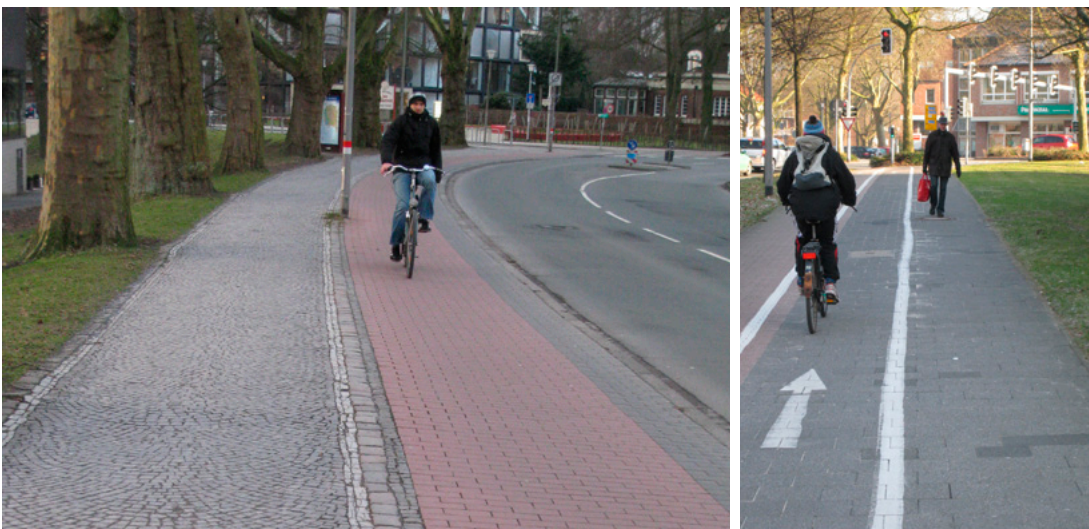
VEP Muenster, 2025

3. Components of Muenster's bicycle infrastructure

3.1 Cycle ways (primary network)

3.1.1 Cycle ways on sidewalk level

Cycle ways along sidewalk levels were the first type of cycle ways introduced along main thoroughfares and accounted for the traditional forms of bike routes within Muenster. Today they are usually paved red, 2 meters wide and broad enough for cyclists to pass one another. Occasionally the width of sidewalks is not sufficient, in which case the width of the cycle ways needs to be reduced. A few streets are only marked with a white bicycle stripe on the pavement. The construction of these sidewalks is easier and more cost-effective than the red paved ones. When the cycle way is crossed by a street, curbs are lowered down to 0.5 cm to ensure smooth and convenient cycling transitions.



Figures 3
Cycle way on sidewalk level: red paved (left) and marked with bicyclist stripe (right).

3.1.2 On-street cycle lanes

The second type consists of cycle lanes on street level. They are located at a height equal to the road body and usually placed between the traffic lanes and the sidewalks. White bars provide a visual separation of these from the motorised traffic. Here also, two different types of bars exist which motorised traffic users have to look out for. In the first case (Figure 4), a permanent white bar indicates that the bicycle lane is only for cyclists. In this case, motorised traffic is not allowed to enter the lane. On the contrary, if the bar is lined (safe guard), cars are permitted to cross the bar only, when they do not disturb or jeopardise cyclists. The latter type of bar is usually applied in narrow streets where assigning dedicated spaces to cycles is not a feasible option.



Figure 4
On-street cycle lanes with permanent bar.

Figure 5
Cyclists and buses operate on the same lane.



3.1.3 Cycle ways where bus operation is permitted

As a special case of the above mentioned cycle lanes, sometimes in Muenster buses and cyclists drive on the same lane. This happens when bus lanes already exist and cross sections of streets are too small to offer sufficient space for separated bicycle lanes. Then, former bus lanes are changed to cycle lanes, but buses are still permitted to operate on these lanes, either driving behind cyclists or overtaking them by the usage of usual driving lanes. This solution avoids expensive road construction work and enables safe and convenient cycling. Figure 5 shows the “Schorlemer Straße” in Muenster where the above was implemented.

3.1.4 Bi-directional cycle ways

Usually cycle ways are only one-direction ways. But to ensure easy, flexible and quick mobility and improved accessibility, bi-directional cycle ways are useful as they also help prevent costly and inconvenient detours for cyclists. This regulation needs to have proper signage as it can be seen in Figure 6. In Muenster, in the “Orléans-Ring” street, a bi-directional cycle way was realised.



Figures 6
Bi-directional cycle ways in Muenster.

3.1.5 Muenster’s “Promenade”

One of the most well-known features of Muenster’s bicycle network is its Promenade. In the eighteenth century, a former rampart was reconstructed and a green corridor covered by trees was laid out instead. This corridor is 4.5 km long and clearly separates the historical city from the rest of the town. Only at the points where the old gates of Muenster are situated, is the Promenade interrupted by the main roads leading into the historical city. The Promenade accounts for the most frequented bicycle paths within Muenster due to its function as a distributor road and also as a linkage to several destinations and directions. In some sections, up to 1,750 cyclists per hour have been counted on the Promenade. Given its generous width of

5 meters and the fact that cyclists can drive through with hardly any interruptions, the Promenade is also called the highway for bicycles.



Figures 7
Impressions of Muenster's Promenade.

3.2 Intersections

3.2.1 Turn lefts – Indirect, Bicycle floodgates, Segregated turn-left lanes

Cyclists turning left have to cross motorised traffic lanes. Therefore this aspect requires special attention. At major intersections they are usually guided indirectly. That means that the cyclists first cross the crossing street parallel to the straight-going motorised traffic until they reach a waiting area (Figure 8) in the street. Afterwards they cross the main street before the traffic on the cross-street enters the intersection.



Figure 8
Indirect turn-left (waiting area).

The indirect turn-left is very safe, but also somewhat circuitous. On side streets which turn into a main street at intersections controlled by traffic lights, a convenient solution for cyclists turning left was developed: the bicycle floodgate (cf. Figure 9). Therefore an additional stop line approximately 10 meters in front of the actual stop line at the traffic light was marked on the street. While the first line is for the cyclists, the second one is for cars. This creates a space in which 20 to 30 bicyclists can gather during a red light phase. When the light turns green for this direction, the cyclists can cross the intersection in all directions, straight or to the left. The cars follow behind. In this way, the car driver can always observe the bicycle traffic in front of his car and hence this ensures a safe solution for cyclists.



Figures 9
Flood gates.

Another possibility to lead cyclists turning left is by using the marked and segregated turn-left lanes. As it can be seen in Figure 10, there is a segregated turn-left lane for cyclists leading them directly to the right of the turn-left lane of motorised traffic.

Figures 10
*Segregated
turn-left lane.*



At some intersections the level of safety has been increased by special management of traffic lights, where cars and cyclists have their own separate signals. The light for cyclists turns green earlier than the lights for cars. Hence cyclists are able to pass the intersection safely and without any disturbance of motorised traffic, regardless of whether they turn left or go straight.

3.2.2 Roundabouts

Roundabouts support reduction of traffic speeds and conflicts and ensure a constant traffic flow without the need of installing traffic lights. Especially, when more than 2 streets are crossing and the construction of traffic lights becomes too expensive, a roundabout enables a self-regulating and less circuitous solution. In the city of Muenster, cyclists are generally led on the outermost lane of motorised traffic. Hence drivers of motorised vehicles are able to recognise cyclists directly and become rather aware of them than on a separated way at sidewalk level.

The most frequented roundabout of Muenster is the “Ludgeriplatz”. Every day around 38,000 vehicles, 12,000 cyclists and innumerable pedestrians pass the Ludgeriplatz. In 2008 comprehensive construction work was undertaken to improve the safety of cyclists at this location. The characteristics of Ludgeriplatz are explained below.

Along the drives into the roundabout, cyclists are led from red paved lanes on sidewalk level down to segregated lanes on street level (Figure 11 left). Hence vehicle drivers become aware of cyclists before entering the roundabout. The function of lined bars has already been explained in 3.1.2. At Ludgeriplatz these are used to guide cyclists into the roundabout safely (Figure 11 right).

Figures 11
*Leading into the
roundabout (left and
centre) and rumble
stripes at slips of
roundabout (right).*



Directly at the drives into the roundabout, there need to be additional spaces for operation of larger vehicles such as articulated buses. Especially on the right-hand side of the right traffic lane such an area is required otherwise buses would run over the curbs. The problem with this additional space though is that cyclists can pass busses on their right side; and typically when buses enter roundabouts, their drivers are focused on the traffic within the roundabout while they do not observe what is happening at their right-hand side. And quite often cyclists stand in the area of the “dead angle”. Therefore the situation becomes very dangerous. Such traffic situations occurred repeatedly at Ludgeriplatz and this led to accidents where cyclists often got severely injured and some were even killed. Figure 10 (right) illustrates the solution for this problem. By implementing rumble strips in these areas, cycling becomes very uncomfortable, hence discouraging cyclists to overtake from the right. Additionally at the drives into the roundabout specific signs were placed to consciously prevent cyclists from entering the dangerous area. This sign reads as “Attention, Dead Angle – I am only safe behind the vehicle” (Figure 12).



Figures 12
Sign: “Attention, dead angle” (left), sign “Stop” (centre) and Ludgeriplatz (right).

By the instalment of “Stop”-signs at the drives into the roundabout, traffic speed could be reduced remarkably. As also the mutual awareness and consideration got enhanced since each person on the road had to give way before entering the roundabout.

3.3 Meshed network of cycle paths (secondary network)

3.3.1 Restricted speed zones in residential areas

In residential areas cycling is permitted on the streets. There segregated cycle paths do not exist since the width of roads is usually too narrow to provide sufficient space for all activities-driving, car parking, sidewalks and cycle ways. To calm down traffic within those areas, the maximum speed is restricted to 30 km/h. That is why they are usually called “30 zones” (Figure 13).



Figure 13
Sign – Entry of “30 Zone”.

3.3.2 Bicycle streets



Figure 14
Sign "Bicycle Street".

Bicycle streets are streets in residential areas where bicycles are the dominant mode of transport. Here all motorised vehicles have to give way to bicycles. Furthermore, cyclists are allowed to cycle besides each other without getting sanctioned. In Muenster, 16 of these particular streets exist. It is planned to extend this number up to 27. Figure 14 shows a typical sign that indicates a bicycle street.

3.3.3 Pseudo one-way streets

Another measure to foster bicycle traffic is the so-called pseudo one-way street. Usually one-way streets are implemented in residential areas where space is restricted and traffic should be calmed down to improve the livability of a neighbourhood. Pseudo one-way

streets enable cycling in both directions, which is indicated by the additional "bicycles allowed" sign to the "do not enter" sign (Figure 15). This solution is very safe for cyclists because both motorists and cyclists can see each other approaching and give way if necessary.

In Muenster several streets were changed into one-way streets to provide a comprehensive bicycle network where cycling in an easy, quick and flexible way is ensured, e.g. the different departments of the University are distributed within the whole city. To encourage cycling amongst students and to provide direct access between the different university buildings, several streets in the city centre that used to be one-way streets have been changed into pseudo one-way streets. At some points an extra-marked cycle-way is implemented to indicate the right of way for cyclists. This measure becomes especially important if cars leaving their parking space have to pass the cycle lane.



Figures 15
Pseudo one-way streets.

3.3.4 Further measures to extend the meshing of Muenster's bicycle network

There exist other regulations that support the flexibility of cycling in Muenster. These include *e.g.* free thoroughfare for cyclists at dead ends and also intersections where turning into certain directions is forbidden for cars.



Figures 16
Free thoroughfare at a dead end (left), revocation of turn-left prohibition (centre) and pedestrian area where cycling is only permitted between 20:00 and 9:00 (right).

Muenster's city centre consists of several pedestrian areas. In some of these cycling is free, but within pedestrian areas in the inner city-centre, where shops, cafes, bars as well as historical buildings are situated, cycling is only permitted at fixed times during nights. Figure 16 (right) displays a sign that indicates a pedestrian area where cycling is permitted between 20:00 and 9:00.

3.3.5 Measures to increase safety of cycling

Cycle ways are often crossed by ways of other traffic participants. To ensure the visibility of cyclists for car drivers, lined marking can be added to increase safety of cyclists. Figure 17 (left) shows such a marking at a property entrance and Figure 17 (centre) at a street crossing. Moreover, piles preventing cars from entering cycle ways are marked with a white and a red stripe. This helps avoiding collisions of cyclist with the piles (Figure 17 right).



Figures 17
Lined marking at a property entrance (left) and a street crossing (centre), marked pile (right).

3.4 Traffic management

3.4.1 Traffic lights and signage

Traffic lights and signs are essential for traffic regulation. To control the high proportion of cyclists, special traffic lights and signs are required. In Muenster, bicycle traffic is managed by three different types of traffic lights at all major intersections.

This first type of regulation is a separate traffic light for cyclists. As it is displayed in Figure 18 they are indicated by a bicycle. At some intersections this is complemented by an arrow within the light that assigns the direction of turn.

The second and the third types are usually combined with traffic lights for motorised traffic. If the common traffic light is placed on the right-hand-side of the cycle way, cyclists have to comply with the common traffic light. This second type is shown in Figure 19.



Figure 18
Traffic lights for cyclists – type 1.



Figure 19
Common Traffic lights for cyclists and motorised traffic – type 2.

Furthermore the third type is given, where cycle ways and sidewalks are at the same level. At intersections both ways are adjacent to each other and curbs are lowered equally (cf. Figure 20 left). Then there are traffic lights that indicate a pedestrian count for cyclists as well. As a variation of the type three lights, there also exist traffic lights that directly indicate their compliance for both, cyclists and pedestrians. This type is displayed in Figure 20 (right).



Figures 20
Traffic lights for
bicyclists – type 3.

In addition to the regulation by traffic lights, there are special traffic signs. As it was already mentioned in the earlier sections, every facility or preference given to the cyclists, *e.g.* at dead ends, pseudo one-way streets or pedestrian areas, need to be clearly indicated by signs. Furthermore, there are signs for “Dead angles”, special regulations at bus lanes or indicating bi-directional cycle ways, etc. But, there are several other signs indicating in which way cyclists will be led before reaching a particular location, *e.g.* when a cycle path ends (Figure 21 left) or the access at an intersection requires special attention (Figure 21 right) such signs are installed.



Figures 21
Signs “End of cycle
path” (left) and
announcement
of bicycle traffic
regulation at the next
intersection (right).

3.4.2 Signposting system

The signposting system of Muenster mainly consists of 1,750 signs (1 m × 25 cm) that inform about destinations in the whole city and their respective distances (Figure 22 left). These signs are usually placed at intersections where different cycle routes meet. Away from such intersections, the directions of cycle paths are indicated by intermediate signs (Figure 22 – middle and right).

Figures 22
Signposting within Muenster's bicycle network – main signs (left) and intermediate signs (middle and right).



In addition to the above type of signs, there are also signs indicating specific routes. Several circular routes that are marked with a specific number are currently part of the bicycle network.

Figure 23
Further signs indicating particular routes.



As it is displayed in Figure 23, number 80 and 112 stand for such a particular route. For instance this can be a route that leads along cycle ways situated away from major traffic axes where relaxed cycling is possible. Likewise signs can indicate that the cycle way is part of a historical route (marked by the castle door) and also part of the European cycle way number R1.

3.4.3 Phased traffic lights

At two cycle routes along “Herwarthstraße” and “Von-Steuben-Straße” leading to the central station of Muenster, traffic lights for cyclists are phased. Compliance of an average speed of 14 km/h ensures steady cycling there.

3.5 Services

3.5.1 Parking management

In Muenster parking of bicycles needs to be considered as well. More than 105,000 cyclists per workday demand a high number of available parking facilities at their homes, their work places, at shopping facilities, at university buildings, etc. All parking facilities have to be equipped with an adequate number and design of bicycle racks. Furthermore, racks have to enable secure locks and, if possible, bicycles should be protected against the weather too.



“Bike & ride” facilities are provided at several points within the city. Bus stops, especially those situated in the suburbs, are equipped with racks. By this measure the catchment area of buses has increased significantly. At the main interchange point, the central train station, the available space outside the station was overcrowded with bicycle racks. Since these racks were not able to cover the increasing demand for parking space for bicycles, Muenster built an underground car park at the station forecourt which will be introduced in the following section (3.5.2).

Figure 24
Bicycle parking at the central train station.

Of particular importance is the parking of bicycles in the Old Town, where shopping and central institutions are located. There the available space has to be shared between cyclists, streams of pedestrians, open air cafés and store displays. Due to the fact that 40 % of bicyclists come into the inner centre of Muenster for shopping, sufficient parking space is required to ensure commercial profit induced by the cyclists.



Figure 25
Bicycle parking within the Old Town.

Another challenge of parking management is the central cantina at Muenster’s university. The bicycle is the most widespread transport mode amongst 55,000 students. During lunch time, when the cantina is frequented by an extremely high number of students, parking bicycles often becomes very difficult.

Figure 26
Bicycle parking at Muenster’s University.

The construction of parking facilities in residential areas became problematic since residents claimed that parked bicycles would hamper walking along sidewalks. Therefore, the State-Government regulated by law that new buildings must provide a certain number of parking facilities for bicycles. In apartment houses, for example, bicycle sheds or cages present themselves as a good solution, while individual solutions can be found for single occupancy houses. Often the bicycles are simply placed in the garage and the car is left outside.



Figures 27
Bicycle parking in residential areas.

3.5.2 Bicycle station

As it was already mentioned, Muenster's bicycle station was introduced to cover commuters' growing demand for bicycle parking spaces at the central station.

After the bicycle station was opened, the attractiveness of cycling increased remarkably. About 2,000 people switched from other transport modes to cycling.



Figure 28
Bicycle station in Muenster.

Bicycles can be left overnight and over the weekend inside the station. In this way, they are protected against theft and vandalism due to permanent video-monitoring and closing during nights. Thanks to a space-saving design, bicycles are parked in two levels. Overall the bicycle station provides parking space for 3,300 bicycles. The parking area is divided in different sections referring to daily-, monthly-, annually- and long-term-parkers. Today almost all available spaces for parking situated outside the bicycle station are occupied with around 3,000 bicycles. The underground bicycle station itself can be reached by a big ramp and by two steps, one leading directly into the central station and the other one into the adjacent pedestrian area.



Figures 29
Bicycle station – Bicycle wash (left) and bicycle parking in two levels (right).

The bike station is open from 5:30 – 22:00 and also offers a bicycle repair service, a bicycle wash, bicycle rentals and lock boxes. Costs for rentals are EUR 7.50 per day, EUR 10 per 20 hours and EUR 17.50 per 3 days. A parking place costs EUR 0.70 per day, EUR 7 per month and EUR 70 per year.

The bicycle station was planned by the city of Muenster who commissioned the WBI (Westfälische Bauindustrie GmbH) for construction and operation of the station. Today the station is monitored and serviced by a tenant who was instructed by WIB.



Figures 30
Bicycle station – Ramp and steps.

3.5.3 Bicycle stores

In Muenster there are about 40 bicycle stores. That means that one bicycle store serves 7,000 residents. Hence Muenster is not only Germany's leading city for cyclists, but also the leading city of commerce and services associated with bicycles. Muenster provides even a mobile repair service, the "Leezendoc", which reaches its customers by a car packed with spare parts to get the bikes back on the road as quickly as possible.



Figure 31
One of Muenster's 40 bicycle stores.

4. Essentials for a high quality bicycle infrastructure

In the preceding section, Muenster's bicycle infrastructure has been discussed and illustrated by photographs. The case study of Muenster has demonstrated that by putting in place high quality bicycle infrastructure as well as regulations and enforcement in favour of cyclists, the proportion of a city's cyclists can be increased significantly. From the Muenster case it can be seen that in order to enable a high quality bicycle infrastructure, the following issues need to be considered.

First of all, a bicycle network should be as direct and well-meshed as possible. Cyclists should be able to travel easily and quickly wherever they want to go. This requires cycle ways along main traffic axes as well as preferences at locations where the flexibility and freedom of cycling is restricted, *e.g.* by one-ways or dead ends. Supported by cycling highways like Muenster's Promenade, the attractiveness of the system can be enhanced.

Secondly, the cycle paths need to be designed for the future demand rather than for the present one. The implantation of bicycle infrastructure usually leads to a significant growth of the number of cyclists so the planning has to be based on prognosis and targets of the city's cycling strategy.

Thirdly, safe route conduction, strict regulations, observations and sanctions are required in order to ensure safety. This can be achieved by traffic regulatory measures, the specific indication of dangerous situations and measures that increase mutual awareness between all traffic participants. Proper signalling, signing and marking, separated traffic lights for cyclists, signs like "Attention, dead angle" or bicycle floodgates at intersections are some of the suitable measures.

Fourthly, an appropriate designed system of signposting is expected to facilitate cycling, especially for those who do not know how to reach their destinations.

Fifth, sufficient parking facilities, equal to motor vehicles, are required. If there is a lack of parking space people would not use their bicycles.

Sixth, services for repairs and rentals are required to support people in times of bicycle breakdowns or for tourists who want to explore the city on a bicycle.

There are further issues that have not been considered in this paper. Communication is required in order to increase acceptance within the population as well as to raise awareness of the advantages of cycling. Finally there are two other prerequisites for the implementation of a high quality bicycle infrastructure. Political willingness and financial support are a must. These are important at all stages: planning, implementation, operation, maintenance and extension. Without political will and funds it is hardly possible to attempt such important and bold measures in sustainable mobility successfully.

All these issues need to be part of a systematic bicycle network, where all components are unified and well meshed. Furthermore, the bicycle system needs to be integrated into an overall transport strategy as particularly a good interface between cycling and public transport is important to enable the combination of different sustainable transport modes in any city.

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