Safe roads for all users - insights from the German "bicycle capital"

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Paper prepared for the session RS - Road Safety Planning, Safe System and Vision Zero
2025 Transportation Association of Canada (TAC) Conference & Exhibition
Québec City, Québec

Abstract

In previous years, the traffic accident statistics of the state of North Rhine-Westphalia repeatedly showed a very poor accident record for Münster. This led to an urgent and comprehensive need for action at various levels. To achieve improvements as quickly and efficiently as possible, several analyses and surveys have been conducted to improve road safety. The knowledge gained from this has been continuously incorporated into the ongoing work to improve road safety. In 2007, a “Traffic Accident Prevention” regulatory partnership was therefore established with the aim of developing joint strategies and measures to improve road safety. Its building blocks include the four fields of action “Monitoring and punishment”, “Construction and traffic engineering”, “Traffic education and road safety advice” and “Public relations”, which are all closely interlinked. Since then, reactive and preventive measures have been used to make Münster safer for all road users. The city of Münster has thus been carrying out holistic / integrative road safety work at various levels for many years, which has been evaluated several times. The road safety program is now well established and has become an integral part of current practice. Increasing and changing mobility and the growing city are constantly presenting road safety work with new challenges. If we now consider the requirements of climate protection, we can see that the traffic-safe city of tomorrow should be a bicycle and pedestrian-friendly infrastructure in particular. This is why the decision was made in 2020 to realign road safety work. This contribution provides an overview of the past, present and future of road safety work for a safer city of Münster for everyone.

1. INTRODUCTION

Until a few years ago, road traffic accident statistics for the State of North Rhine-Westphalia repeatedly showed that Münster had a very poor accident record. It was determined that there was an urgent need for wide-ranging action on a number of levels. To enable improvements to be achieved as rapidly and efficiently as possible, a number of studies and reports aimed at improving road safety were drawn up. The insights gained from these reports have been continuously incorporated into ongoing work to improve road safety. The Road Traffic Accident Prevention Partnership ("Ordnungspartnerschaft Verkehrsunfallprävention") was founded in 2007 with the aim of developing joint strategies for and identifying measures aimed at improving road safety. Its components include four closely linked areas of activity: surveillance and enforcement, civil and traffic engineering, road safety education and advice, and public relations. Since then, the partnership has employed reactive and preventive measures with the aim of making Münster safer for all road users. Münster City Council has now been running this integrated road safety programme, which operates on a number of different levels, for several years. The programme has been evaluated on a number of occasions. The road safety programme is now an established fixture and it would be hard to imagine operating without it. Increasing and changing mobility and a growing city mean that there are always new challenges for the road safety programme. Given the need for climate action, it is clear that road safety measures in the city of tomorrow need to incorporate bicycle and pedestrian-friendly infrastructure. In 2020, therefore, a decision was taken to realign the road safety programme. This article provides an overview of the past, present and future of the road safety programme, which aims to make Münster a safer city for all

2. THE VISION: MÜNSTER – SAFE ROADS FOR ALL ROAD USERS!

Being able to use public roads without fear of accident is vitally important for quality of life in a city. That applies to all road users. Every resident of and every visitor to the city should feel at ease and be able to get about safely on Münster's streets, cycle paths and pavements irrespective of their mode of transport. Münster should be made safer for all road users, whether travelling by lorry, bus, car, bicycle or on foot, a wheelchair user or visually impaired, pushing a pushchair or on a scooter, young or old. The city of Münster is a liveable city with a road network rooted in its history. It is a growing city and its population has increased by around 37,000 people over the last 10 years. As of December 2020, there were 316,403 people living in Münster. Roads are the arteries of a city. Within Münster, road users can make use of a network of around 1,200 km of roads and 470 km of cycle paths. Bicycle traffic is of particular significance, making up over 40% of traffic[1].

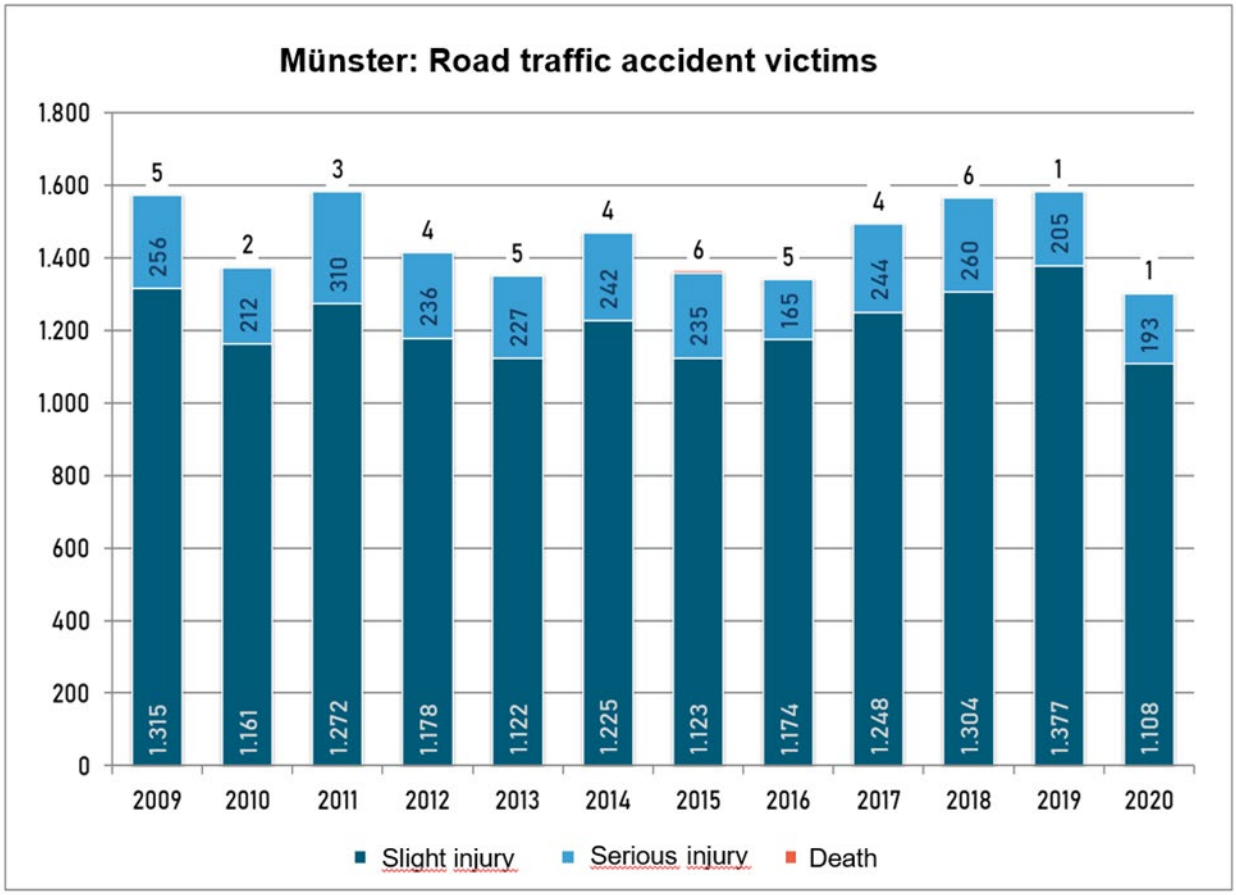
According to a 2019 survey on workday road use by people living in Münster, only 34.2% of journeys were made using motorised private transport. 65% of journeys are made using public transport, by bicycle or on foot. As a regional hub for the Münsterland region, consideration also needs to be given to the high levels of commuter traffic in Münster. According to Pendleratlas NRW[2], in 2019 there were approximately 105,207 inbound commuters, 44,922 outbound commuters and 128,777 commuters commuting within the city of Münster, all creating additional traffic. Münster is a cycle-friendly city, and around 400,000 journeys a day are made by bicycle. The average Münster resident owns two bicycles and rides their bicycle for around 20 minutes a day. 40% of all journeys made by Münster residents are made by bicycle. Unfortunately, with cycling making up such a high proportion of road traffic, conflict and accidents are inevitable. Accidents involving cyclists and accidents involving pedestrians usually result in personal injury. As a result, official accident statistics for cities in which cycling is popular tend

to show that road traffic accidents resulting in personal injury are a particular problem. This is a result of the high levels of bicycle use.

3. ACCIDENT STATISTICS

In 2009, a road safety programme was launched with the aim of reducing the high number of road traffic accidents in Münster, particularly accidents resulting in personal injury. Despite this, in the years through to 2019, the total number of road traffic accidents actually increased. In 2020, this number then dropped significantly (-15%). This drop in the number of accidents is to a large extent the result of reductions in both motorised and non-motorised traffic volumes as a result of the coronavirus pandemic. Since March 2020, life in Münster and across Germany – and with it patterns of road use – has been upended by the coronavirus pandemic.

Figure 1. Total annual road traffic accidents/percentage change in population, vehicle numbers and road traffic accidents resulting in personal injury in Münster[3]

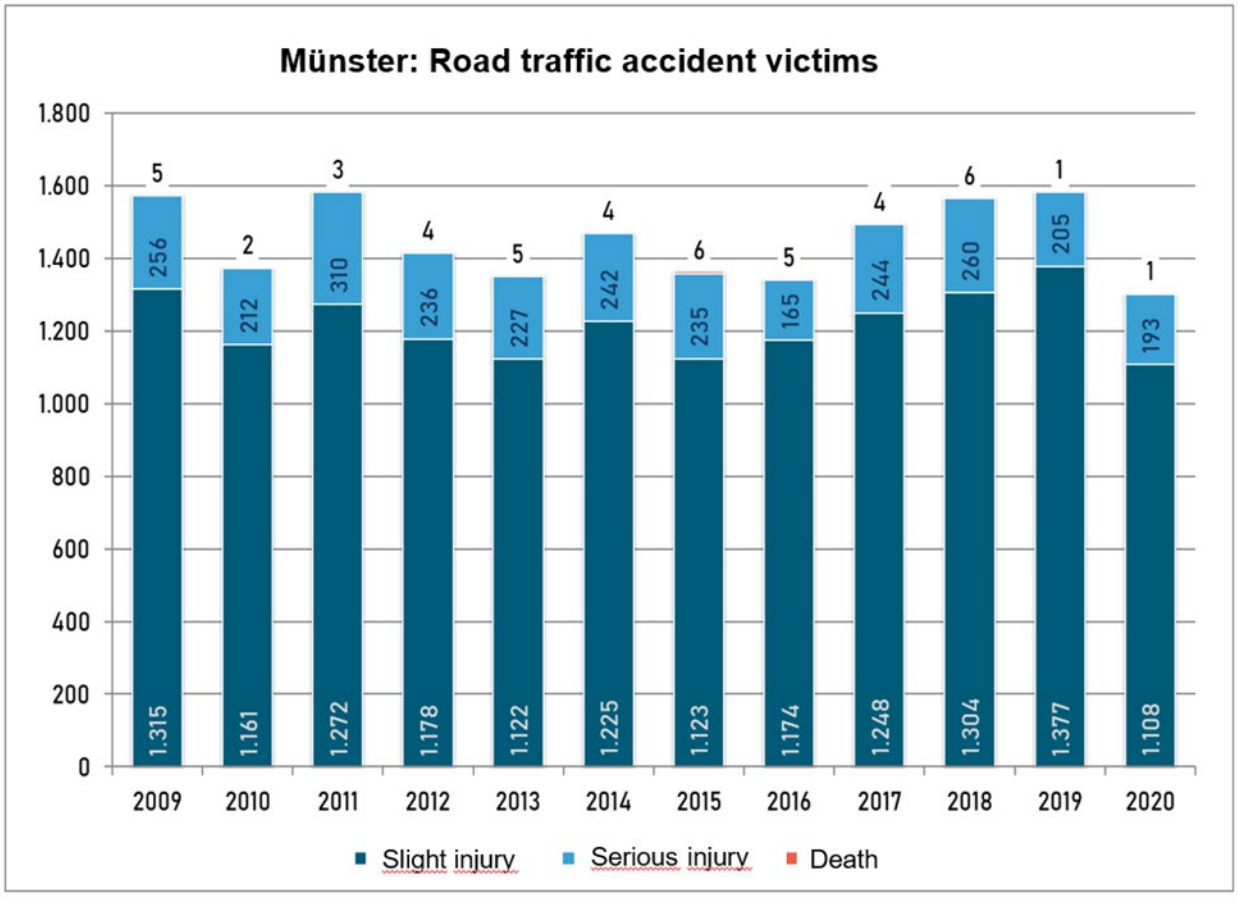


Working from home, home schooling, lockdowns and limitations on socialising have had a big effect on mobility. The increase in the number of road traffic accidents can in part be explained by the continuous increase in population and motor vehicle numbers, and by the high proportion of bicycle traffic. Since 2009 the population has increased by around 15%, from 275,543 to 316,403 (as at December 31, 2020). Since 2009, the number of motor vehicles has increased by approximately 19% to 170,424 vehicles (as at

January 1, 2020). Figure 1 shows total road traffic accidents in the city of Münster annually and the percentage change in population, motor vehicle numbers and road traffic accidents resulting in personal injury. [4]

In 2020, a total of 1,160 road traffic accidents resulting in personal injury were reported. Since the road safety programme was launched in 2009, the number of road traffic accidents resulting in personal injury has fluctuated within the range 1,160 to 1,365 (figure 2). The vast majority (>80%) of people injured sustained only minor injuries. Minor injuries are defined as injuries which do not result in immediate inpatient admission to hospital. Between 2009 and 2020, the number of seriously injured people fluctuated within the range 13% to 20%, with the percentage of accident victims who sustained serious injuries falling over the last two years. Serious injuries are defined as injuries which result in hospital admission lasting more than 24 hours but do not result in death within 30 days. In both of the last two years, one person has been killed in a road traffic accident[5].

Figure 2. Total annual road traffic accidents/percentage change in population, vehicle numbers and road traffic accidents resulting in personal injury in Münster[6]

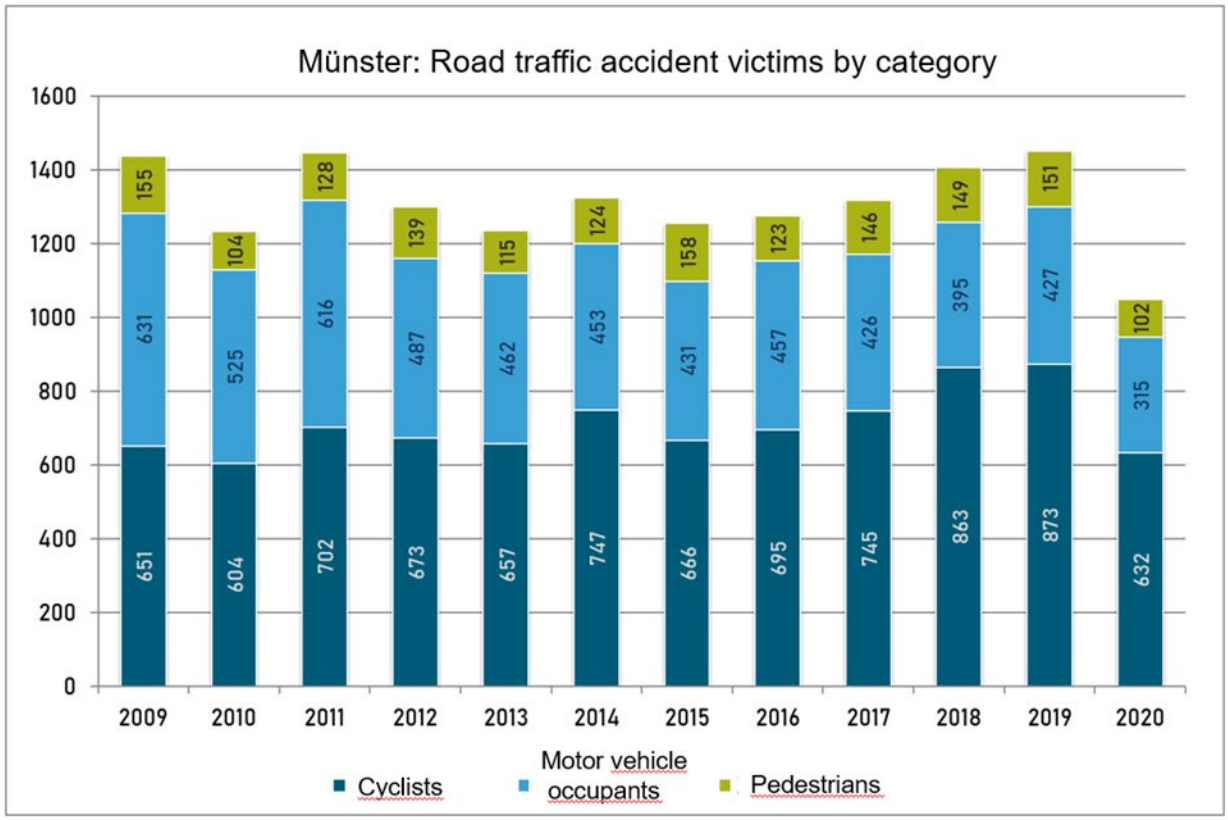


Cyclists, including electric bicycle users, account for the majority (57%) of accident victims in Münster. In 2020, a total of 747 cyclists, including 114 electric bicycle users, were injured in road traffic accidents and one electric bicycle user was killed. The number of cyclists injured fell by 167 (from 799 to 632) compared to 2019; the number of electric bicycle users injured rose by 41 (from 73 to 114). This

represents a significant increase. From 2019 to 2020, the number of motor vehicle occupants involved in a road traffic accident fell 26.2% from 427 to 315. In 2009, when the road safety programme was launched, twice as many motor vehicle occupants (631) were injured in road traffic accidents. In 2020, car occupants accounted for 24.2% of all accident victims.

Over the period of comparison, the number of pedestrians involved in road traffic accidents has remained pretty constant, and pedestrians currently account for 7.8% of accident victims. Last year 102 pedestrians were injured in road traffic accidents – 49 fewer than in 2019. Figure 3 shows the number of accident victims broken down into cyclists, motor vehicle occupants and pedestrians. The reduction in the number of injuries suffered by motor vehicle occupants over the period studied is clearly visible[7].

Figure 3. Road traffic accident victims by target group[8]



For many years, the city of Münster sat at the bottom of the table for road traffic accident statistics in North Rhine-Westphalia, particularly for road traffic accidents resulting in personal injury in cities with more than 100,000 inhabitants. (The North Rhine-Westphalia Ministry of the Interior and the police ceased publishing this table several years ago.) The city council was heavily criticised for its road safety record, which had consistently worsened since 2001. In response, the police and city council decided to take a comprehensive look at the background to, causes of and circumstances surrounding the number of accidents occurring in the city. To lift the city out of bottom place in the state accident statistics, they needed to improve road safety right across the city. There was an urgent need for wide-ranging action.

Figure 4. Sicher durch Münster (‚Safely through Münster') logo[9]

Source: City of Münster

In 2007, Münster City Council, the police and 24 additional partners from across society, business and local government founded the Road Traffic Accident Prevention Partnership with the slogan Sicher durch Münster ('Safely through Münster', figure 4). Their declared goal was to develop common strategies, to develop a road safety programme incorporating concrete measures for delivering lasting improvements to road safety in the city, and to reduce the number of accidents involving injury by 10% annually.

With the help of Münster's two major insurance companies, LVM and Provinzial, German Insurers Accident Research, part of the German Insurance Association (GDV), was prevailed upon to produce a detailed analysis of accidents in the city and some first recommendations for remediation. A city-wide road traffic accident report was published in 2008[10]. 63 accident black spots and 22 sections of road prone to accidents were identified across the city's network of major roads. More than 27,700 accidents occurring in Münster between 2004 and 2006 were analysed. To complement this, the behaviour of road users of all types was observed over a period of several days at a number of typical accident black spots and the speed of more than 220,000 motor vehicles measured [11]. Speed measurements showed that many vehicles were exceeding the speed limit. At night in particular only a third of drivers were complying with the speed limit. The investigation also found that almost all of the accident black spots identified were crossroads or junctions, 86% of which were traffic light-controlled. The investigation also yielded some important insights about cyclists. From 2004 to 2006, cyclists were involved in 47% of road traffic accidents resulting in personal injury. Fault for these accidents was split almost equally between motorists (51%) and cyclists (47%). In addition to the accident analysis, observations of a random sample of road user behaviour were carried out. The objective of these observations was to see if there were any characteristic errors being made by road users which were contributing to accidents in Münster. The observations showed that the majority of pedestrians and cyclists stop at red traffic lights. Extrapolating from the proportion of cyclists who fail to stop at a red traffic light (7%) to the total number of traverses at all traffic signals in Münster suggests that there are around 10,000 – 13,000 incidents in which a cyclist fails to stop at a red light per day. In addition to analysis, the report also put forward recommended actions. These included:

- Traffic light staging in which two or more conflicting streams are conditionally permitted to pass at the same time should be avoided entirely.
- Part time traffic lights which are switched off at night should switch to full time operation.
- Right-turn lanes at triangular traffic islands which are prone to accidents should be signalled.
- Cycleways should be of adequate size.
- Line markings on both sides or similar should be used to make cycle paths clearer.
- Crossings which are known to be prone to accidents should be surfaced in red.

The report and its recommendations, together with analysis by and insights from the authorities and police, played a major role in shaping the effort to deliver lasting improvements to road safety in Münster.

Based on the above report, in 2009 a road safety programme was agreed for an initial period of five years (from 2009–2013). The road safety programme was focused on four areas of activity.

I. Surveillance and enforcement
II. Civil and traffic engineering
III. Road safety education and advice
IV. Public relations

An overview of the key points within these four areas of activity is given in the next section. Münster's Road Traffic Accident Prevention Partnership shared the 2011 State Internal Security Prize. The award was granted for the "Sicher durch Münster" project. The State Internal Security Prize honours exemplary public safety partnerships for their citizen-oriented, constitutional and professional work[12]. Because the road safety programme was initially agreed for a fixed period through to 2013, an interim evaluation was required at the half-way point in 2011 to highlight the brevity of the project and extend it. The interim evaluation was carried out by the GDV and concluded that the measures implemented at accident black spots identified in the initial evaluation had already contributed to a significant improvement in road safety. It also concluded that there was still a long way to go and that there was still plenty of room for improvement. Based on these results, a consultation on extending the project was set up. A meeting of Münster City Council elected to extend the road safety programme for a further 4 years (2014-2017).

In 2015, the GDV commissioned BSV Büro für Stadt- und Verkehrsplanung Dr.-Ing. Reinhold Baier GmbH to carry out a final evaluation. This evaluation was aimed at verifying to what extent the actions taken had contributed to improving road safety and to identifying future priorities for the road safety programme[13]. A before-and-after comparison between the periods 2004 – 2006 and 2013 – 2015 showed a positive trend, with reductions in the number of accidents, number of accident victims and accident costs.

- The number of accident victims fell from 58 per 10,000 population (2004 – 2006) to 48 per 10,000 population.
- The number of accidents fell from 49 per 10,000 population to 41 per 10,000 population.
- Accident costs fell from €209 per inhabitant to €178 per inhabitant.

Although the stated objective of the Road Traffic Accident Prevention Partnership of reducing the number of traffic accidents resulting in personal injury by 10% annually was not achieved, a positive overall trend was nonetheless discernible. The final evaluation clearly showed that high levels of bicycle use meant that existing cycling infrastructure was operating at or above capacity. A key recommendation from the study was therefore for modern cycling infrastructure with sufficient capacity. Key recommendations were for cycling infrastructure at junctions to include adequately sized cycleways, more intensive surveillance to ensure compliance with traffic regulations, and the removal of triangular traffic islands with right-turn lanes. The final evaluation was published in 2018. In 2017, while the final evaluation was being prepared, it was agreed at a council meeting that the road safety programme should become a permanent programme. This political recognition and the provision of permanent resources were important in that they enabled the road safety programme to be better planned and designed.

4. ROAD SAFTY PROGRAMME AREAS OF ACTIVITY

In a similar vein to the international concept of “enforcement, engineering, education, public relations”, Münster’s road safety programme takes an integrated approach based on four areas of activity. There are four elements:

1. surveillance and enforcement
2. Civil and traffic engineering
3. Road safety education and advice
4. Public relations

These elements are closely interlinked with the aim of realising an integrated, tightly focused road safety programme. Each partner in the road safety partnership is anchored in one or more of these areas of activity.

4.1 Surveillance and enforcement:

Research has shown that increased surveillance and enforcement in conjunction with appropriate educational measures can significantly reduce road traffic accidents. The concept underpinning this area of activity consists of a combination of enforcement and education, with the aim of encouraging road users to comply with road traffic regulations. In addition to daily checks and enforcement in stationary and moving traffic by police and the Office for Public Order (Ordnungsamt), campaigns covering a range of topics were initiated at regular intervals. The topics covered were in each case based on a specific cause of accidents. Of particular note were checks on cyclists (alcohol, drugs, using the wrong lane, failure to stop at a traffic light, correctly observing right of way/priority, bicycle equipment), motor vehicle checks (correctly observing right of way/priority, checking blind spots, speed, driving too close to the car in front, alcohol, drugs, driving without due consideration for cyclists) and surveillance measures around schools and nurseries (speed warning/thank you signs).

4.2 Civil and traffic engineering:

The vast majority of road traffic accidents are caused by people and errors committed by people. But in addition to road user behaviour, infrastructure also plays an important role. It is estimated that over 75% of road traffic accidents are the result of road users making an incorrect assessment of the lie of the road, speeds or unclear traffic conditions. Given the high number of such accidents, it is clear that uniform, easily comprehensible design of the entire road environment is very important for improving road safety. It follows that, by using construction and technical measures, civil and traffic engineering has a big role to play in improving traffic flows, and thereby reducing road traffic accidents. Structural improvements to infrastructure generally take some time to realise, however, and are expensive. Since the launch of the road safety programme, activities in this area have been consciously focused on reactive and preventive measures.

Reactive road safety measures are implemented in consultation with the police and Münster City Council and are guided by accident statistics and causes of accidents. These measures are generally decided on by the Accidents Committee, once a junction or stretch of road has been assessed by police as being an accident black spot (UHS or UHL in the German nomenclature), as set out in the circular “Aufgaben der Unfallkommission” in Nordrhein-Westfalen[14] (Role of the Accidents Committee in North

Rhine-Westphalia) issued by the North Rhine-Westphalia Ministry of the Interior and Ministry of Construction and Transport.

Preventive measures are just as important, since, according to a GDV analysis of accidents across the city in 2008, around two thirds of road traffic accidents occur at sites which are not accident black spots. A particular focus was placed on accidents involving cyclists, as more than half of all injuries are sustained by cyclists. With respect to existing cycleways, the GDV report identified recurring hazardous situations, for which city-wide standard solutions were developed (uniform markings, surface design, colouring, signs, signalling). Agreement was reached on standardising the means by which bicycle traffic was protected from motor vehicle traffic turning into and out of crossroads and junctions, improving bicycle traffic safety at property entrances, better visibility of essential posts on cycle paths, and improving safety for bicycle traffic on two-way cycle paths. To attain this standard, all cycleways were reviewed and any deficiencies identified recorded in a database (figure 5), prioritised and processed depending on urgency.

Figure 5. Extract from the cycling infrastructure review database

Source: Münster City Council

Many of the accident black spots identified annually are at traffic lights. To improve road safety, all 280 traffic lights in Münster are incrementally being converted to LEDs. LEDs provide higher luminosity and therefore better visibility. More than 75% of traffic lights have now been updated to use this technology. In addition, more than 168 traffic lights have been equipped with acoustic signals and vibrator buttons suitable for people who are visually impaired or blind. To improve road safety, part time traffic lights which had previously been disabled at night were switched to 24-hour operation, as it was found that, compared to 24-hour traffic lights, disabling traffic lights at night nearly doubles uncertainty at junctions (GDV no. 2). Thanks to a generous donation from Brillux in celebration of its 125th anniversary, 125 road safety mirrors were attached to traffic lights to provide visibility of blind spots. Since 2009, large vehicles have featured stickers on the back of the vehicle to draw attention to their blind spot. These stickers are now present on all buses, fire service vehicles and emergency vehicles, all municipal bin lorries and lorries operated by the council's Mobility and Civil Engineering Department, and many lorries operated by local companies. Around 4,500 stickers have now been distributed.

The existing road network is subject to regular comprehensive inspections. These inspections include verifying that the road network is safe for traffic and identifying and recording any damage. The inspections are carried out on foot or by bicycle by eight road safety inspectors employed by the city council. Their role includes identifying any damage and inspecting signs, road markings and directional signs[15].

4.3 Road safety education and advice:

Road safety education and advice are of key importance for accident prevention. Among the main tasks in this area of activity are communicating the importance of being considerate to other road users, compliance with traffic regulations and safety issues for different types of road user. This element is primarily the domain of the police and trained police road safety advisers. The programme is tailored to the various different user groups (figure 6). Road safety education for preschool children attending daycare centres, for example, is delivered using an educational puppet show about children as pedestrians. There are also programmes for year 4 primary school children (cycle training), young

Figure 6. Various road safety education campaigns

Source: Münster City Council

novice drivers (crash course) and students (interactive lecture on bicycles). In addition to these road safety education activities, year 7 pupils are offered the opportunity to attend a road safety day. There is also a road safety programme for year 5 pupils entitled "New school, new routes", and programmes for senior citizens, people with disabilities and refugees. Road safety advisers also man information stands at trade shows and Münster's weekly market.

4.4 Public relations:

Changing the attitude of road users so that they take greater care and show greater consideration to other road users is both necessary and dependent on public relations activities. The role performed by this area of activity is to run campaigns to support the work of the other areas of activity (figure 7) and to ensure that the public are aware of the Road Traffic Accident Prevention Partnership.

Using an intensive, creative approach, this area aims to raise awareness of road safety and permanently fix road safety in the minds of road users. Each year, as the days grow shorter, the partnership distributes 4,000 yellow safety vests featuring the Road Traffic Accident Prevention Partnership logo to cyclists and, since 2019, a further 1,000 reflective bags to pedestrians. The campaign slogan is “See and be seen”. The partnership has now distributed around 40,000 yellow vests which are helping to make the roads safer in the darker months. In 2011, the Denkzettel campaign was launched. The campaign featured no-nonsense information combined with hard-hitting images principally showing the potential consequences of a road traffic accident, and characters telling their personal accident stories. The campaign aimed to promote safer behaviour by road users. The campaign saw large numbers of life-size displays and posters in bus shelters. Slogans were posted on buses and individual activities relating to the campaign were organised. The Road Traffic Accident Prevention Partnership also carried out other projects and activities, including placing cinema and radio adverts on key issues such as checking your blind spot, alcohol and lights, school cycling initiatives, information stands, and campaigns such as ‘Keep your distance!’ and ‘Wise heads protect themselves’.

Figure 7. Campaigns

Source: Münster City Council

The current poster campaign slogan is ‘Show your sweet side’. The posters show amiable chocolate bars (sweet side is ‘chocolate side’ in German) calling for people to show more consideration to other road users. The aim is to ask all.

5. THE ROAD SAFTY PROGRAMME AT PRESENT

To make a city like Münster a safe city for all road users, all types of road user need to be considered, particularly when it comes to apportioning public spaces. It is of little help if, for example, the only group for which road safety is improved is cyclists, while parked bicycles continue to pose a hazard to pedestrians. Special consideration therefore needs be given to pedestrians and, in particular, to groups such as wheelchair users, people with pushchairs, children and people with a visual impairment. The aim must be that every road user, irrespective of their individual needs, should be able to move about the city safely.

5.1 Measures

A number of good ideas for improving road safety have emerged from various working groups. Some working groups such as the Accidents Committee and the Road Safety Inspectorate form part of the council's statutory duties. In addition to these two working groups, a working group for road traffic (a committee consisting of council, police and municipal public transport operator employees responsible for road traffic issues), an expert team on bicycle traffic, a cross-party road safety working group (council, police and politicians), a steering group (council and police) and the Road Traffic Accident Prevention Partnership have also been set up. All of these working groups have the goal of improving road safety.

Areas targeted for improvement include improving road safety where motor vehicles (particularly large motor vehicles) are turning off the main carriageway across the path of cyclists and pedestrians continuing straight on at traffic lights. Where a traffic light has stages during which two or more conflicting streams are conditionally permitted to pass at the same time, conflict between motorised traffic and cyclists/pedestrians occurs at every green phase. Accidents can be caused by a brief period of inattention, items obstructing a road user's view or blind spots. Such accidents can have serious consequences.

Figure 8. Pavement parking

Source: Münster City Council

In May 2019, the council agreed legislative proposal V/0154/2019 entitled "Creating freedom from conflict in the management of right-turning motor vehicles and parallel pedestrians/cyclists at traffic lights," [16] which will result in separate right turn lanes being planned and introduced at 19 prioritised

traffic lights. Where right turning traffic has been separated into a separate phase at existing traffic lights, bicycle and pedestrian accidents involving this right turning traffic have been eliminated.

Accessible street design is an important factor in realising the goal of a city which is safe for all road users. Accessibility is not just important for people with restricted mobility or a visual impairment – it also, for example, helps people with pushchairs to walk around the city more safely. To make roadside pavements easier to use, a programme of continuously enhancing accessibility at bus stops, traffic lights, traffic islands and crossings using contrasting elements, tactile paving for people who are visually impaired, dropped kerbs and acoustic signals has been initiated. It is also important that pavements are kept free of obstructions. For nearly 25 years, the policy in Münster was that pavement parking was tolerated within the city limits (figure 8). Where an obstruction or traffic hazard arose, a warning notice or fine was issued, with an obstruction being deemed to be present when the remaining usable pavement width was less than one metre. In spring 2021, this policy was repealed. The new policy is that pavements should be usable by the people for whom they are intended and who are authorised to use them, and should be free from obstructions or traffic hazards. Where an obstruction or traffic hazard is present, a warning notice or fine will be issued directly. The result is that obstructions which reduce the usable pavement width to one metre are no longer tolerated. Given the high levels of bicycle use in Münster, cycle parking facilities are also very important. Ever more bicycles are illegally parked on the pavement (figure 9), obstructing pedestrians and people with limited mobility and in some cases forcing them into the road.

Figure 9. Pavement parking

Source: Münster City Council

The usable space is becoming ever smaller. The bicycle parking programme launched in 2021 is intended to create 3,000 bicycle parking spaces (1,500 cycle stands) annually in Münster city centre, adjacent districts, suburban centres and at bus stops, primarily by replacing car parking spaces. It is hoped that this will reduce the huge numbers of bicycles illegally parked on pavements and ensure that pedestrians and people with limited mobility are able to pass safely. In addition, the council has been tasked by

politicians with developing a strategy for dealing with abandoned bicycles, with the aim of being able to gradually remove them from the city. The bicycle parking programme will be financed using Stellplatzablösemittel funds (funds paid to the council by builders in lieu of providing on-site car parking spaces). In future, waste management companies are also set to get involved in the road safety programme. Like the illegally parked bicycles discussed above, rubbish bins awaiting emptying are left on the pavement, in some cases permanently, further restricting the usable pavement area. It is intended that a concept will be developed to eliminate this problem.
When the road safety programme was launched, only cycle crossings which were known to be prone to accidents were surfaced in red. This changed with the approval of a city cycle plan in late 2016. This states that all cycleways predominantly serving bicycle traffic should be surfaced in red. In contrast to cities with a low(er) proportion of bicycle traffic, in Münster, where it is the dominant traffic type, for road safety reasons cycling infrastructure needs to be made clearly visible in order to raise awareness of cyclists and prevent accidents. All transport infrastructure intended exclusively (e.g. cycle lanes) or primarily (e.g. cycle-priority streets) for bicycle traffic (including all cycle crossings) are to be made more visible by having a self-explanatory, easily recognisable, red appearance[17]. This will mean that all cycleways in Münster will gradually be surfaced in red (figure 10).

Figure 10. Pavement parking

Source: Münster City Council

In addition, in the longer term important cycle routes should be placed on road humps at all property entrances and junctions with side roads. The resulting reduction in speeds when turning is expected to reduce the risk of accidents. Implementation of this measure is still at a very early stage. Münster residents make 727,000 journeys per day by bicycle, on foot, by bus or by train, compared to just 296,000 by motor vehicle. The same number of motor vehicle journeys again are made by people who do not live in the city (visitors, commuters). This is where the concept of Greater Münster cycle routes (‘Veloroutes’) comes in. Following discussions at the Greater Münster mayors' forum, the Veloroutes concept has been developed primarily by Münster City Council in close collaboration with municipalities in the Greater Münster area [2016 Münster cycle plan]. The aim of the Veloroutes – also known as priority cycle routes – is to develop a network of routes suitable for everyday use between Münster and

neighbouring municipalities, with the aim of encouraging people to make the switch from car to bicycle. There routes will primarily be based on existing infrastructure which will be upgraded and optimised for safety[18].

Figure 11. Greater Münster cycle routes

Source: www.veloregion.de

There will be a total of 14 continuous, safe, hassle-free everyday priority cycle routes between the inner-city Promenade cycle route, outer city districts and neighbouring towns aimed at enabling rapid, safe access to the city (figure 11). The priority cycle routes run exclusively on existing infrastructure. To ensure a uniform standard, this infrastructure needs to be expanded and upgraded. Key quality features include expansion to at least the dimensions specified in the ERA recommendations for cycling infrastructure, cycle lane edge marking on both sides to facilitate orientation, an asphalt or concrete block paving surface suitable for day-to-day use, lighting (including some sensor-activated lighting) along the whole length of the route, a continuous network with no breaks in that network and a guarantee

that the routes will be cleaned, maintained and kept free of ice and snow in winter. More information on these routes can be found at www.veloregion.de. Smart, sensor-activated lighting has been in operation on a section of the Kanalpromenade route along the Dortmund-Ems Canal since late 2019. Approaching cyclists are detected by sensors attached to street lights, which then turn the cycle path lighting up to full power. Once cyclists have cycled past, the lighting is automatically dimmed back to the background level. This adaptive lighting not only saves valuable energy and reduces the routes' environmental impact, it also makes road users feel much safer when cycling in the dark [www.veloregion.de]. The scheme has predominantly been funded by the federal government.
Cycle-priority streets have been in use in Münster since 1990. Cycle-priority streets are residential streets on which bicycles have priority over all other types of vehicle. Under German road traffic regulations, motor vehicles are only permitted on cycle-priority streets in exceptional cases. In Münster, however, nearly all cycle-priority streets are open to motor vehicles. This is indicated by appropriate road signs. Designating streets as cycle-priority streets is a useful tool for promoting bicycle traffic. When designed with visual clarity and in a well-planned network, cycle-priority streets help concentrate bicycle traffic flows. They increase both objective and subjective safety and are an attractive alternative to cycleways along main roads. Previously, Münster's cycle-priority streets were not always properly designed and could not always be distinguished from other access roads. New quality standards for

Figure 12. Cycle-priority street 2.0 (Photo:)

Source: Patrick Schulte

Münster's cycle-priority streets (figure 12) were developed and have been in effect since summer 2019[19]. These quality standards include:

- The carriageway width should be 4–5 m plus a 0.50–0.75 m safety lane to separate traffic from parked vehicles.
- Cycle-priority streets should have preferential treatment at junctions.
- Motor vehicle traffic should be partly restricted.

- The whole of the carriageway should be surfaced in red (with the exception of safety lanes for separating traffic from parked vehicles and parking spaces)

To date, a total of 9 cycle-priority streets meeting the new quality standards, with a total length of approx. 5.8 km, have been implemented.
Less formal measures can also improve road safety for more vulnerable road users. It would be remiss of us to neglect to mention fixed driver feedback signs. These signs are intended to alert motorists to hazardous situations while engaging them on an emotional level, making them more likely to reduce their speed. An image of children with the message “Thank you” for drivers driving at the correct speed or “Slow down” for drivers driving too fast (figure 13) encourages drivers to pay more attention to their speed. This praise or admonishment is visible to all and enables social control of individual speed. Areas where they can be used include near nurseries and schools and at accident black spots. Analysis of these fixed driver feedback signs in Münster has shown that these sign do encourage compliance with the speed limit in the vast majority of cases. Pedestrians also feel safer. Problems between pedestrians and motorists are rarer and pedestrians are able to cross the road more safely. Across the city, 35 fixed and two mobile driver feedback displays are now in use.

Figure 13. Driver feedback sign

Source: Department of Mobility and Civil Engineering

5.2 Traffic studies

Traffic studies use external expertise to identify road traffic safety deficits and provide recommendations for remedying these deficits. Because Münster’s roundabouts are regularly identified as accident black spots, a traffic study was commissioned to study two roundabouts at which a high number of accidents had been recorded. Most city centre roundabouts in Münster are designed so that cycle traffic has priority and cycle crossings are surfaced in red. Due to the high proportion of bicycle traffic, accidents involving motor vehicles and cyclists at entries to and exits from roundabouts are a frequent occurrence. The study aimed to identify any roundabout design errors and provide recommendations for remedying them. The study found that the cycle priority crossings were too close to the roundabout carriageway and should be moved to a position 4–5 metres from the roundabout carriageway. It was also recommended that cycle and pedestrian crossings should be raised onto road humps, with the aim of reducing speeds and improving attentiveness at entries to and exits from roundabouts. It was also determined that, to discourage vehicles from cutting across the central apron on roundabouts and therefore reduce speeds, the central apron should be raised. These recommendations are currently in the process of being implemented. Once implemented, they will be evaluated, with the aim of enabling these measures to be implemented on other roundabouts.

In view of the high proportion of bicycle traffic in Münster, road traffic accidents involving cyclists are common. The Road Traffic Accident Prevention Partnership commissioned Münster University of Applied Sciences to carry out a detailed study of bicycle accidents in Münster in 2019. Their focus was on road traffic accidents involving bicycles which did not occur at a site identified as a one-year accident black spot in 2019. The analysis showed that in 2019 only around 8% of road traffic accidents involving cyclists occurred at sites identified as one-year accident black spots. The Accidents Committee took a closer look at these accidents. No separate analysis of accidents involving cyclists at sites identified as accident black spots over a three-year period was performed, as it was not possible to compare the data set available for 2019 with data for 2017 and 2018. The study found that cyclists were significantly more likely to be identified as being primarily at fault for accidents occurring at sites which were not accident black spots. 43% of road traffic accidents involving cyclists at these sites were caused by the cyclist. In addition, at sites which were not accident black spots, the dominant accident types are not accidents when turning off a road and accidents when turning onto/crossing a road. Accidents in which a driver lost control of their vehicle and accidents involving parallel traffic occurred with comparable frequency. The study carried out detailed analysis of 136 traffic accidents involving cyclists at sites which were not accident black spots. This sample comprised approximately 10% of all accidents in which a bicycle was involved (1244 accidents). These 136 accidents occurred at a total of 30 locations. For the analysis, the team analysed accident reports and performed site visits. A profile was produced for each location. This listed items such as distinctive features of the accident, traffic management and road user behaviour. In addition to analysis of accident data, site visits delivered further important insights.

Typical, recurring problems included:

- streets with high levels of parked vehicles
- poor visibility between different road users
- cycle lanes which were too narrow and obstacles in cycle lanes
- a lack of markings or contrast

Based on their accident analysis and site visits, the University team proposed operational and strategic recommendations for future road safety.

Operational recommendations:

- There should be no obstructions to visibility for traffic waiting at junctions and lines of sight need to be preserved.
- Obstacles and irregularities should be removed.
- Signs and markings should be upgraded/renewed.
- Speeds in dangerous zones should be reduced.
- Traffic flows likely to come into conflict should be separated, e.g. at bus stops.
- Cycling and pedestrian infrastructure should be of sufficient size.
- Clear, easily understood signposting (standardisation).

Strategic recommendations:

- Road safety education long-term reduction in incorrect road use
- Regular inspection of accident data accident prevention and early intervention
- Observe developments adapt infrastructure and planning
- Close cooperation with police access accident data and use police expertise

The study by Münster University of Applied Sciences enabled the identification of areas of activity (infrastructure audits, development of standards, focus on visibility at junctions, public relations, etc.) for future road safety work. These are currently being discussed by city councillors. The study demonstrated that road safety work always needs to be developing and that we must always consider current accident statistics. Only through a consistent road safety programme can Münster City Council achieve its objective of becoming a safe city for all road users.

6. SUMMARY

A consistent road safety programme has brought many benefits. Despite a growing population and increased traffic volumes, especially for non-motorised private transport, the accident numbers have risen only modestly and have not risen in relative terms.
Working as a team with other road safety partners has enabled the programme to achieve greater reach and be more effective.
The programme has a broad focus on four key issues:

- Surveillance and enforcement:
- Civil and traffic engineering
- Road safety education and advice
- Public relations

The road safety programme is now an established fixture and it would be hard to imagine operating without it. Increasing and changing mobility and a growing city mean that there are always new challenges for the road safety programme. Given the need for measures to reduce climate change, it is clear that road safety measures in the city of tomorrow need to incorporate bicycle and pedestrian-friendly and public transport infrastructure. This article offers an overview of the past, present and future of the road safety programme, which aims to make Münster a safer city for all.
There is still a long way to go – this is just a brief stop along the way. To enjoy even greater success in future, we should adopt an integrated approach to whole population mobility, at the heart of which should be changing behaviour and raising awareness across the community.

References

[1] Stadtplanungsamt Münster, Münster City Council, „Traffic statistics“. Germany. (2020)

[2] Pendleratlas NRW, Germany. https://pendleratlas.de/nordrhein-westfalen/ (2020)

[3] Stadtplanungsamt Münster, Münster City Council, „Traffic statistics“. Germany. (2020)

[4] Stadtplanungsamt Münster, Münster City Council, „Traffic statistics“. Germany. (2020)

[5] Stadtplanungsamt Münster, Münster City Council, „Traffic statistics“. Germany. (2020)

[6] Stadtplanungsamt Münster, Münster City Council, „Traffic statistics“. Germany. (2020)

[7] Stadtplanungsamt Münster, Münster City Council, „Traffic statistics“. Germany. (2020)

[8] Stadtplanungsamt Münster, Münster City Council, „Traffic statistics“. Germany. (2020)

[9] Ordnungspartnerschaft Verkehrsunfallprävention „Sicher durch Münster“, Münster, Germany. https://www.sicher-durch-muenster.de/ (2008)

[10] Report of the Gesamtverband der Deutschen Versicherungswirtschaft e. V.(GDV), „Verbesserung der Verkehrssicherheit in Münster“, (internal report, unpublished), Germany. (2008)

[11] Ordnungspartnerschaft Verkehrsunfallprävention „Sicher durch Münster“, „Report of the road safety partnership“ Germany. (2008)

[12] State of North Rhine-Westphalia, Germany. press release (2011)

[13] Report of the Gesamtverband der Deutschen Versicherungswirtschaft e. V.(GDV), „Verbesserung der Verkehrssicherheit in Münster“, (internal report, unpublished), Germany. (2018)

[14] State of North Rhine-Westphalia, Germany. “Aufgaben der Unfallkommission“ https://recht.nrw.de/lmi/owa/br_bes_text?anw_nr=1&bes_id=46114 (2025)

[15] Münster City Council, Road Maintenance Department, Germany. Internal report, unpublished (2020)

[16] Münster City Council, Stadtplanungsamt, Germany. “V/0154/2019 Creating freedom from conflict in the management of right-turning motor vehicles and parallel pedestrians/cyclists at traffic lights”, Germany. (2019)

[17] Münster City Council, Road Maintenance Department, Germany. “Münster cycle plan”. https://www.stadt-muenster.de/verkehrsplanung/mit-dem-rad/netzplanung/planung (2016)

[18] Münster City Council, Road Maintenance Department, Germany. “Münster cycle plan”. https://www.stadt-muenster.de/verkehrsplanung/mit-dem-rad/netzplanung/planung (2016)

[19] Münster City Council, Stadtplanungsamt Münster, Germany. https://www.stadt-muenster.de/verkehrsplanung/mit-dem-rad/fahrradstrassen (2019)