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The impact of 30 km/h sections on road safety on main urban roads



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1. Background and motivation

In 2025, 960 road users were killed and 26,811 seriously injured on Germany's roads in built-up areas [1]. Compared with 3,349 fatalities and 64,015 serious injuries in 1991 [2], this represents substantial progress, but Vision Zero – zero road deaths – remains a distant goal. Particularly since 2010 (1,011 fatalities and 33,262 seriously injured [3]), only minor improvements have been recorded.

One discussed approach for achieving Vision Zero and further improving safety on urban roads is the introduction of 30 km/h (approximately 20 mph) speed limits on main roads. Amendments to the German road traffic regulations (StVO) in 2016 and 2024/2025 made it easier to introduce such speed limits. Section-specific 30 km/h limits are now frequently used to improve air quality, reduce noise or ensure road safety. However, their impact on accident occurrences has not previously been examined in detail.

Against this background, BERNARD Gruppe ZT GmbH carried out a comprehensive analysis of 30 km/h sections on main urban roads on behalf of the German Insurers Accident Research (UDV). The findings presented here are based on the research report, available for free download on the website of the UDV.

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2. Methodology

The aim of the study was to examine the effects of 30 km/h sections on main urban roads in detail, focusing on changes in actual driving speeds and accident occurrences. To achieve the study's objectives, the following steps were carried out:

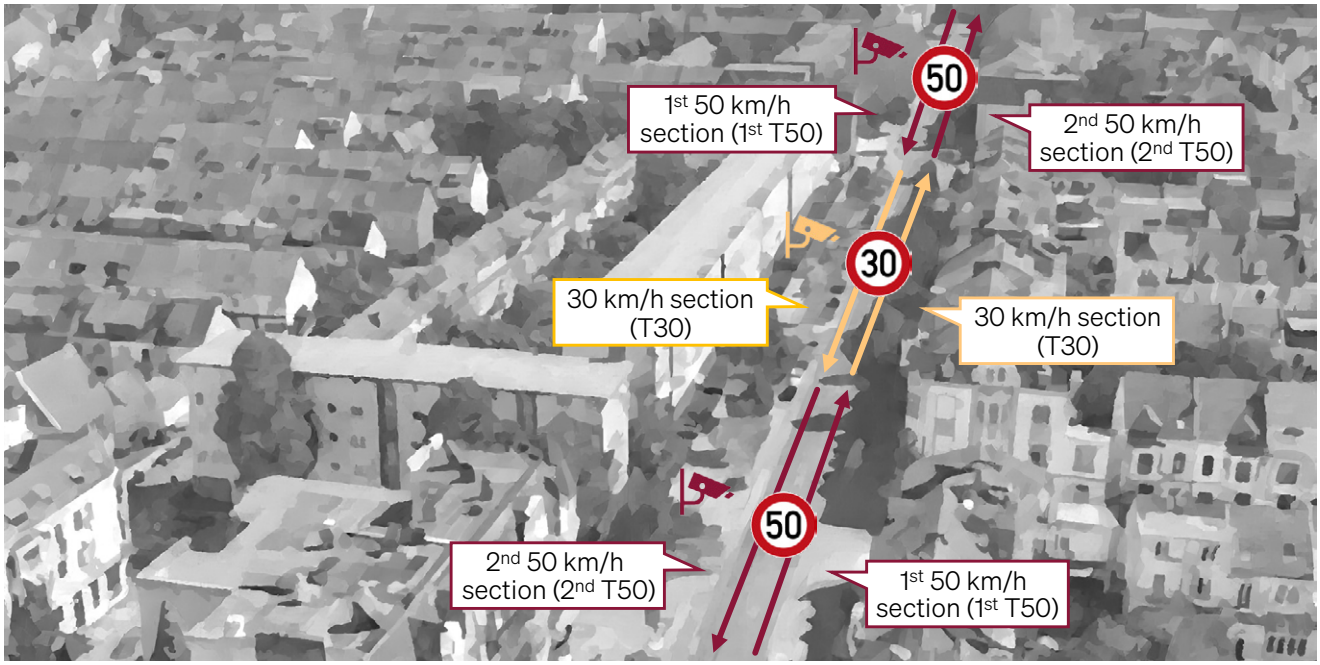
- Review of the rules regarding 30 km/h limits, the state of research and current developments,
- survey of German cities and municipalities on 30 km/h limits on main urban roads,
- 24-hour on-site surveys assessing traffic volumes and speeds by vehicle class (40 roads or 80 directions of travel with a total of 375,416 motor vehicles in the 30 km/h sections),
- analysis of floating-car data, covering one month three months before and one month three months after implementation (42 roads or 84 directions of travel),
- overview analysis of police-recorded accidents on 100 roads with permanent 30 km/h limits (3,296 accidents resulting in personal injury (A. cat. 1-3); three rolling years before and two or three rolling years after implementation),
- detailed analysis of police-recorded speed-limit-relevant accidents – i. e. involving motor vehicles in moving traffic along the road corridor – on 42 roads with permanent and time-limited 30 km/h limits (1,342 accidents resulting in personal injury; three rolling years before and two or three rolling years after implementation), considering design conditions and traffic volumes measured on 40 roads.

The on-site surveys as well as the analyses of floating car data and police-recorded accidents covered three sections of each corridor: the 30 km/h section and the adjoining 50 km/h sections (figure 1). The first 50 km/h section is encountered before entering the 30 km/h section, and the second after leaving it.

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The on-site surveys, floating car data analyses and detailed analyses of police-recorded accidents were carried out for three sections of the corridors

Figure 1 · Schematic overview of the on-site measurements, floating car data analyses and accident data analyses (own illustration, AI-generated using ChatGPT)



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3. Literature Analysis

3.1 German regulations

Germany has a long history of 30 km/h limits. As early as the 1980s, the regulations regarding speed limit zones made it possible to establish 30 km/h for definable areas containing roads with similar characteristics [4]. By contrast, 30 km/h limits on main urban roads are a relatively recent instrument. Proactive limits in sensitive areas have been possible, for example, since 2016. The amendment of the German StVO at that time specified that the speed limit should generally be set to 30 km/h in the immediate vicinity of kindergartens, hospitals and similar facilities if they have direct access to the road concerned or generate substantial originating and destination traffic [5]. The latest amendment of the StVO in 2024/2025 expanded the scope to include playgrounds and heavily frequented school routes [6]. It also became possible to introduce limits near pedestrian crossings [7]. In addition, the maximum gap that can be closed with a 30 km/h limit between two existing 30 km/h sections was extended from 300 to 500 metres [8]. The rules for sensitive areas apply particularly to classified roads (federal, state as well as district roads regarding the research subject) [9]. Besides safety reasons, 30 km/h sections can also be introduced for noise protection or air pollution control.

3.2 International regulations (selection)

Even among German-speaking neighbouring countries, approaches to 30 km/h limits on main urban roads differ substantially. In Switzerland, for example, a limit may be introduced where a hazard that is difficult to recognise cannot otherwise be removed, or where certain road users require special protection that cannot otherwise be provided [10]. The suitability and proportionality of the measure must, however, be confirmed by an expert assessment [11]. In Austria, as in Germany, limits can be introduced outside sensitive facilities without major obstacles [12]. In addition, the authority in charge may set a reduced maximum speed for an entire built-up area if this appears appropriate for improving road safety [13].

Other European countries have made more fundamental changes. Since 2020, Spain has generally applied a 30 km/h limit to urban roads with only one lane in each travel direction [14]. Greece followed with a comparable rule in 2025 [15]. In Wales, a regulation came into effect in 2023 that reduced the speed limit on urban roads almost by default to 20 mph (approximately 30 km/h), using a proxy definition for the relevant roads[1], [16].

3.3 Current state of research and recent developments (selection)

Although 30 km/h speed limits have been the subject of numerous studies, both for zones and section-specific limits, previous studies either examined only a few roads or analysed them at a relatively low level of detail (for example, without accounting for the number of lanes or other infrastructure conditions).

[1] The reduction applies to 'restricted roads', which are defined as roads with lighting installations no more than 200 yards (approx. 183 m) apart. This usually applies to main roads within built-up areas.

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A study of three main urban roads in Schwerin (Germany) found a marked decline in accidents after 30 km/h limits were introduced. Accidents resulting in personal injury or death fell from 12 (including one fatal accident) before implementation to four (with no fatalities) afterwards [17]. However, inappropriate driving speeds were not a particularly common accident cause either before implementation or afterward [17]. The decline therefore mainly involved accidents attributed to other causes.

Bologna became the first large Italian city to introduce a comparatively widespread 30 km/h regime. In the first year after implementation, road deaths fell to 10, compared with an average of 19.5 in the two preceding years (-49%) [18]. Accidents resulting in personal injury fell from an average of 1,949 to 1,758 (-10%) [18]. Cyclists did not benefit from this trend. The number of cyclists involved in accidents rose by 6 per cent, although this was attributed to substantially increased cycling (+10%) [18]. Bologna's results are considered especially notable because they run counter to Italy's national trend of increasing accident occurrences [18].

In Helsinki, 30 km/h limits and enforcement, alongside extensive infrastructure measures, have also contributed to improved road safety [19]. Between August 2024 and July 2025, there were no traffic fatalities for a full twelve-month period for the first time [20]. However, the 30 km/h limits were introduced mainly on secondary roads and only to a very limited extent on Helsinki's main urban roads[2]. Unfortunately, fatalities occurred once again after the successful twelve-month period, meaning Vision Zero has not yet been achieved sustainably [21].

Initial results have also been documented for Wales. In 2022, the last full calendar year before the widespread introduction of 20 mph, 2,344 road casualties were recorded nationwide on roads with 20 or 30 mph limits; in 2024, the first full calendar year after introduction, there were 1,759 (-25%) [22]. It must be noted, on the one hand, that casualty numbers on 20 or 30 mph roads in Wales have declined steadily by similar magnitudes since 2010 [22]. On the other hand, the policy may be seen as supporting that trend, whereas comparable progress in Germany has stagnated.

Some studies also estimate the probability of different injury severities by impact speed. The estimated probabilities differ according to study age, vehicles, countries and age groups. All agree, however, that the probability of a fatal injury to a pedestrian rises dramatically with collision speed, especially between 30 and 50 km/h. One US study estimates the probability of a fatal injury (MAIS 6) to a pedestrian at 21 per cent at 50 km/h (31 mph), versus 5 per cent at 30 km/h (19 mph) – only a quarter as high [23].

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[2] Analysis of available digital road data, including road class and maximum permitted speed, Finnish Transport Infrastructure Agency, Digiroad – National Road and Street Database, Digiroad K 2025_02, https://vayla.fi/en/transport-network/data/digiroad

4. Road sections of the detailed analysis

Enquiries to German municipalities and the researchers' own investigations identified 875 main urban roads (1,729 directions of travel) with section-specific 30 km/h limits. Only a small number met the study-design requirements. In some cases, implementation dates were unknown or too far in the past or present. Few roads had three sections with consistent cross-sections throughout the study period. The detailed analysis therefore included 42 roads (84 direction-specific road sections).

The recorded road characteristics were primarily those expected to interact with section-specific 30 km/h limits (table 1). Some analyses also examined the influence of heavily used property accesses (petrol stations, supermarket car parks, etc.) and differences associated with the reasons for introducing the limit or adjacent land use.

Overview of the 30 km/h section in the detailed analysis

Table 1 · Distribution of the 30 km/h speed limit schemes examined in the detailed analysis, broken down by direction of travel and grouped by sets of design features (data source: on-site surveys of 42 roads)

Characteristic	Category	Permanent (24 h) speed limit	Time-limited speed limit
All	all	34	50
Marked parking areas	present	25	27
	absent	9	23
Physical separation of travel directions	present	12	2
	absent	22	48
Through lanes per direction	one	24	48
	two	10	2
Tram in mixed traffic	present	10	8
	absent	24	42
Junction density	free of junctions	18	23
	> 0 to ≤ 5 junctions/km	4	6
	> 5 to ≤ 10 junctions /km	12	17
	> 10 to ≤ 23 junctions/km	–	4
Length of 30 km/h limit	≥ 100 to ≤ 300 m	28	42
	> 300 to ≤ 500 m	2	8
	> 500 to ≤ 750 m	4	–

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5. Speed measurements

5.1 On-site measurements

Measurements at three cross-sections per corridor, selected to allow largely free speed choice and minimise junction effects, already demonstrate poor compliance with 30 km/h limits. Only one quarter of all vehicles measured in the 30 km/h sections complied. Half of all drivers travelled faster than 36 km/h, exceeding the posted limit plus tolerance. Approximately one in seven drivers even exceeded 47 km/h – a speed that would only just be acceptable under a 50 km/h limit.

Speeds in the 30 km/h sections were only marginally below those in adjoining 50 km/h sections. Both the median speed (V_{50}, exceeded by 50% of the drivers) and V_{85} (exceeded by 15%) were only 5 km/h lower (table 2). Motorcycles travelled somewhat faster (a V_{50} of 38 km/h and V_{85} of 49 km/h), while lorries and buses were somewhat slower (31 and 44 km/h, respectively).

Drivers hardly slow down in 30 km/h sections compared to adjoining sections with a speed limit of 50 km/h

Table 2 · Comparison of the V_{50} and V_{85} percentile speeds from on-site measurements in the three sections (Data source: On-site measurements on 40 streets)

	V_{50} percentile speed	V_{85} percentile speed
1st 50 km/h section (388,499 motor vehicles)	41 km/h	52 km/h
30 km/h section (375,416 motor vehicles)	36 km/h	47 km/h
2nd 50 km/h section (406,060 motor vehicles)	41 km/h	52 km/h

5.2 Floating car data

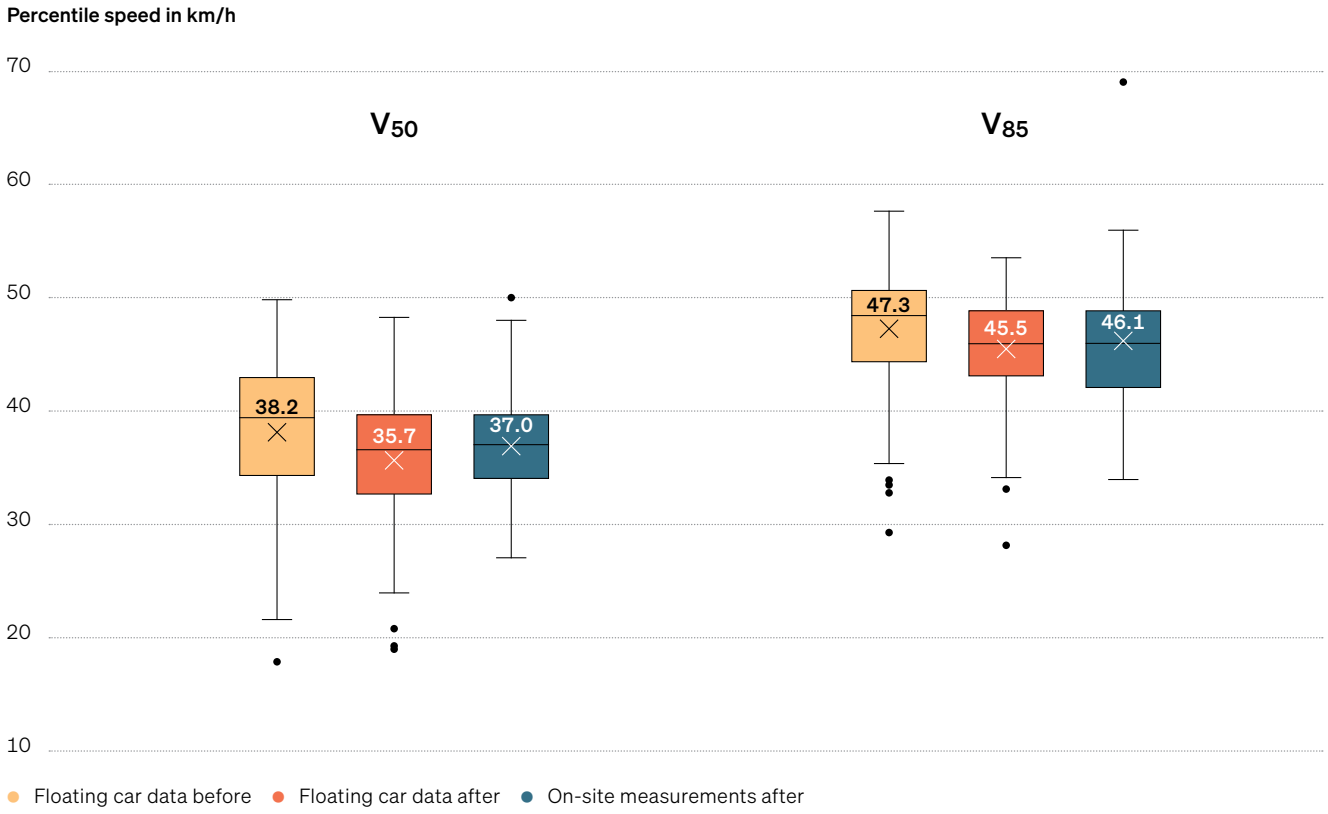
Floating car data made it possible to establish speed profiles before and after the introduction of 30 km/h limits. Unlike on-site measurements, they do not allow for vehicle classes to be distinguished. They also represent only a subset of traffic, so traffic volumes and trends cannot be derived. Furthermore, speeds based on floating car data are derived from journey times through the sections, so junctions and similar features have a greater influence than in on-site measurements.

Differences between floating car data and on-site speeds were minor, particularly in the 30 km/h sections, because bigger signalized junctions usually lay outside those sections. The percentile speeds from on-site measurements therefore corroborate the floating car data speeds and the before-and-after comparison. Speeds declined only marginally after the 30 km/h limits were introduced (figure 2). The mean V_{50} was 38.2 km/h before implementation and only 2.5 km/h lower afterwards. The difference in mean V_{85} was even smaller, at 1.8 km/h.

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Speeds in the 30 km/h sections decreased only slightly after implementation

Figure 2 · Comparison of V_{50} and V_{85} percentile speeds in the 30 km/h sections before and after implementation (Data sources: Floating car data from 42 roads, on-site measurements on 40)



Among the road characteristics examined, longer 30 km/h sections were associated with somewhat larger speed reductions. The V_{50} fell by 2.2 km/h for short sections (≥ 100 to ≤ 300 m), 3.6 km/h for medium-length sections (> 300 to ≤ 500 m) and 4.6 km/h in the small sample of long sections (> 500 to ≤ 750 m). The V_{85} fell by 1.6, 1.8 and 4.7 km/h, respectively. Although the sample of long sections comprised only four road sections and therefore only has a limited statistical robustness, this subgroup showed the largest speed reduction of any subgroup comparison in the floating car data.

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6. Accident data analysis

6.1 Overview analysis of 100 roads

Initial insights were obtained from unfiltered data (all accidents resulting in personal injury) of 100 roads with permanent (24 h) 30 km/h limits. Accidents resulting in death or serious injury (A. cat. 1+2) fell from 83.0 to 53.7 per year. Accidents resulting in only minor injury (A. cat. 3) also declined markedly, from 582.0 to 401.7 per year. The general trend in urban accidents must, however, be considered: between 2013 (the beginning of the earliest before period in the research project) and 2024, serious urban accidents in Germany declined by 18 per cent, from 32,804 to 26,917 [24], [1].

Similar trends could be observed among the ten roads where the after period ended before the COVID-19 pandemic. Serious accidents decreased significantly (from 5.3 A. cat. 1+2 per year to 3.7), even though the overall numbers were small due to the limited sample of pre-COVID roads. Accidents resulting only in minor injury fell only moderately (from 28.3 A. cat. 3 per year to 25.0).

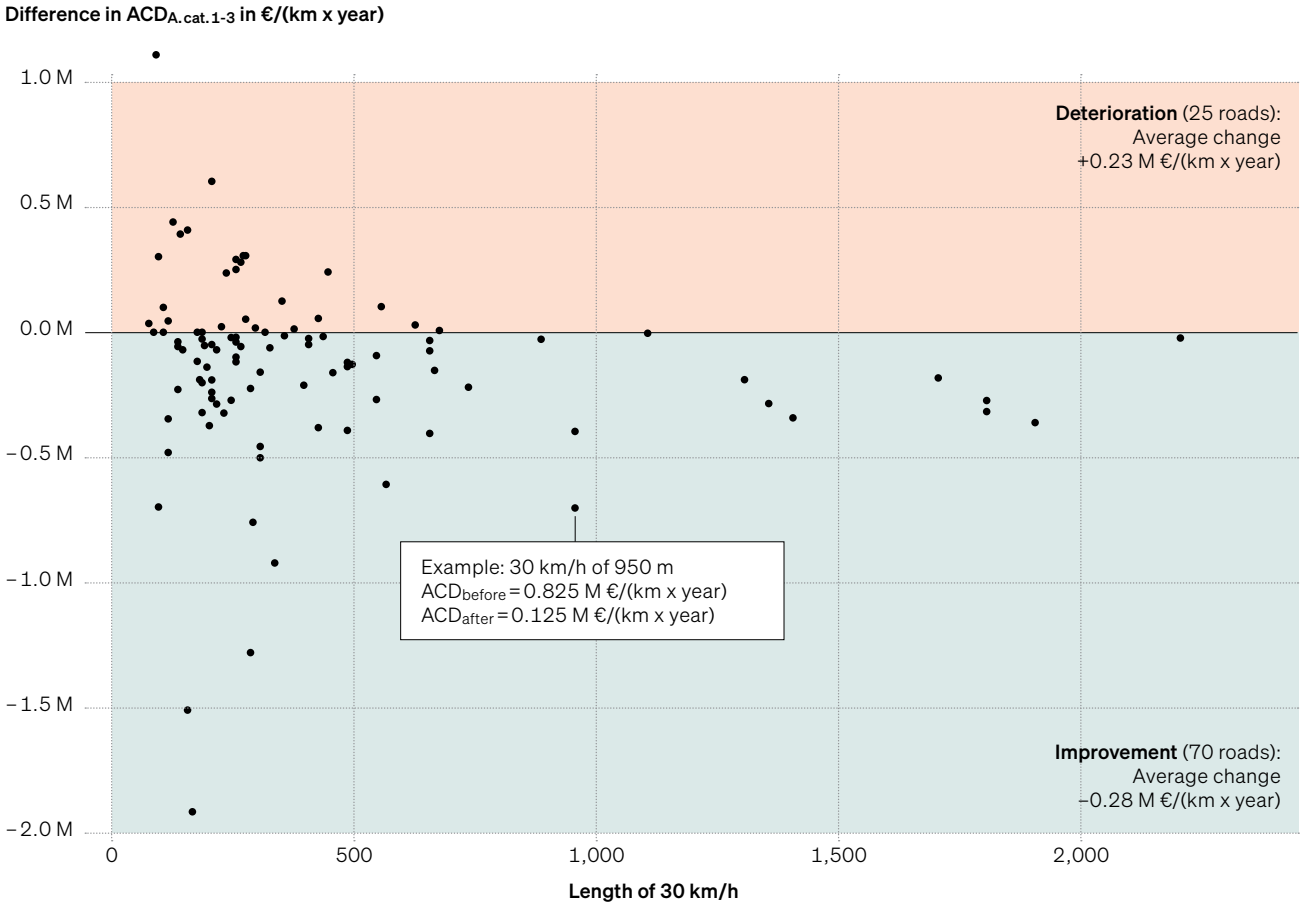
Changes in accident cost density (ACD)[3], which captures both changing accident numbers and shifts in accident severity, varied notably (figure 3). Overall, 70 roads improved, 25 deteriorated to higher values and five showed no change. Even short lengths of 30 km/h more often showed improvement than deterioration, and improvements were usually larger than the less frequent deteriorations. Longer stretches of 30 km/h almost always improved: 20 of 23 roads with 30 km/h limits extending at least 500 metres had lower accident cost density afterwards, with only minor deteriorations on the remaining three roads.

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[3] Cost assumptions of 173,000 € per accident resulting in death or serious injury and 14,800 € per accident resulting only in minor injury in accordance with the guidance for investigations by accident commissions (“Merkblatt zur Örtlichen Unfalluntersuchung in Unfallkommissionen”)

On longer stretches with 30 km/h, the developments are almost always positive

Figure 3 · Development of accident cost densities by length of the 30 km/h measure (Data source: police-recorded data of individual accidents from 100 roads, accident data from 3 years before and 2 or 3 years afterwards)



Of the ten pre-COVID roads, seven had declining accident cost densities, two deteriorated towards higher values and one remained unchanged. All four roads with 30 km/h extending at least 500 metres improved.

6.2 Detailed analysis of 42 roads

Unlike the 100 roads in the overview, the 42 roads in the detailed analysis included both permanent (24 h) and time-limited 30 km/h speed limits. Adjoining 50 km/h sections were also included. Only accidents that could potentially be addressed by the 30 km/h limit were retained. This means that only accidents resulting in personal injury during the time periods to which the later 30 km/h applied were analysed in detail. Additionally, at least one motor vehicle had to be travelling in moving traffic along the affected road corridor. The following accidents were excluded:

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- Accidents occurring outside the applicable hours of time-limited restrictions,
- Accidents not involving motor vehicles, such as single-vehicle accidents of cyclists or accidents between pedestrians and cyclists,
- Accidents involving only drivers of motor vehicles crossing or turning into the affected road, but not drivers traveling along it (for example, accidents between motor vehicle drivers turning in from access roads and cyclists traveling along the main road),
- Accidents that involved motor vehicle drivers along the route but not moving traffic in the classical sense (for example, dooring accidents involving cyclists or accidents while manoeuvring in intersections).

After filtering, 1,342 accidents resulting in personal injury (55%) and 187 accidents resulting in death or serious injury (52%) remained across the complete three-section corridors. Within the sections subject to 30 km/h limits, 288 accidents resulting in personal injury (69%) and 40 serious accidents (74%) remained. Because major junctions with high accident concentrations usually lie outside the 30 km/h sections, the proportion of accidents not immediately relevant to the speed limit is higher in the 50 km/h sections. Even in the 30 km/h sections, however, almost one third of the accidents resulting in personal injury involved circumstances that a 30 km/h limit cannot directly address. This shows that 30 km/h limits alone are not sufficient and that further measures, potentially including infrastructure, are essential.

The review of the police-documented accident descriptions also made it possible to assign each accident to a direction of travel, thereby allowing for a direction-specific analysis of the 42 streets (resulting in a total of 84 sides or travel directions).

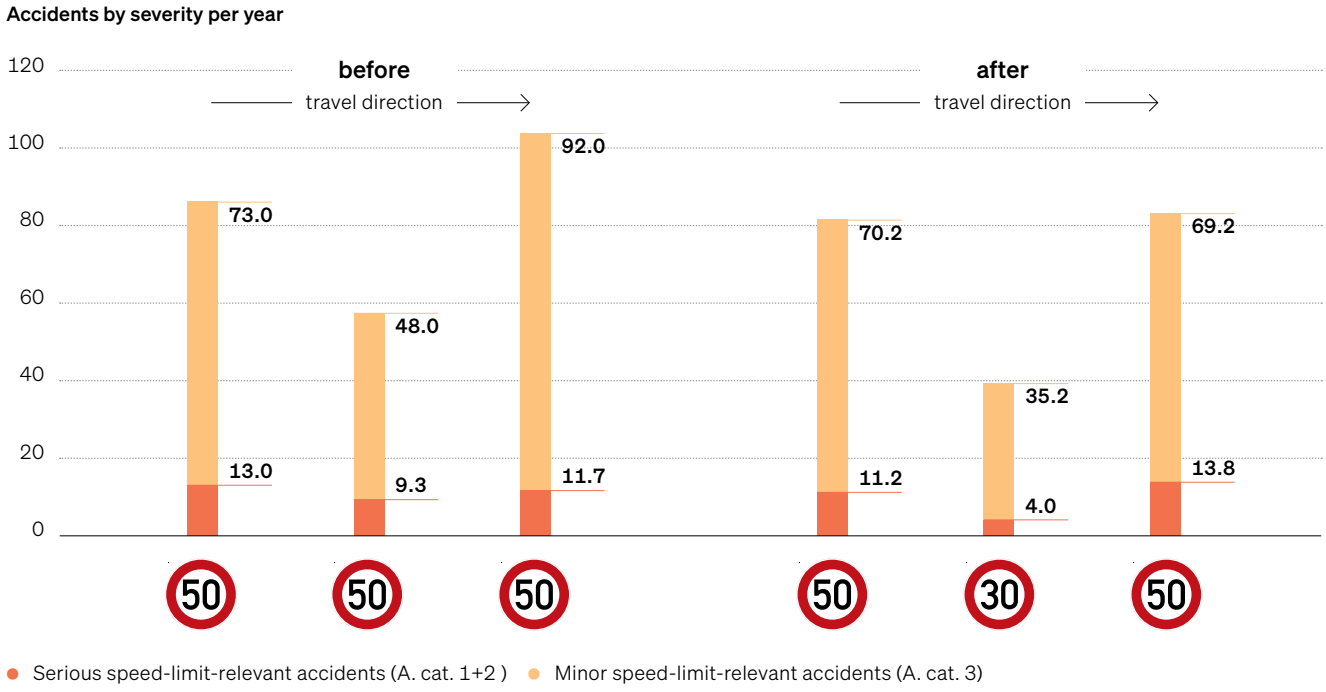
Because large and complex junctions are predominantly located in the adjoining 50 km/h sections, the overall accident occurrences in those are higher. Considering all accidents (2,428 resulting in personal injury and 357 serious ones), those resulting in personal injury fell by 25 per cent in the 30 km/h sections, from 80.3 A. cat. 1-3 per year to 60.2, compared with approximately 10 per cent in each adjacent 50 km/h section (from 173.0 A. cat. 1-3 per year to 158.0 and 182.7 to 162.3). The contrast was especially stark for accidents resulting in death or serious injuries: in the preceding 50 km/h sections, these hardly declined (from 25.0 A. cat. 1+2 per year to 24.5), while in the following 50 km/h sections they increased slightly (from 25.0 to 28.0). In the 30 km/h sections, however, they fell by almost 60 per cent, from 12.7 to 5.5 A. cat. 1+2 per year.

A similar picture emerges when only accidents that potentially can be directly addressed by the speed limit are considered (figure 4). Accidents resulting in personal injury declined by just over 30 per cent in the 30 km/h sections, compared with 5 per cent and 20 per cent in the adjoining 50 km/h sections. Serious speed-limit-relevant accidents in the 30 km/h sections likewise fell by almost 60 per cent, while the adjoining 50 km/h sections saw much smaller reductions or even increases.

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Serious accidents are declining much more sharply in 30 km/h sections

Figure 4 · Speed-limit-relevant accidents before and after the implementation of the speed limit in the 30 km/h sections and adjoining 50 km/h sections by accident severity (Data source: police-recorded data of individual accidents from 42 roads, accident data from 3 years before and 2 or 3 years afterwards, 1,342 speed-limit-relevant accidents resulting in personal injury in total)

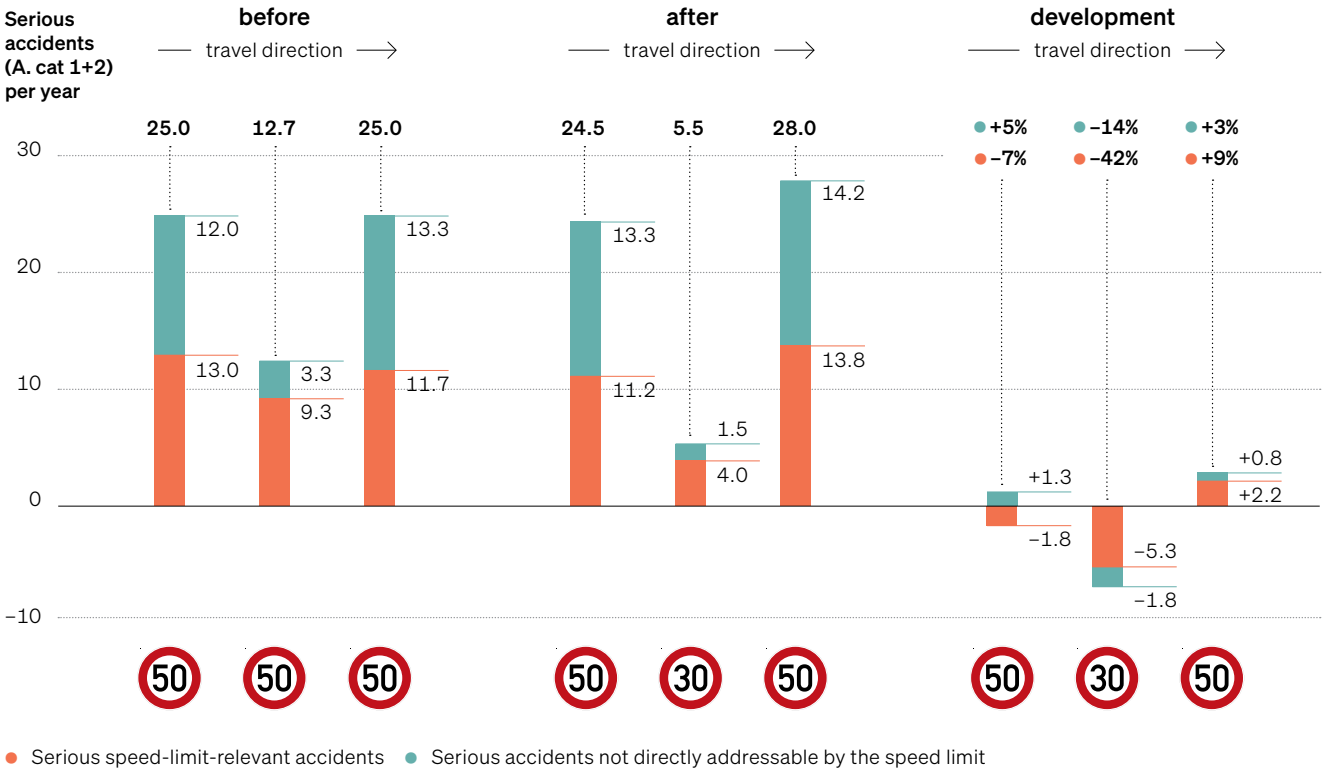


For serious accidents, the reduction is particularly pronounced among those accidents relevant to the speed limit. However, accidents not directly addressable by the limit also declined, unlike in the adjoining 50 km/h sections (figure 5). The marked reduction in serious accidents suggests not only prevention of serious accidents but also a shift towards minor ones and hence a reduction in accident severity.

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In addition to the serious speed-limit-relevant accidents, those not directly addressable by the limit also declined in the 30 km/h sections

Figure 5 · Development of serious accidents in the 30 km/h sections and adjoining 50 km/h sections (Data source: police-recorded data of individual accidents from 42 roads, accident data from 3 years before and 2 or 3 years afterwards, 357 accidents resulting in death or serious injury in total)

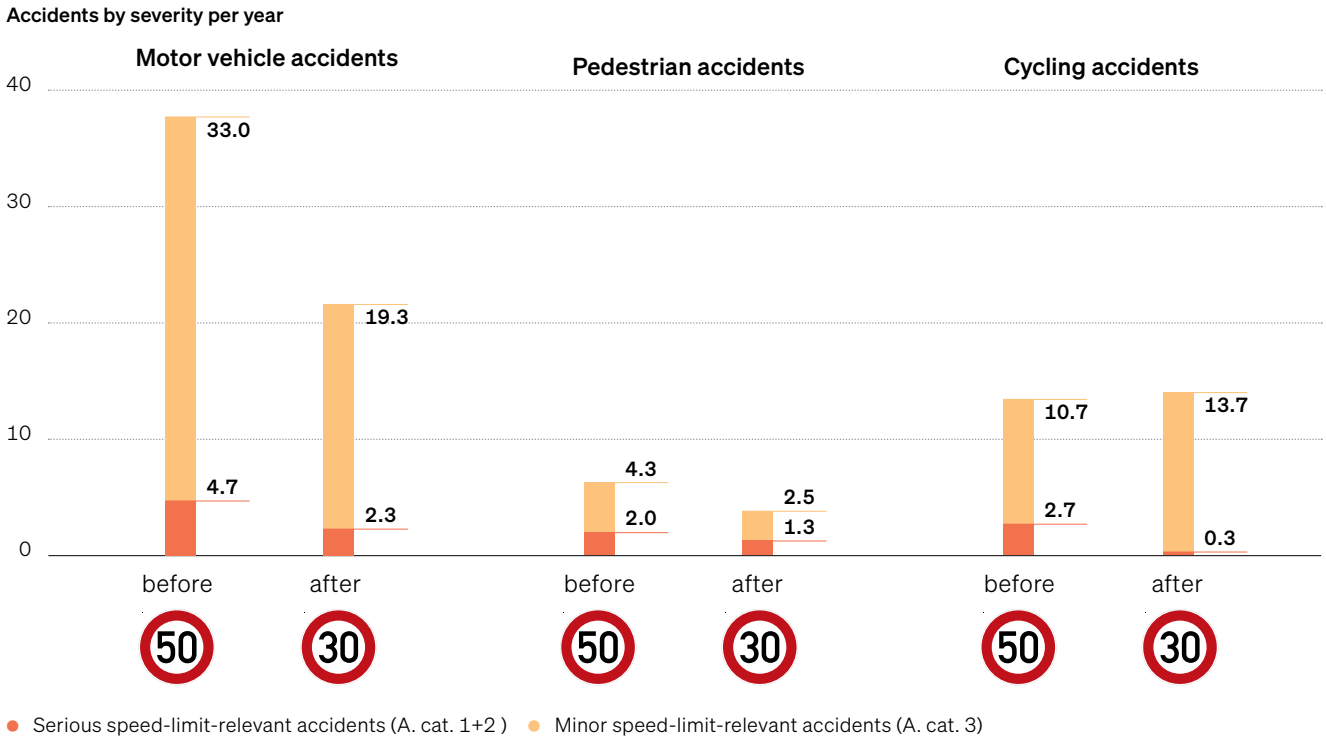


The reductions of speed-limit-relevant accidents in the 30 km/h sections mainly concern accidents of motor vehicle drivers without involved pedestrians or cyclists (figure 6). These accidents declined by around 40 per cent. A similar reduction percentagewise, from much smaller numbers, was seen in accidents between pedestrians and motor vehicles. Accidents between cyclists and motor vehicles did not decline overall; serious accidents between both did decline significantly, however.

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Accidents only involving motor vehicles are declining significantly, whereas accidents also involving cyclists in general are not

Figure 6 · Speed-limit-relevant accidents in the 30 km/h sections by road-user involvement and accident severity (Data source: police-recorded data of individual accidents from 42 roads, accident data from 3 years before and 2 or 3 years afterwards, 288 speed-limit-relevant accidents resulting in personal injury in total)



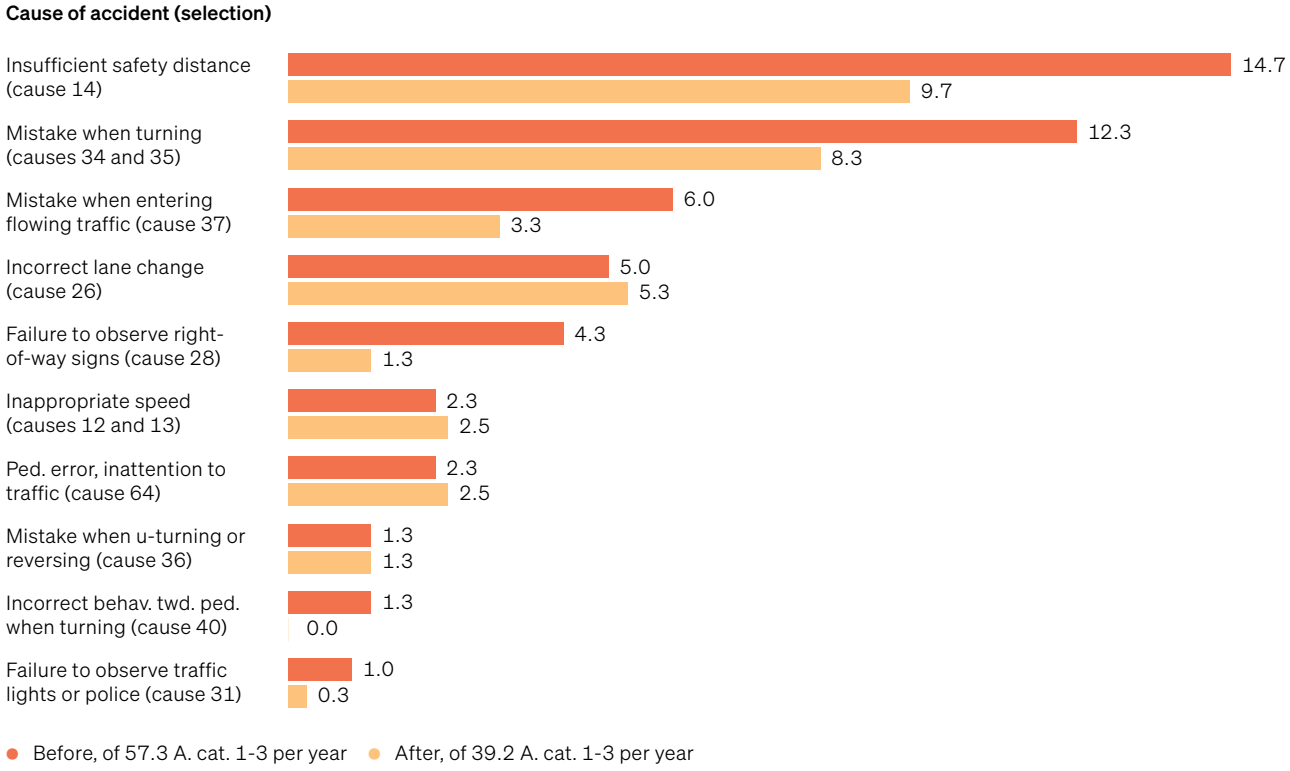
The introduction of 30 km/h sections primarily affects speed-limit-relevant accidents that are only indirectly related to the actual driving speed (figure 7)[4]. Accidents caused by insufficient safety distance or mistakes when turning, for example, became markedly less frequent. Accidents directly caused by inappropriate speed increased slightly, which is unsurprising given actual driving speeds and poor compliance with the introduced 30 km/h limits.

4 The accident causes shown account for just over 80 per cent of the speed-limit-relevant accidents resulting in personal injury. Causes with limited informative value (e.g. cause 49, "other driver errors"), causes that a speed limit cannot address (e.g. cause 01, "influence of alcohol") and very rare causes (e.g. cause 05, "distraction by using electronic devices") are omitted.

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30 km/h speed limits primarily reduce accidents indirectly related to driving speed

Figure 7 · Causes of speed-limit-relevant accidents resulting in personal injury in the 30 km/h sections (Data source: police-recorded data of individual accidents from 42 roads, accident data from 3 years before and 2 or 3 years afterwards, 288 speed-limit-relevant accidents resulting in personal injury in total)

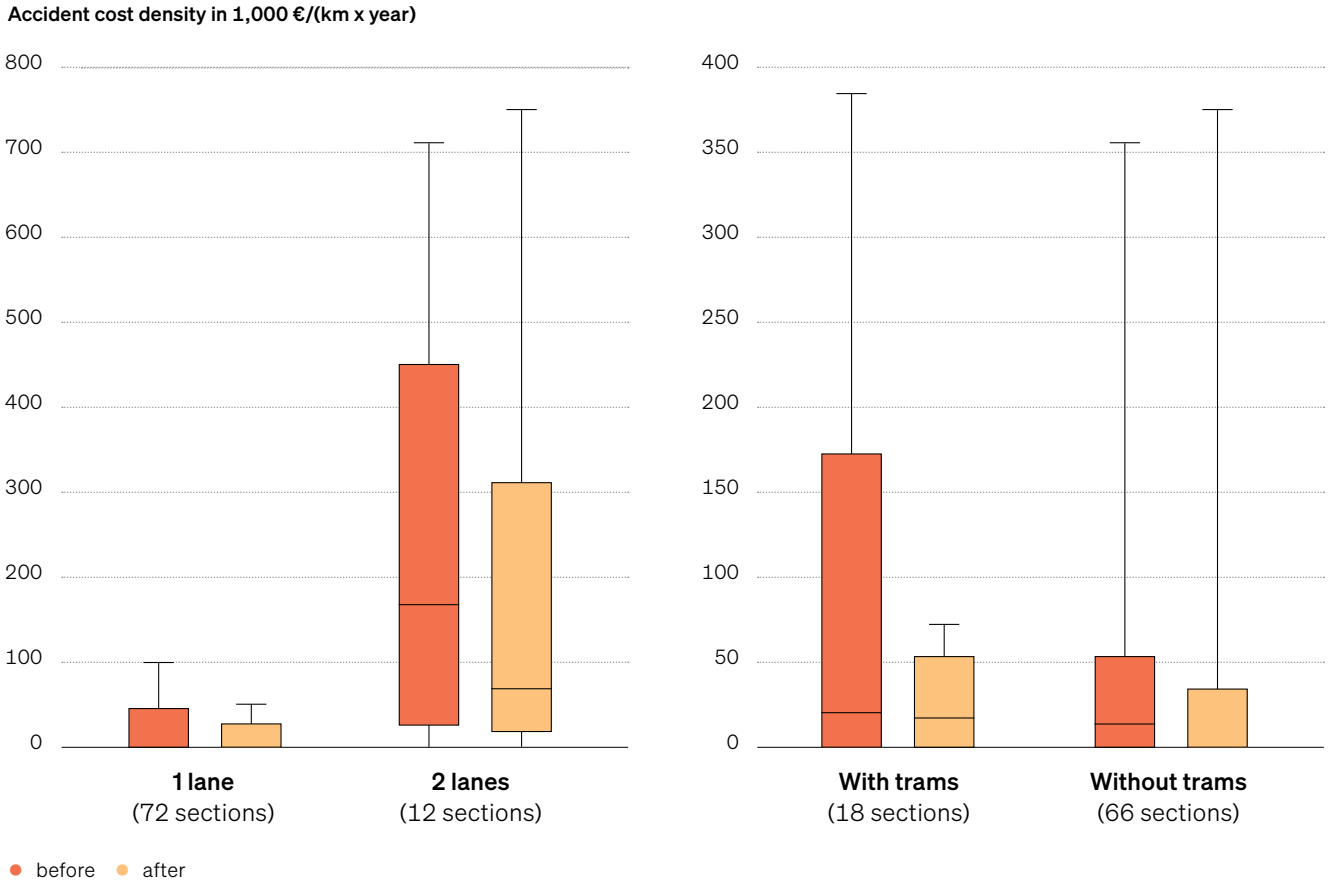


Regarding certain infrastructural aspects, those that describe more complex traffic situations are particularly noteworthy. Roads with multiple lanes in each direction or trams running in mixed traffic show substantially higher accident occurrences than roads with one lane per direction or no trams in mixed traffic. The same applies to sections with junctions compared to those without. In these more complex situations, accident cost densities improved markedly following the introduction of 30 km/h limits (figure 8). Accident cost rates, which also reflect changes in traffic volumes, showed similar trends.

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Road sections with higher traffic complexity benefit particularly from a 30 km/h speed limit

Figure 8 · Accident cost densities before and after the implementation of 30 km/h speed limits, by number of lanes per travel direction and tram routing in mixed traffic (means and outliers omitted for clarity) (Data source: police-recorded data of individual accidents from 42 roads, accident data from 3 years before and 2 or 3 years afterwards, 288 speed-limit-relevant accidents resulting in personal injury included in each analysis)



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7. Summary and Recommendations

The following points must first be considered when interpreting the study and its recommendations:

- Many factors contribute to improved road safety. Serious accidents on urban roads in Germany have declined by 18 per cent during the study period (2013 to 2024). Thus, even changes in speed-limit-relevant accidents on the roads examined cannot be attributed solely to the introduction of 30 km/h sections.

- The study examined only sections of 30 km/h on main roads. The findings therefore cannot be transferred to a citywide application of such a speed limit. In particular, the observed reduction in serious accidents could be smaller under citywide implementation.

- The detailed analysis included only 30 km/h sections on corridors where a 50 km/h limit had previously applied throughout. No conclusions can therefore be drawn about gap closures between existing 30 km/h sections or extensions of existing sections with 30 km/h.

- The analyses by road-user involvement, accident cause and infrastructure characteristics were restricted to accidents that could potentially be directly addressed by a lower speed limit. In the 30 km/h sections studied, these accounted for 69 per cent of accidents resulting in personal injury and 74 per cent of serious accidents. The remaining 31 per cent and 26 per cent, respectively, were excluded from those parts of the detailed analysis.

The introduction of 30 km/h sections on the main urban roads studied contributed to improved road safety. Even across all accidents, those resulting in personal injury declined more strongly in the sections reduced to 30 km/h (25%) than in the adjoining 50 km/h sections (around 10%). Speed-limit-relevant accidents also declined much more strongly in the 30 km/h sections, particularly those resulting in serious injury or death. The marked reduction in serious accidents also suggests reduced accident severity and a shift from serious to minor accidents. The reduction occurred in accidents only involving motor vehicles and in those involving pedestrians. Speed-limit-relevant accidents involving cyclists did not generally decline, although serious accidents involving cyclists did.

The 30 km/h limits primarily addressed accidents only indirectly related to speed, partly because actual speeds fell only slightly. In particular, accidents caused by insufficient following distance and turning errors declined noticeably. Particularly significant improvements occurred in more complex traffic situations, such as roads with several lanes per direction or trams in mixed traffic. Longer 30 km/h sections also showed more positive results and larger speed reductions.

30 km/h sections on main urban roads improve road safety and should be used. According to the German VwV-StVO, speeds should therefore be restricted to 30 km/h immediately outside sensitive roadside facilities and along heavily frequented school routes. The speed limit may also be reduced to 30 km/h at pedestrian crossings. The measure should be considered particularly on roads with greater traffic complexity. Where there is flexibility regarding the length, very short sections should generally be avoided in favour of longer ones.

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Introducing a 30 km/h section alone is not enough, though. Stricter enforcement can substantially improve compliance and would further improve road safety. Without appropriate enforcement, actual speeds decline only slightly.

Although section-specific 30 km/h limits on main urban roads can contribute to road safety, they are insufficient as a stand-alone measure. Approximately one third of all accidents cannot be addressed directly through such limits. These circumstances – for example, single-vehicle accidents of cyclists, dooring accidents or collisions between motor vehicles entering from side roads and cyclists on the main road – must be addressed through other infrastructure measures, including adequate space and safety distances and good sight lines.

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