# EVIDENCE-BASED INTERVENTION TALKING POINTS
# TRAFFIC CALMING

## What we mean by it[1]

Traffic calming measures reduce speed of traffic in areas where pedestrians, cyclists, and motorcyclists are present, road infrastructure safety quality is poor, and/or vehicles enter a built-up area on a rural road. Traffic calming measures include:

- **Speed humps**: a raised section of pavement with a parabolic (curved) or flat top that extends across the road. These can alert drivers to slow down, especially on approach to a pedestrian crossing point.
- **Raised crossings**: pedestrian crossings that are slightly elevated above the level of the rest of the road to slow down vehicle speed and make pedestrians more visible.
- **Raised intersections**: elevated sections of roadway to slow down a vehicle's speed as it approaches and/or drives through an intersection.
- **Raised midblock crossings**: pedestrian crossings between intersections that appear too far away or inconvenient for pedestrians to walk to cross.
- **Raised midblock platforms**: elevated sections of road that are designed to reduce vehicle speeds on the approach to intersections or pedestrian crossings.
- **Chicanes**: deliberate s-shape curves in the road, made by either painted road markings or concrete curbs that slow vehicles down by making them weave around the curve.
- **Chokers**: concrete curbs that are extended into the roadway to reduce the amount of road space left for vehicles.
- **Lane narrowing**: where the width of vehicle travel lanes is reduced using painted line markings.
- **Gateway treatments**: transition points between a higher-speed environment and a lower-speed environment. These are marked by signs, alongside other measures, including physical or painted lane narrowing, or pavement treatments, such as brick or cobblestone, to give drivers visual and physical cues to reduce speed.
- **Roundabouts**: roadway around a circular central island, where all vehicles must travel in one direction and which force drivers to slow down.
- **Rumble strips**: raised, indented sections of the road surface that vibrate and make noise when vehicles drive over them. When used across the width of the road or lane (as transverse markings), they alert drivers to slow down, especially on approach to a pedestrian crossing point.

[1] Our definition is based on the following sources:
Turner, B., Job, S., & Mitra, S. (2021). Guide for Road Safety Interventions: Evidence of What Works and What Does Not Work. World Bank, Washington, DC., USA.
Sharpin, A.B., Adriazola-Steil, C., Luke, N., Job, S., Obelheiro, M., Bhatt, A., Liu, D., Imamoglu, T., Welle, B., & Lleras, N. (2021). Low-Speed Zone Guide. Bloomberg Philanthropies.

## Where we need it

Areas where pedestrians need to cross the road, where vehicles enter and drive through a built-up area or where pedestrians, cyclists, and motorcyclists are present. In practice, this would include residential areas, villages, markets, retirement villages, school zones, healthcare and hospital precincts, around places of worship, university hubs, public transport hubs and major train station zones, city centers, and central business districts (CBD).

and/or

Areas where deaths or serious injuries occur among any road users from road crashes, regardless of the road function.

## Key asks

- Design and install visible traffic calming measures that both encourage vehicles to slow down and effectively reduce their travel speed.
- Implement area-wide traffic calming across networks of streets.
- Install traffic calming measures in residential, public transport, commercial, health, educational, religious, and recreational areas.

# Why we need it

## Linkage to key global road safety documents

The extensive linkage between traffic calming measures and the recommendations set out in existing key global road safety documents give more weight as to why this intervention ought to be implemented. Governments are able to demonstrate that they are putting recommended best practice into real practice when they implement the traffic calming measures.

Implementing traffic calming measures achieves, supports, and/or promotes the implementation of:

- 16 recommended actions in the Global Plan;
- 3 of the Global Road Safety Performance Targets;
- 14 statements in the Stockholm Declaration;
- 8 recommendations of the Academic Expert Group of the 3rd Ministerial Conference on Global Road Safety;
- 11 interventions across 3 components in the Save LIVES package;
- 13 commitments in A/RES/76/294, the Political Declaration of the High-Level Meeting on Improving Global Road Safety.

## *To reduce deaths and injuries*

### *Traffic calming measures help countries achieve the Global Plan target*

The Global Plan for the Decade of Action for Road Safety 2021–2030 (Global Plan)[2] sets a target to reduce road traffic deaths and injuries by 50% by 2030. Achieving this target requires implementation of evidence-based interventions that are known to reduce road traffic deaths and injuries. Traffic calming measures are one such evidence-based intervention.

### *Traffic calming measures reduce speeds and likelihood and severity of crashes*

Traffic calming measures are designed to ensure that approaching vehicles reduce their travel speed (self-explaining design).[3]

Speed humps and raised crossings, for example, can reduce the 85th percentile travel speed (a speed at or below which 85% of traffic will be traveling): an 18%[4] reduction was reported in the United States of America and a 30%[5] reduction in Tanzania.

Gateway treatments, which alert drivers that they are entering a low-speed area, are shown to be effective in reducing travel speeds by 11–17 km/h as well as reducing fatal and serious crashes by 23%.[6]

Traffic calming measures, because they reduce speed, can lead to up to 40% reduction in road crashes and in the severity of crashes.[7]

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[2] World Health Organization. (2021). Global Plan for the Decade of Action for Road Safety 2021–2030

[3] International Road Assessment Programme, iRAP. (2022). The Road Safety Toolkit.

[4] United States Department of Transportation. (2014). Engineering Speed Management Countermeasures: A Desktop Reference of Potential Effectiveness in Reducing Speed. Federal Highway Administration.

[5] Poswayo, A., Witte, J., & Kalolo, S. (2017). SARSAI : Low Cost Speed Management Interventions around Schools – Dar es Salaam, Tanzania Road Safety Case Studies. Journal of the Australian College of Road Safety, 28(3), 63–68.

[6] Makwasha, T. & Turner, B. (2013). Evaluating the Use of Rural-Urban Gateway Treatments in New Zealand. Proceedings of the 2013 Australasian Road Safety Research, Policing & Education Conference
28–30 August, Brisbane, Queensland.

[7] Harvey, T. (1992). A review of current traffic calming techniques. Primavera, V2016/31102.

### *Traffic calming measures increase compliance with the speed limit*

In Ghana, the mean vehicle speeds, the proportion of vehicles exceeding the 50 km/h speed limit (30% vs 60%), and the odds of pedestrian fatality were significantly lower in settlements with traffic calming measures than those without.[8]

In Bogota, Colombia, driver compliance with the speed limit increased from an average of 29% to 86% when 30 km/h speed limit signs were complemented with traffic calming measures.[9]

The self-explaining design of traffic calming measures may be more workable than increased police enforcement in low- and middle-income settings. Rumble strips on the main Accra-Kumasi highway in Ghana, for example, reduced crashes by about 35% and fatalities by about 55%.[10]

### *Traffic calming measures make pedestrians more visible*

Drivers traveling at higher speeds have reduced levels of peripheral awareness due to a narrower field of vision. This impedes their ability to quickly predict or detect potential conflicts on the road.[11] Traffic calming measures, such as raised intersections and raised midblock crossings, reduce vehicle travel speeds, improve visibility of pedestrians, and encourage drivers to yield to pedestrians at the crossing.[12]

### *Traffic calming measures make intersections safer*

Intersections are particularly dangerous conflict points between different road users. Designing intersections as a single-lane roundabout can reduce the number of collisions and injuries.[13] Well-designed roundabouts may contribute to reductions in fatalities and serious injury by between 70% and 80%.[14] The tight circle of a roundabout forces drivers to slow down and the circular travel pattern reduces the likelihood of some of the most severe forms of intersection crashes (e.g., head on, right angle and left turn collisions).

## *To implement a Safe System approach*

The implementation of traffic calming measures demonstrates the adoption of the Safe System approach. The Safe System approach is a human-centric approach which dictates the design, use and operation of our road transport system to protect the human road users.[15]

A Safe System approach means any road safety intervention ought to ensure that the impact speed remains below the threshold likely to result in death or serious injury in the event of a crash. Depending on the level of protection that the road users have and the type of crash, this threshold will vary. Typically, the impact speed must remain below 30 km/h for a pedestrian hit by a vehicle, below 50 km/h for a properly restrained motor vehicle occupant in a side impact crash, and below 70 km/h for a properly restrained motor vehicle occupant in a head-on crash.[16] Road infrastructure designs that self-explain and self-enforce approaching vehicles to slow down and effectively reduce vehicles' travel speed, such as traffic calming measures, protect all road users.

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[8] Damsere-Derry, J., Ebel, B.E., Mock, C.N., Afukaar, F., Donkor, P., & Kolawole, T.O. (2019). Evaluation of the effectiveness of traffic calming measures on vehicle speeds and pedestrian injury severity in Ghana. Traffic Injury Prevention, 20:3, 336-342.
[9] P99 & 100, Sharpin, A.B., Adriazola-Steil, C., Luke, N., Job, S., Obelheiro, M., Bhatt, A., Liu, D., Imamoglu, T., Welle, B., & Lleras, N. (2021). Low-Speed Zone Guide. Bloomberg Philanthropies.
[10] Afukaar F.K. (2003). Speed control in developing countries: issues, challenges and opportunities in reducing road traffic injuries. Injury control and safety promotion, 10(1-2), 77–81.
[11] Global Road Safety Facility. (2023). Speed Management Hub - Frequently Asked Questions, Note 8.2.
[12] National Association of City Transportation Officials. (2013). Urban Street Design Guide. Island Press.
[13] Bellefleur, O. & Gagnon, F. (2011). Urban Traffic Calming and Health. National Collaborating Center for Healthy Public Policy.
[14] Turner, B., Job, S., & Mitra, S. (2021). Guide for Road Safety Interventions: Evidence of What Works and What Does Not Work. World Bank, Washington, DC., USA.
[15] World Road Association. (2019). The Safe System Approach - Road Safety Manual: A Manual for Practitioners and Decision-Makers on Implementing Safe System Infrastructure.
[16] International Transport Forum. (2008), Towards Zero: Ambitious Road Safety Targets and the Safe System Approach, OECD Publishing, Paris.

History shows that countries that have adopted the Safe System approach implement evidence-based interventions, such as roundabouts on rural roads, and tend to have the lowest rates of fatality per population and the fastest rates of reduction in fatality numbers.[17]

## *For economic benefits*

### *Traffic calming measures reduce costs for government, individuals, and businesses*

Traffic calming measures save lives and reduce the severity of crash injuries, thereby reducing economic costs and positively contributing to a country's economic growth. The economic costs related to injury and loss of life from traffic crashes include money needed to treat injuries, loss of hours worked, vehicle repair costs, insurance or third-party costs, and costs caused by increased congestion when a crash occurs.

Traffic calming can reduce crashes, injuries, and fatalities by 40%, which amount to monetary savings of 10.7 US cents per vehicle mile (1.61 km) driven on local roads, 6.6 US cents per vehicle mile on collector roads, and 7.0 US cents per vehicle mile on minor arterial roads in the United States of America (US).[18]

### *Traffic calming measures can contribute to increasing GDP*

A World Bank study highlighted that halving road crash deaths and injuries could generate additional flows of income, with increases in GDP per capita over 24 years as large as 7.1% in Tanzania, 7.2% in the Philippines, 14% in India, 15% in China, and 22.2% in Thailand.[19]

### *Traffic calming measures are cost-effective*

Traffic calming measures are one of the most cost-effective speed management interventions achieving benefit-cost ratios (BCRs) ranging between 2.15 and 17 depending on the type of traffic calming measure (Figure 1) i.e., every US$1 spent on traffic calming interventions reaps between a US$2.15 and US$17 benefit.

[17] https://www.wri.org/research/sustainable-and-safe-vision-and-guidance-zero-road-deaths.
[18] Litman, T. (1999). Traffic Calming Benefits, Costs and Equity Impacts. Victoria Transport Policy Institute.
[19] World Bank. (2017). The High Toll of Traffic Injuries: Unacceptable and Preventable. World Bank.

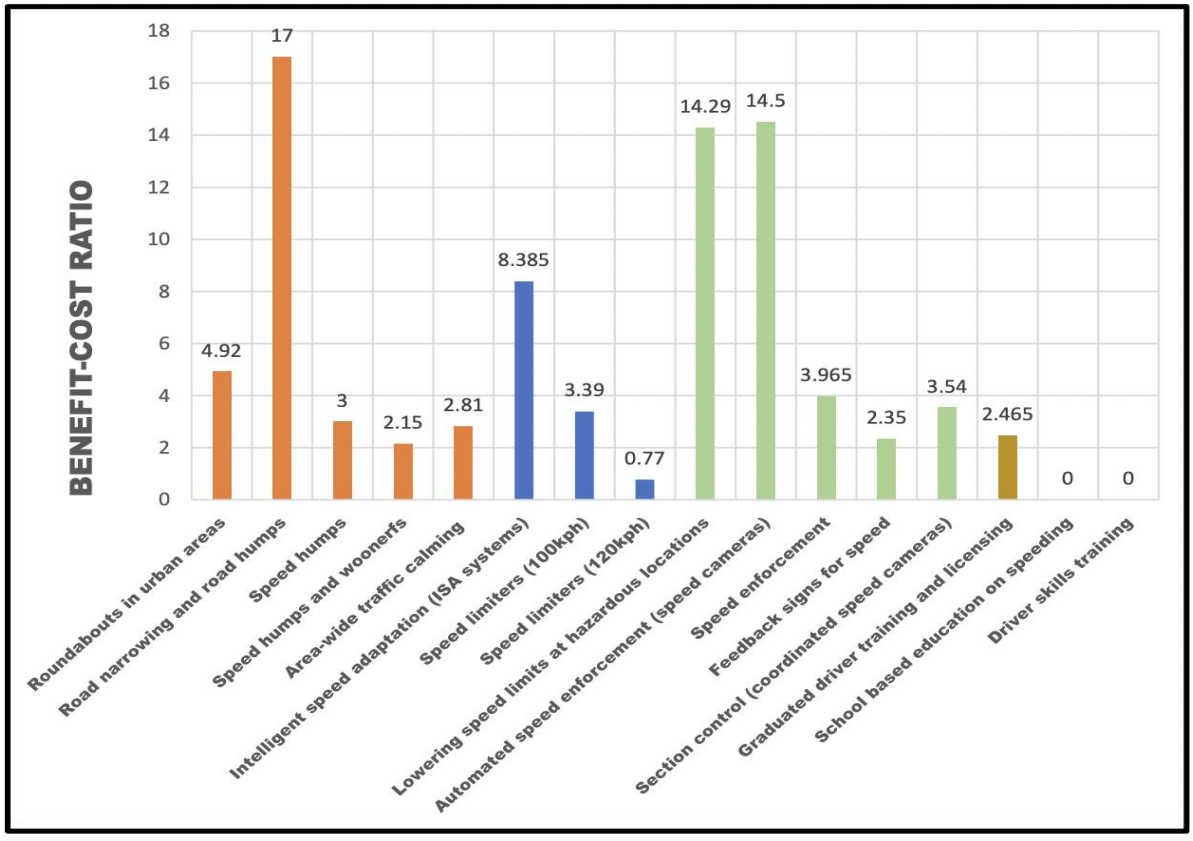


*Figure 1: Benefit cost ratios of various speed management interventions.*
*Source: World Bank[20] © World Bank*

## *Traffic calming measures are more effective across networks of streets, especially in low - and middle-income countries*

Traffic calming measures produce bigger safety benefits when implemented across a network of streets rather than one section of the road.[21]

These benefits are more significant in low- and middle-income countries compared to high-income countries.[22] For example, implementing area-wide traffic calming in Mombasa in Kenya, Addis Ababa in Ethiopia, and Kampala in Uganda would yield BCRs of 17.56[23], 36.51[24] and 30[25] respectively, whereas in towns in Ireland and Greece, BCRs are in the range of 1.9–3.68[26].

[20] Job, R.F.S. & Mbugua, L.W. (2020). Road Crash Trauma, Climate Change, Pollution and the Total Costs of Speed: Six graphs that tell the story. GRSF Note 2020.1. Washington DC: Global Road Safety Facility, World Bank.
[21] International Road Assessment Programme, iRAP. (2022). The Road Safety Toolkit.
[22] Job, R.F.S. & Mbugua, L.W. (2020). Road Crash Trauma, Climate Change, Pollution and the Total Costs of Speed: Six graphs that tell the story. GRSF Note 2020.1. Washington DC: Global Road Safety Facility, World Bank.
[23] Mohapatra, D.R. (2017). An Economic Evaluation of Feasibility of Non-Motorized Transport Facilities in Mombasa Town of Kenya. In Economic and Financial Analysis of Infrastructure Projects, an Edited Volume (pp 134-157). New Delhi, India: Educreation Publishing.
[24] Mohapatra, D.R. (2017). Feasibility of Non-Motorized Transport Facilities in Addis Ababa City of Ethiopia: An Economic Analysis. In Economic and Financial Analysis of Infrastructure Projects, an Edited Volume (pp 184-204). New Delhi, India: Educreation Publishing.
[25] United Nations Economic Commission for Africa & United Nations Economic Commission for Europe. (2018). Road safety performance review Uganda. New York and Geneva: United Nations.
[26] Yannis, G., Evgenikos, P., & Papadimitriou, E. (2008). Best practice for cost-effective road safety infrastructure investments. CEDR, Paris.

### *Traffic calming measures can increase local spending and property values*

Traffic calming measures make streets safer and more inviting for pedestrians and cyclists which increases access to shopping areas, boosts retail spending, improves the local economy, and may improve real estate value (e.g., by 13%).[27]

When the Mission District of San Francisco, US, implemented street designs with narrower lanes which slowed down traffic, nearly 60% of retailers reported increased spending by local people, and nearly 40% reported an overall increase in sales.[28]

## *For co-benefits*

### *Traffic calming measures can decrease noise pollution*

The resultant speed reduction from traffic calming, for instance from 50 km/h to 30 km/h, can reduce noise levels by as much as five decibels.[29]

### *Traffic calming measures promote walking, cycling, public transport, and related health benefits*

Traffic calming measures, such as lane narrowing, reduce the amount of land devoted to vehicular traffic and parking; the resultant extra space can be used as green areas for community activities, safer, more convenient and comfortable walking and cycling space, and for public transport.[30] This results in friendlier and more livable public streets that encourage community interaction and attract customers to commercial areas.[31] Improved walkability and bikeability also mean people are more likely to walk or cycle instead of driving.[32] This contributes to a reduction in air pollution and improvement in environmental attractiveness.[33]

### *Traffic calming measures can reduce crime*

Neighborhoods that make it more difficult to travel at higher speeds because of traffic calming measures, such as narrow streets and chicanes, or which have few straight thoroughfares, have significantly less crime than those without traffic calming measures.[34] A study in Dayton, Ohio, US, showed that traffic calming reduced neighborhood crime by as much as 50%.[35]

[27] Sharpin, A.B., Banerjee, S.R., Adriazola-Steil, C., & Welle, B. (2017). The Need for (Safe) Speed: 4 Surprising Ways Slower Driving Creates Better Cities. World Resources Institute.
[28] Sharpin, A.B., Banerjee, S.R., Adriazola-Steil, C., & Welle, B. (2017). The Need for (Safe) Speed: 4 Surprising Ways Slower Driving Creates Better Cities. World Resources Institute.
[29] 20's Plenty for Us. (2016). 20mph Cuts Air & Noise Pollution to Prevent Blighted Lives. A 20's Plenty for Us Briefing.
[30] Litman, T. (1999). Traffic Calming Benefits, Costs and Equity Impacts. Victoria Transport Policy Institute.
[31] Global Designing Cities Initiative. (2016). Global Street Design. Island Press; 2nd None ed. edition.
[32] Sharpin, A.B., Banerjee, S.R., Adriazola-Steil, C., & Welle, B. (2017). The Need for (Safe) Speed: 4 Surprising Ways Slower Driving Creates Better Cities. World Resources Institute.
[33] Rossi I.A., Vienneau D., Ragettli M.S., Flückiger B., & Röösli M. (2020). Estimating the health benefits associated with a speed limit reduction to thirty kilometres per hour: A health impact assessment of noise and road traffic crashes for the Swiss city of Lausanne. Environ Int.;145:106126.
[34] Lockwood, I.M. & Stillings, T. (1988). Traffic calming for crime reduction and neighborhood revitalization. 68th Annual Meeting of the Institute of Transportation Engineers.
[35] Pedestrian and Bicycle Information Center. (2007). Traffic Calming and Crime Prevention. PBIC Case Study—Ohio, Florida & Virginia.

# Successful implementations

***Dar es Salaam, Tanzania:*** **26% reduction in injuries and 60% reduction in vehicular speed from speed humps, rumble strips, and other infrastructure interventions**

In Dar es Salaam, the School Area Road Safety Assessment and Improvements (SARSAI) program implemented low-cost infrastructure interventions in nine school environments, including concrete speed humps, rumble strips, thermoplastic pedestrian footpaths, pedestrian crossings, installation of bollards, and new signs, which reduced road injuries among children. A 12-month post-intervention evaluation showed a 26% decrease in road traffic injuries and traffic speeds in school zones reduced by up to 60%.[1]

***Ghana:*** **55% reduction in fatalities from rumble strips at Suhum Junction**

Based on crash data between 1998 and 2000, loss of control with excessive vehicle speeds was the primary contributing factor of crashes and the majority of road users injured by these crashes were pedestrians. Low-cost traffic calming measures, such as rumble strips and speed humps, were implemented on Ghanaian roads. Rumble strips installed at the Suhum Junction on the main Accra-Kumasi highway reduced crashes by about 35% and fatalities by about 55%.[37]

***Australia:*** **63% casualty reduction at raised crossings, 55% casualty reduction at raised intersections, and 47% casualty reduction at raised midblock platforms**

Raised intersections, raised pedestrian crossings, and midblock platforms on urban arterials in Australia have resulted in a 55% reduction in casualties at raised intersections, 63% reduction at raised pedestrian crossings, and 47% reduction at midblock platforms.[38]

***New Zealand:*** **23% reduction in fatal and serious crashes from rural-urban gateway treatments**

Rural-urban gateway treatments at 102 sites in New Zealand led to a 26% reduction in all crashes and a 23% reduction in fatal and serious crashes. The results showed that gateways, particularly with lane narrowing, were effective in lowering crashes in rural-urban transition zones.[39]

***Auckland, New Zealand:*** **from 54 to zero crashes and US$6 million cost savings from a raised roundabout with pedestrian crossings**

In Auckland, in 2020, a stop sign controlled busy intersection was replaced by a new raised roundabout with four pedestrian crossings. This resulted in a reduction in reported crashes at the junction, from 54 crashes over five years prior to implementation of the roundabout, to zero crashes in the 18 months afterwards. The crash cost savings from the construction of the raised roundabout and crossings were estimated to be worth more than US$6 million at a Present Value (the current value of a future sum of money based on a specific rate of return), and also encouraged modal shift, improved access to public transportation and local businesses, and helped reduce carbon emissions.[40]

[37] Afukaar, F.K. (2003). Speed control in developing countries: issues, challenges and opportunities in reducing road traffic injuries. Injury control and safety promotion, 10(1-2), 77–81.
[38] P. 20-27, Makwasha, T. & Turner, B. (2017), 'Safety of raised platforms on urban roads', Journal of the Australasian College of Road Safety, vol. 28.
[39] P. 14-20, Makwasha, T. & Turner, B. (2013). Evaluating the use of rural-urban gateway treatments in New Zealand. Journal of the Australasian College of Road Safety, 24(4).
[40] Royce, B. (2022). "Fix Crash Corner' – A Roundabout Story" Journal of Road Safety, 33(4), 61-67.

***Belgium:*** **59% reduction in injuries on 90 km/h speed limit roads and 15% reduction on 50 km/h speed limit roads from roundabouts**

In the Flemish area of Belgium, 95 roundabouts were built between 1994 and 1999. These roundabouts were built on roads with a speed limit range of 50 km/h to 90 km/h. This resulted in a 30% reduction in slight injuries, 38% reduction in serious injury crashes, and 34% reduction in overall crashes. The reduction in injuries was greater in the 90 km/h speed limit roads (59%) than the 50 km/h speed limit roads (15%).[41]

***United Kingdom (UK):*** **50% reduction in deaths and serious injury crashes from chicanes, mini-roundabouts, speed humps, and lane narrowing**

In the UK, between 1991 and 1997, traffic calming interventions were introduced in 56 villages of varying size, traffic volume, and speed limits. The traffic calming included chicanes, mini-roundabouts, speed humps, and lane narrowing in the village and/or at the gateways. This resulted in a reduction of 25% in all crashes and 50% in death and serious injury crashes across all these villages.[42]

***Oslo, Norway:*** **zero pedestrian and cyclist deaths in 2019 from around 500 speed humps and other infrastructure interventions**

Oslo made one lane for cars in each direction by replacing car lanes with bus or bike lanes, and installed around 500 speed humps and lower speed limits, resulting in almost two-thirds of the city's network having a speed limit of 30 km/h. Since then, Oslo achieved zero pedestrian and cyclist fatalities in 2019.[43]

***Catania, Italy:*** **injuries reduced by 32–50% from speed tables, a chicane, and road narrowing**

In Catania province, three traffic calming measures—speed tables, a chicane, and road narrowing—were implemented on three different road sections respectively. A before-after analysis of fatal and injury crash data on the road sections where speed tables were placed showed that the number of crashes decreased by about 44%. This included a 100% reduction in fatalities and a 38% reduction in injuries. On the section with the chicane, there was a 36% reduction in crashes, a 50% reduction in injuries and a 100% reduction in fatalities. On the sections with road narrowing, crashes were reduced by 33%, and a 32% decrease in injuries was reported.[44]

***Seattle, Washington, US:*** **55% decrease in pedestrian fatalities from lane narrowing and speed humps**

In Seattle, there were over 54,000 road traffic crashes between 2007 and 2010 and 42% of fatal crashes were attributed to speed. This prompted the Seattle Department of Transportation to set a goal of zero road fatalities by 2030 in its 2012 Road Safety Action Plan. Speed reduction was one of the priority areas to reach that goal. Changes to road environments were made by implementing traffic calming measures such as lane narrowing and speed humps. These resulted in a 29% decrease in all traffic fatalities and about 55% decrease in pedestrian fatalities. It has also led to improved walking and biking conditions, including the creation of neighborhood greenways, and 129 miles of bike lanes and sharrows (shared lane markings), improved pedestrian infrastructure, and safety improvements in walking routes to schools.[45]

[41] De Brabander, B., Nuyts, E., & Vereeck, L. (2005). Road safety effects of roundabouts in Flanders. Journal of Safety Research, 36(3), 289–296.
[42] Wheeler, A.H. & Taylor, M.C. (2000). Changes in accident frequency following the introduction of traffic calming in villages Prepared for Charging and Local Transport Division, Transport Research Laboratory, TRL REPORT 452.
[43] Hartmann, A. & Abel, S. (2020). How Oslo Achieved Zero Pedestrian and Bicycle Fatalities, and How Others Can Apply What Worked. World Resources Institute.
[44] Distefano N. & Leonardi S. (2019). Evaluation of the Benefits of Traffic Calming on Vehicle Speed Reduction. Civil Engineering and Architecture 7(4): 200-214.
[45] Health Resources in Action. (2013). Seattle, Washington: A Multi-Faceted Approach To Speed Reduction. A Community Speed Reduction Case Study.

***New Zealand:*** **11.4–22.7% reduction in average speed from speed humps, raised platforms, lane narrowing, and roundabouts***

At the request of residents, speed humps were built in Taunton Terrace in Auckland. After a year, an evaluation showed that the speed hump had reduced the maximum speed by 11 km/h from the 50 km/h posted speed limit and the average speed was reported to be 31.6 km/h. Similarly, the average speeds between the 14 speed humps in Blackburn Local Area Traffic Management in Hamilton decreased by an average of 6.6 km/h (-14.4%) six months after installation.[46]

After the installation of five raised platforms in Konene Street, Rotorua, the average speed between the platforms varied between 34.5 and 36.6 km/h, below the 50 km/h posted speed limit. The installation of seven raised platforms in Tuckers Road, Christchurch, resulted in a reduction of average speeds by 8.8 km/h (-17.1%).[47]

In Christchurch, a lane narrowing was implemented on a 440m section of Thorrington Road. After two years, traffic volume decreased by approximately 65%, the average speed decreased by approximately 5 km/h (-11.4%), and no crashes have been reported since the implementation.[48]

Three years after the construction of three roundabouts on Puriri Street in Butt City, the average speed reduced by 12.2 km/h (-22.7%).[49]

*Any travel speed reduction achieved via traffic calming measures has death and injury reduction benefits. In principle, a 1% reduction in average speed results in an approximate 2% decrease in injury crash frequency, a 3% decrease in severe crash frequency, and a 4% decrease in fatal crash frequency[50]. Furthermore, 10 km/h reduction in a speed limit could be expected to produce around a 15–20% reduction in injury crashes, and up to around a 40% reduction in pedestrian fatal and serious injuries.[51]

# How to implement it

The following guidance documents can support governments in the design and implementation of traffic calming measures:

- *Low-Speed Zone Guide* developed by the Global Road Safety Facility (World Bank) and the World Resources Institute[52]
- *Global Street Design Guide* developed by the Global Designing Cities Initiative[53]
- *Road Safety Toolkit* developed by the International Road Assessment Programme (iRAP)[54]

[46] P. 77-78, 81-82, Minnema, R. (2006). The Evaluation Of The Effectiveness Of Traffic Calming Devices In Reducing Speeds On "Local" Urban Roads In New Zealand. February.
[47] P. 87-91, Minnema, R. (2006). The Evaluation Of The Effectiveness Of Traffic Calming Devices In Reducing Speeds On "Local" Urban Roads In New Zealand. February.
[48] P. 107-108, Minnema, R. (2006). The Evaluation Of The Effectiveness Of Traffic Calming Devices In Reducing Speeds On "Local" Urban Roads In New Zealand. February.
[49] P. 115-116, Minnema, R. (2006). The Evaluation Of The Effectiveness Of Traffic Calming Devices In Reducing Speeds On "Local" Urban Roads In New Zealand. February.
[50] OECD/International Transport Forum. (2018). Speed and crash risk. ITF (International Transport Forum).
[51] Turner, B., Job, S., & Mitra, S. (2021). Guide for Road Safety Interventions: Evidence of What Works and What Does Not Work. World Bank, Washington, DC., USA.
Elvik, R.(2009). The power model of the relationship between speed and road safety. Update and new analyses. Institute of Transportation Economics. TOI Report 1034/2009.
Mitra, S., Job, S., Han, S., & Eom, K. (2021). Do Speed Limit Reductions Help Road Safety? Do Speed Limit Reductions Help Road Safety?, June.
OECD/International Transport Forum. (2018). Speed and crash risk. ITF (International Transport Forum).
[52] Sharpin, A.B., Adriazola-Steil, C., Job, S., et al. (2021). Low-Speed Zone Guide. World Resources Institute and The Global Road Safety Facility.
[53] Global Designing Cities Initiative. (2016). Global Street Design. Island Press; 2nd None ed. edition.
[54] International Road Assessment Programme, iRAP. (2022). The Road Safety Toolkit.