iRAP

ROAD SAFETY FOUNDATION

iRAP URBAN COUNTERMEASURES

THE ROAD SAFETY TRUST

Making Roads Safer

Knowledge from across the globe has been brought together in a three-year project managed by the Road Safety Foundation (RSF) and supported by a grant from The Road Safety Trust.

The project enhances iRAP for use in urban environments.

iRAP helps road authorities to proactively assess risk on road networks or individual sections. It provides Star Ratings and fatal and serious injury estimates that can help with strategic planning at the network level and road safety impact assessment of different treatment options.

Introduction

Traditionally road authorities have taken a reactive approach to reducing road traffic crashes, focussing on the treatment of historical crash cluster sites. Although some crash cluster sites do still exist, these are becoming very infrequent and are often not robust; historical crash locations are not very good predictors of future crash locations. Although crash cluster sites are relatively infrequent, we still have high numbers of people being killed or seriously injured on our roads, so addressing such sites alone will not allow us to make the progress we need to make in terms of casualty reduction.

Road safety initiatives across the world and the UK are increasingly embracing Vision Zero and the Safe System. Vision Zero considers that it can never be ethically acceptable that people are killed or seriously injured within the road transport system, and directly challenges the prevailing view that death and serious injury are an acceptable by product of mobility. The Safe System is the outworking of Vision Zero – it means the delivery of a road transport system that is designed so there is no possibility of death or serious injury.

At its core, a Safe System is one that protects road users from fatal or serious injury in the event of a crash. There are two key principles that underpin the Safe System. Firstly, that humans make 'errors' while using roads simply because of normal human behaviour and processing limitations. Secondly, that the human body is frail and there are limits to our tolerance of crash forces. So, while human error accounts for most crash causation, it is important to consider and treat the injury causation – this is where the vehicle, road environment and speed are the key determinants of severity.

Implementing the Safe System also requires us to tackle risk proactively rather than waiting for crashes to accumulate.

The iRAP (International Road Assessment Programme **www.irap.org**) approach provides a **proactive** route assessment methodology to identify and treat risk.

ViDA (**www.vida.irap.org**) is a suite of free road safety tools provided by the International Road Assessment Programme (iRAP) to support its vision for a world free of high risk roads. ViDA enables the preparation and analysis of iRAP Star Ratings, Fatal and Serious Injury (FSI) Estimates and Safer Roads Investment Plans (SRIPs). It is the portal for iRAP's tools – Star Rating for Designs, Star Rating for Schools and the Star Rating Demonstrator. ViDA has supported iRAP surveys and analysis in more than 100 countries globally.

In an iRAP survey, 52 road characteristics are recorded and combined together in the iRAP software (known as ViDA) according to their relative contribution to collision likelihood and severity based on research studies. A score is given to the road which is subsequently banded to allocate a Star Rating for pedestrians, cyclists, motorcyclists and vehicle occupants. The Star Ratings provide an objective measure of the likelihood of a crash occurring and its severity, where 1- Star is the least safe and 5-Star is the safest.

Broadly speaking, every extra star rating results in a halving of crash cost in terms of the number of people who are killed and seriously injured.

Once the iRAP survey and coding are completed, the data generated are used to model risk based on Safe System principles. From this, fatal and serious casualties are estimated and the model triggers countermeasures that are likely to address the type of risk detected. The countermeasures are then tested in terms of their casualty reduction potential to drive an economic appraisal of the measure. This provides the cost of implementation versus the monetary benefits of saving lives and serious injuries. A Safer Roads Investment Plan (SRIP) is generated which provides an optimised investment of likely safety countermeasures and the business case for that investment.

The SRIP can support investment decision making on existing roads and within road designs. Planners, designers and engineers can use this information to develop detailed implementation plans and designs, measure the impact on Star Ratings, and estimate Fatal and Serious Injuries saved.

Before this project, the SRIP contained up to 94 countermeasures which could be suggested by the model to address the risk identified. However, these countermeasures were largely designed primarily for rural areas and there was not a comprehensive set of measures for Vulnerable Road Users.

About the project

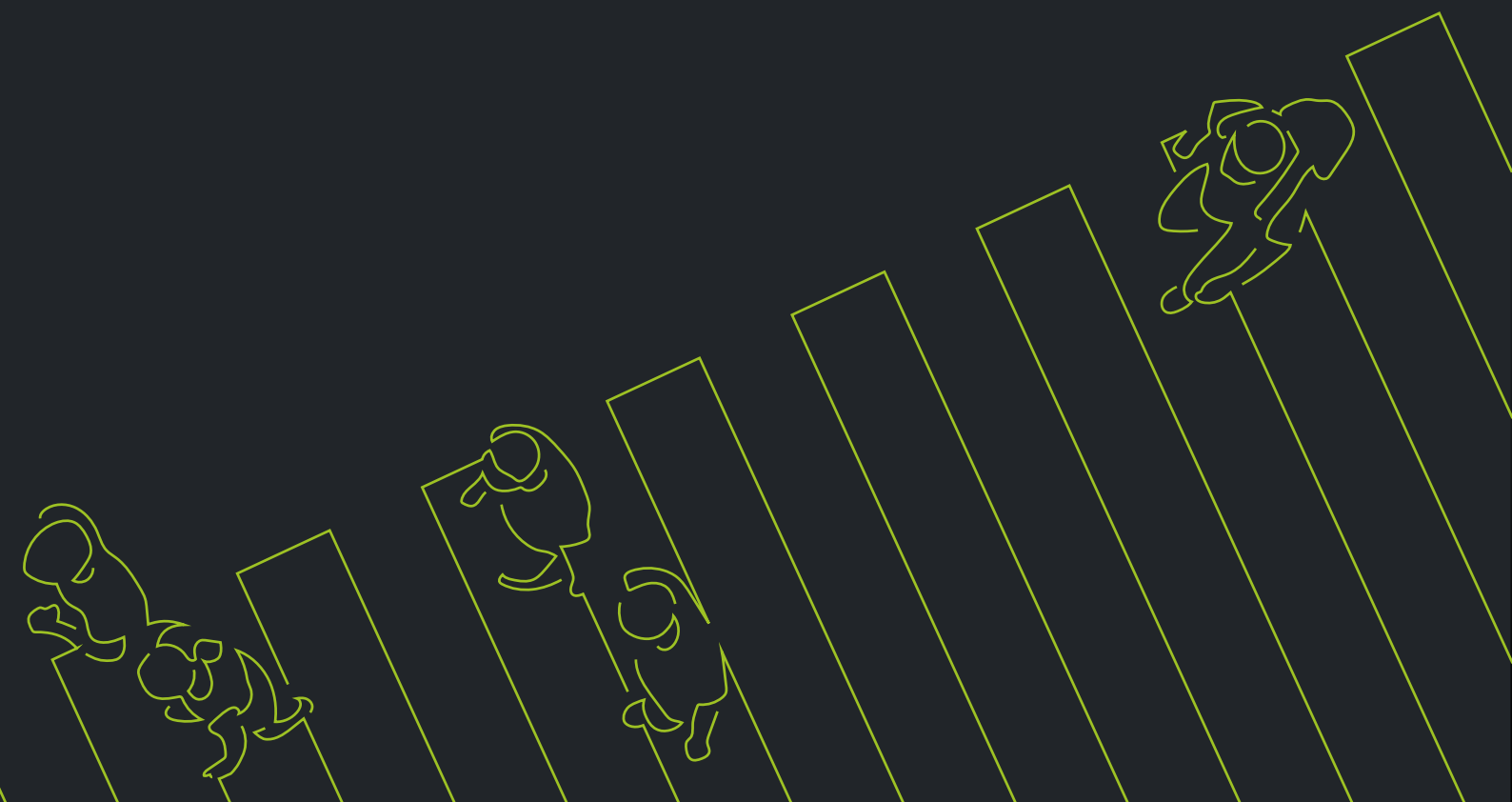
Movement in towns and cities around the world is changing, and road design needs to reflect this. While traditionally, urban road design has been car-centric, many cities have fundamentally shifted to a model that prioritises safety and mobility for pedestrians and cyclists. In addition, a growth in micro-mobility – including low-speed vehicles such as e-scooters and rental bikes – is prompting cities to look for new ways to provide safer urban road environments for all road users.

The project's primary goal was to improve the Safer Roads Investment Plans (SRIPs) to ensure that the recommendations provided by the iRAP model reflect the latest solutions for Vulnerable Road Users (VRUs) in urban environments aligned with the Safe System and Vision Zero approaches.

The latest thinking and innovation for the safety of VRUs can now be accessed in the iRAP tools by road authorities across the world, helping them make a better investment case to prevent fatal and serious injuries in urban areas.

In the project, RSF worked with the iRAP Team and Local Authorities in the UK to define user requirements and review outputs. Countermeasures were trialled by the Local Authorities and their comments on them included in the review. We believe that the urban enhanced SRIP could encourage lower speeds and create more equitable and accessible roads. Local Authorities can include countermeasures in their investment plans that stimulate low speed and because the suggested infrastructure changes are aligned with urban needs, they can account for the variability and dynamics of the urban environment.

The updated tools are freely available in the iRAP ViDA system and will help authorities to better analyse their urban road networks and identify cost effective improvements targeted at reducing fatal and serious injuries. They are a fantastic example of local innovation building on the iRAP Star Rating Methodology to meet a local need. Through iRAP's Innovation Framework, the project is one of several exciting initiatives underway globally that are Made Safer by iRAP and will help countries accelerate towards the global target of halving road death and injury by 2030.



The new countermeasures

A review undertaken of relevant literature and standards has guided the implementation of the enhanced SRIP to:

- Introduce speed reduction as a countermeasure that accounts for the traffic calming measures appropriate to the target speed (and other characteristics of the road)
- Recommend appropriate traffic calming measures for all urban roads where pedestrians and cyclists are present
- Broaden the types of pedestrian/ cycle crossing types
- Enhance 'upgrade crossing quality' with a specific list of recommended measures
- Update the minimum length, minimum spacing and hierarchy rules in line with current best-practice
- Introduce measures to reduce legs on junctions or close junctions to vehicular traffic
- Update trigger sets and hierarchy rules so that recommendations align with current best practices for traffic calming in urban areas.

New countermeasure package

Speed control

The speed control countermeasure is recommended when drivers continuously disregard the speed limit. It can be implemented as vehicle-activated signs or speed cameras and have educational or punitive purposes. The countermeasure will be triggered near schools or crossing points when the speed limit is adequate for urban areas but operational speed is above the speed limit.

Speed limit reduction

It is recommended that a speed limit reduction is introduced on urban roads, where the land use indicates the possible presence of VRU and the speed limit is above 30 mph. The model will trigger this countermeasure around schools, close to crossings and where pedestrian or cyclist flows is high.

Traffic calming

The standard version of the SRIP already has a traffic calming countermeasure but it is quite broad. This new countermeasure provides a more holistic perspective, providing countermeasures and impact on the operating speed for each speed range. Also, several different types of traffic calming devices can be implemented to encourage drivers to reduce speed. Most of them are speed specific.

For example, traffic calming measures to reduce speed below 20 mph can be vertical deflections, like flat-topped road humps, but rumble devices are preferable in the case of 40 mph. The countermeasures include lane width and number of lanes and include choices on low enforcement and strong enforcement.

Staggered crossings

These will be triggered in mid-block sections where a median greater than 3m in width is present. The countermeasure will be recommended when there are two or more traffic lanes per carriageway and even when pedestrian flow is low. Operating speeds and vehicle flow triggers will limit staggered crossings to AADT below 10,000 and operating speeds between 20 and 50 mph.

They are configured as crossing legs on each side of a refuge and are slightly offset so the pedestrian faces the direction of the oncoming traffic, increasing pedestrians' visibility. It can be implemented as an actuated signalised crossing.

Diagonal crossings

It is intended that these are implemented at signalised junctions only. They are recommended for crossings with high pedestrian and traffic volumes.

Therefore, the countermeasure will be triggered in urban 4-leg signalised junctions, with or without protected turn lanes, where crossing flows are higher than 100 pedestrians in the peak hour and when road AADT is greater than 10,000 vehicles.

Pinch point/give-way crossings

These are recommended for mid-block locations with low traffic volumes and where speeds are < 20 mph. When implemented, the road is reduced to one lane at the crossing point and traffic gives way to approaching vehicles.

The countermeasure will be triggered in urban streets, where mid-block crossing flows are presented, operating speeds are < 20 mph and road AADT is below 3,000.

Flush crossings

These crossings will reduce pedestrian movement barriers and remove the implicit priority of vehicles by raising the carriageway level with the footway.

The countermeasure will be triggered in junctions where side road volumes are low and pedestrian or cyclist flows are high.

Pedestrian and cyclist zones

This countermeasure aims to create more space for pedestrians and cyclists, permanently restricting vehicle access during specific periods of the day. They are considered road safety measures because, after their implementation, the conflicts between pedestrians and cyclists are minimised. The countermeasure will be triggered in urban commercial areas where pedestrian peak flows are greater than 400, there is no cyclist facility, low speeds, and low AADT flow.

Mini-roundabouts

The mini-roundabout countermeasure will be triggered at three or four-leg junctions when the operating speed is 30mph or less. The road needs to be an undivided urban road with low peak cyclist flows.

Cycle streets

Unlike the pedestrian and cyclist zone, where vehicles are not allowed to enter, cycle streets are mixed-traffic streets where cyclists have priority over cars. The countermeasure will be triggered in undivided urban roads in residential areas with cycle flows and no cyclist facility. Operating speed and road AADT need to be low.

Protected off-road cycle lanes

This countermeasure recommends the implementation of protection barriers on the side of new cycling facilities on high-speed roads.

Additionally minimum space and length rules have been amended to make the existing countermeasures more urban friendly. As urban environments are very dynamic, the infrastructure needs to prioritise accessibility and VRU safety instead of traffic mobility.

The main change in the existing countermeasures relates to the minimum space and length rules. The standard SRIP includes requirements to avoid some types of countermeasures, like crossings, to be triggered in consecutive sections. These requirements have been removed in the enhanced urban SRIP. Another example of changes in the existing countermeasures is with cycle lanes, now they will be included in the SRIP even if only triggered in one section only.

New countermeasure package

SAFE SPEED

1. Speed control
2. Traffic calming – lane width
3. Traffic calming – number of lanes
4. Traffic calming – target speed (20 mph)
5. Traffic calming – target speed (30 mph)
6. Traffic calming – target speed (40 mph)
7. Traffic calming – target speed (30 km/h)
8. Traffic calming – target speed (50 km/h)
9. Traffic calming – target speed (40 km/h)
10. Speed limit reduction – low enforcement (mph)
11. Speed limit reduction – strong enforcement (mph)
12. Speed limit reduction – low enforcement (km/h)
13. Speed limit reduction – strong enforcement (km/h)

SAFE CROSSINGS

16. Diagonal crossing
17. Signalised junctions with diagonal crossing
18. Give way crossings
19. Staggered crossings
20. Flush crossings

SAFE PED/BIKE

21. Protected off-road cycle lanes
22. Pedestrian and cyclists' zone
23. Cycle street

SAFE JUNCTIONS

14. Junction channelisation removal
15. Mini roundabout

URBAN ENHANCED

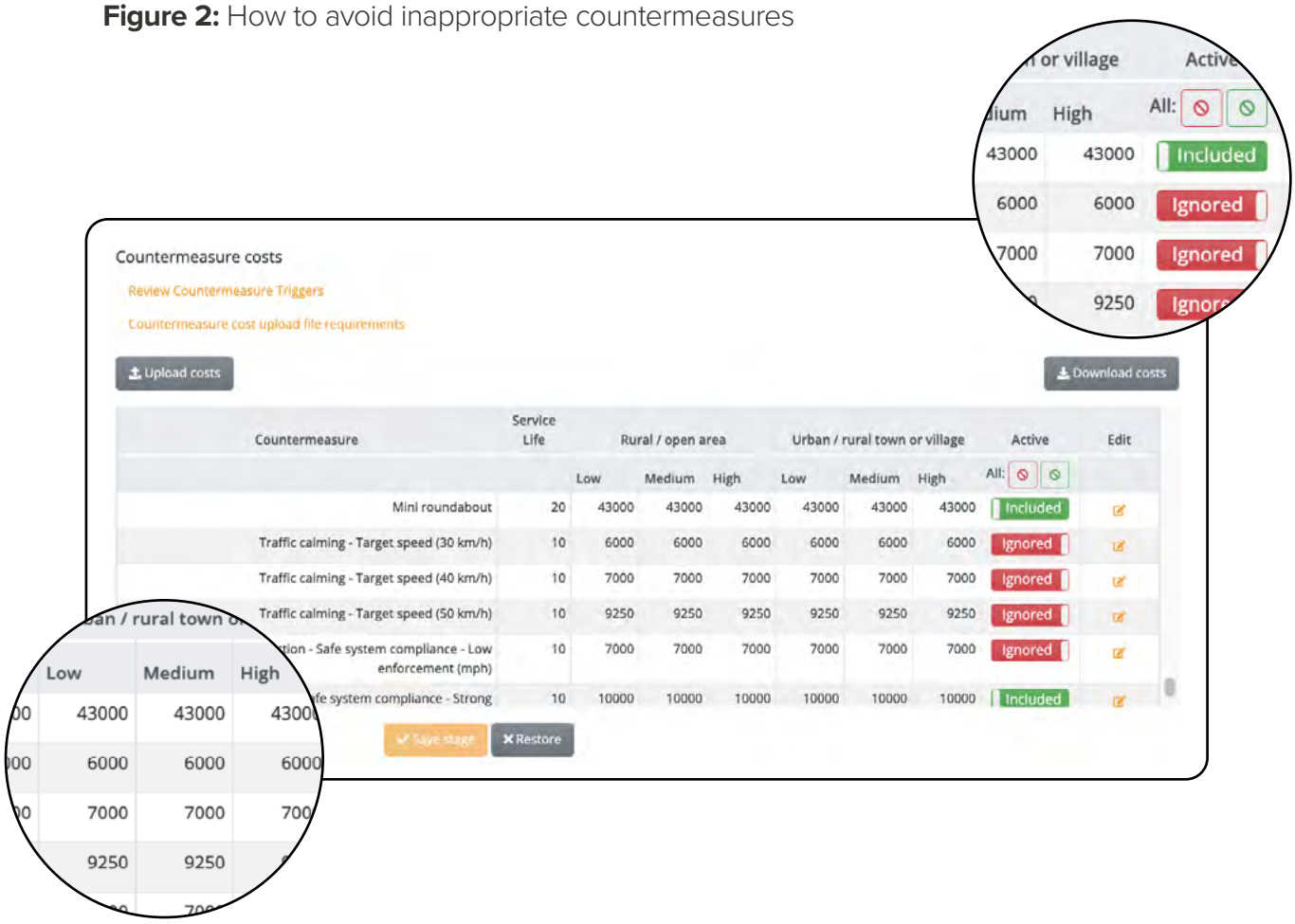
24. Cycle lane (on road) – urban
25. Cycle lane (off road) – urban
26. Unsignalised crossing – urban
27. Signalised crossing – urban
28. Unsignalised raised crossing – urban
29. Pedestrian fencing – urban

How to access the countermeasures

The countermeasures can be found in ViDA **www.vida.irap.org** in Stage 6, Investment Plan. There are now two options available V3.02 Countermeasures and V3.02 Countermeasures (Urban Enhancements). The first is the standard countermeasures package traditionally used in Star Rating assessments and the second includes the additions. The drop-down menu can be seen in Figure 1.

Figure 1: Countermeasure pack choice
Costs for the countermeasures need to be uploaded and if working in mph, km/h countermeasures should be ignored as shown in Figure 2, then the dataset can be reprocessed to generate the SRIP.

Figure 2: How to avoid inappropriate countermeasures



Feedback from users

Initial feedback from the Local Authorities who have trialled the countermeasures was good. They feel that the countermeasures generated on the stretch of roads in their area are adequate for the urban environment and felt that they could increase road safety for vehicle occupants and vulnerable road users. They also agreed that the new countermeasures represent changes in the urban infrastructure they already implement and therefore there is a need for such countermeasures in their urban area. Finally, they agreed that the new countermeasures are aligned with the Safe System Approach.

We are always looking for more feedback, so if you would like to provide comments, or if you have any queries, please contact us on **icanhelp@roadsafetyfoundation.org**

The iRAP methodology, tools and core training are provided free to the world with the major donor support of