ENHANCING iRAP INVESTMENT PLANS FOR VULNERABLE ROAD USERS

FINAL REPORT

ROAD SAFETY FOUNDATION

THE ROAD SAFETY TRUST

Making Roads Safer

About the Road Safety Foundation

The Road Safety Foundation is a UK charity founded in 1986 which advocates for safe and healthy mobility through the adoption of Safe Systems. Our recent work focuses on:

- Identifying investment packages likely to give high returns and analysing the safety performance of roads over time
- Providing the approach, tools and training necessary to support road authorities in taking a proactive approach to road risk reduction
- Undertaking research to progress knowledge and policy

Over the last 20 years, the charity has maintained a particular focus on safer road infrastructure through the establishment of the European Road Assessment Programme and the development of the International Road Assessment Programme (iRAP) and its protocols for measuring infrastructure safety. The RSF is responsible for supporting the Road Assessment Programme in the United Kingdom, and its work serves as a model of what can be achieved, with key research and innovation being replicated in RAP programmes across the world.

Recently, the charity has:

- Supported DfT's Safer Roads Fund carrying out surveys of the 50 highest risk local 'A' roads in England, training local authorities, and modelling the impact of schemes that together made the £100 million investment portfolio
- Provided support and technical insight to Highways England in their SRN-wide iRAP initiative
- Undertaken an independent review for the Office of Rail and Road into how Highways England prioritises investments to improve safety outcomes on the strategic road network
- Led the Older Drivers Task Force report with government support to develop the national Older Driver Strategy Supporting Safe Driving into Old Age

For more information and our full library visit roadsafetyfoundation.org

For more information

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Contents

Glossary

CIHT - Chartered Institution of Highways and Transportation.

Countermeasure - a measure suggested by the iRAP model to address risk highlighted within the model.

Crash cluster sites - a site where there have been a number of reported personal injury crashes.

iRAP - International Road Assessment Programme, a registered charity dedicated to saving lives by eliminating high risk roads throughout the world.

NACTO-GDCI - National Association of City Transportation Officials' Global Designing Cities Initiative.

Safe System - a Safe System is one that protects road users from fatal or serious injury in the event of a crash.

SRIP - Safer Roads Investment Plans draw on data underpinning Star Ratings and Fatal and Serious Injury estimates to determine the most cost-effective road upgrades and prevent deaths and serious injuries.

ViDA - (https://vida.irap.org) is a suite of free road safety tools provided by 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 estimates and Safer Roads Investment Plans. It is the portal for iRAP's tools – Star Rating for Designs, Star Rating for Schools and the Star Rating Demonstrator.

Vision Zero - Vision Zero is a strategy to eliminate all traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all.

VRU - vulnerable road user.

1. EXECUTIVE SUMMARY

Traditionally Road Authorities have taken a reactive approach to reducing road traffic crashes, focussing on the treatment of 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. The iRAP (International Road Assessment Programme https://irap.org/) approach provides a proactive route assessment methodology to identify and treat risk.

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.

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 can support investment decision making on existing roads and within road designs. Planners, designers and engineers can use this to develop detailed implementation plans, designs and 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 the urban area and Vulnerable Road Users (VRUs).

This project funded by the Road Safety Trust provided an opportunity to specify, develop and pilot new **urban countermeasures** to be included in the SRIP to focus on the needs of VRUs and provide a more optimised investment of likely safety countermeasures and the business case for that investment.

In the early stages of the project, Local Authorities were canvassed to see what new countermeasures they wanted to see in the model, that feedback coupled with the findings of the literature review provided the basis for the new urban countermeasures which were then trialled with the Local Authorities. Following feedback from the Local Authorities, the countermeasures were amended and then included in the software tools in iRAP ViDA. 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.

The software development and testing were a large part of the project and our partners iRAP have been fundamental in undertaking this work.

The urban countermeasures and SRIPs are now being used in 20 schemes and it is hoped there will be at least another eight in the next year that use these new countermeasures, therefore it is considered that the project has been a success and has met its overall objective which was to '*improve the SRIPs generated by the iRAP approach, to ensure the latest thinking and innovation for safety measures for VRUs in urban environments are fully embedded for Road Authorities to use to help them make the case for investment to prevent VRU Fatal and Serious Injuries'.*

2. INTRODUCTION

Context

Traditionally Road Authorities have taken a reactive approach to reducing road traffic crashes, focussing on the treatment of 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 https://irap.org/) approach provides a proactive route assessment methodology to identify and treat risk.

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 to develop detailed implementation plans, designs and 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 (VRUs).

Background to 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 SRIPs to ensure that the recommendations provided by the iRAP model reflect the latest solutions for VRUs in urban environments aligned with the Safe System and Vision Zero approaches.

The project provided an opportunity to build on progress and capture the latest innovative treatments for VRUs that could be immediately deployed through the well-established activities of the Road Safety Foundation (RSF) in the UK, EuroRAP across Europe, and iRAP with its global programme reaching over 100 countries. Importantly, this work closely links to the UN Member State Global Road Safety Performance Targets which inform and influence road safety policy and practice in the UK and internationally.

The UN Global Road Safety Performance Targets provide a common standard to benchmark the safety of the world's roads. **3-star or better roads for all road users is a key target to work towards a world free of high-risk roads**.

In the project, RSF worked with Local Authorities in the UK to define user requirements and review outputs. Urban countermeasures were trialled by the Local Authorities and their comments on them included in the review. We believe that the enhanced SRIP containing new urban countermeasures 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 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.

3. METHODOLOGY

The project had five principal components alongside governance and technical oversight. The detail of the work packages and outputs are listed below.

Work Package 1 - Defining the need

A Steering Group was created for the project which included representatives from Hampshire County Council, Kent County Council, Solihull Metropolitan Borough Council, Transport for Greater Manchester (TfGM), BRAKE and iRAP. Discussions were held with the Steering Group to ascertain what urban countermeasures and the functionality they would like to see in the model. Their feedback was captured in a User Requirements Document.

Work Package 2 - Literature Review

The existing literature and standards (including recent work by NACTO/CIHT etc.) was reviewed to consider the effectiveness of urban VRU treatments in different scenarios for potential inclusion as a countermeasure in ViDA. Other publications were also reviewed and self-explaining roads, shared space, safe speed, traffic calming were considered.

The findings were provided in a Literature Review; an overview of which can be seen in Section 7.

Work Package 3 - Specifying and developing urban SRIP tools

Based on Work Packages 1 and 2, a list of urban countermeasures was developed and categorised according to the evidence base available Those found to be relevant and with an adequate evidence base were listed in a report of appropriate measures and were included in the pilot stage.

The countermeasures that had been identified at this stage are detailed in Table 1.

Table 1: Original list of potential countermeasures

ID	Countermeasure (name in ViDA)	Countermeasure (name in UK)
NC1[1]	Speed limit reduction review	
NC2	Speed control	Speed control
NC3	Traffic calming measures – Road diet (lane width)	Traffic calming - Lane width
NC4	Traffic calming measures – Road diet (number of lanes)	Traffic calming – Number of lanes
NC5	Traffic calming measures – Target speed 20 mph	Traffic calming – Target speed 20mph
NC6	Traffic calming measures – Target speed 30 mph	Traffic calming – Target speed 30 mph

[1] This countermeasure was split into two after consultation with Local Authorities into 'Safe System Compliance - low enforcement or strong enforcement'.

ID	Countermeasure (name in ViDA)	Countermeasure (name in UK)
NC7	Traffic calming measures – Target speed 40 mph	Traffic calming – Target speed 40 mph
NC8	Protected off-road bicycle lanes	Protected off-road cycle lanes
NC9	Pedestrian and bicyclist zone	Pedestrian and cyclist zone
NC10	Bike streets	Cycle streets
NC11	Diagonal crossings	Diagonal crossings
NC12	Signalised intersections with a diagonal crossing	Signalised junctions with diagonal crossing
NC13	Pinchpoint/ Yield Crossings	Give way crossings
NC14	Staggered crossings	Staggered crossings
NC15	Flush crossings	Flush crossings
NC16	Intersection channelization removal	Junction channelization removal
NC17	Mini roundabout	Mini roundabout
NC18[2]	Vehicle flow reduction review	

Work Package 4 - Pilot

For the pilot, a search of the existing data in ViDA was undertaken to see if there were urban routes which could be used to test the countermeasures identified in the previous work package. A gap analysis revealed that more iRAP surveys were required and extra surveys totalling 11.6km were undertaken in Manchester. The surveys were coded and analysis undertaken in ViDA.

To enable the new countermeasures to be tested, an excel testbed was prepared to evaluate them. The testbed was developed to replicate the ViDA result. Figure 1 presents an overview of the type of Excel file used for the testbed.

[2] This countermeasure was removed after consultation with Local Authorities who highlighted that selecting roads where implementing solutions to reduce traffic consistently was felt to be too challenging.

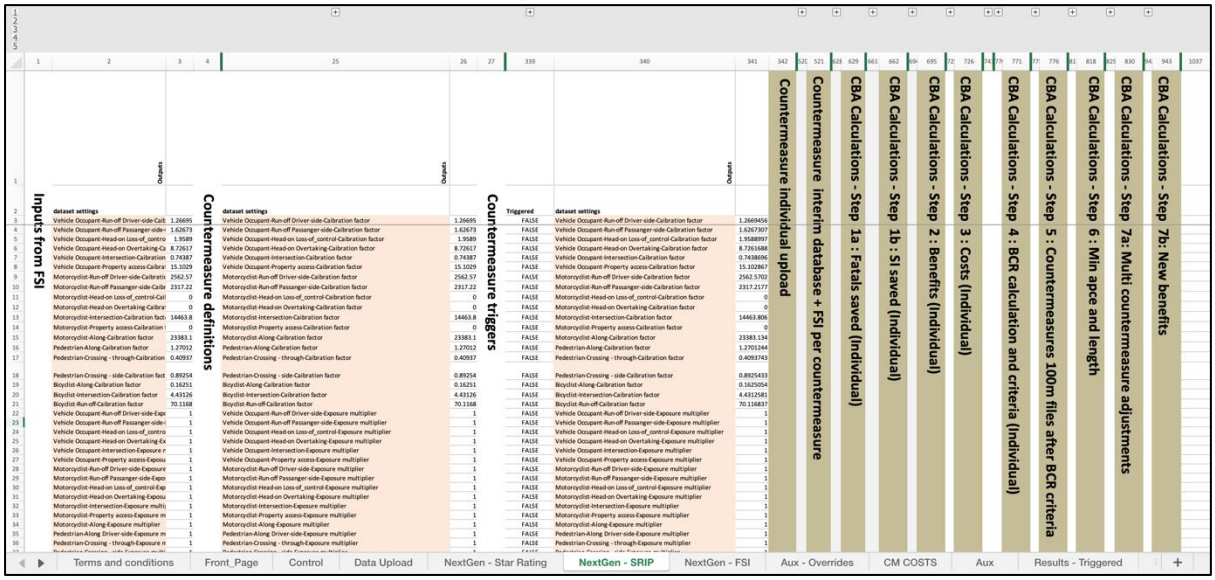

Figure 1: Overview of the testbed prepared for the project

When the testbed was ready, the countermeasures could be tested in a real life situation. Three datasets were chosen to run the analysis on, the results were shared with technical teams from the relevant Local Authorities and their views were sought.

It had been originally intended that Kent County Council, Hampshire County Council and Solihull Metropolitan Borough Council would be asked to undertake the trial. However, with the addition of routes in Manchester and the requirement for urban routes, the following authorities were chosen. The lengths of routes used are also detailed:

- Transport for Greater Manchester (11.6km)
- Birmingham City Council (29.3km)
- Kent County Council (17.9km)

The datasets were run on the testbed to identify the locations where the new countermeasures would be triggered. Maps showing these locations were shared with the Local Authorities and feedback was sought.

The triggers are essential to determine when a countermeasure will be included in the SRIP. The other parts of the process to generate the SRIP (for example the economic analysis and minimum rules) followed the same principles and structure as was in the model at the time.

Following the feedback from Local Authorities (detailed in Section 4) amendments to some of the countermeasures were made and the changes included in the iRAP model.

The final list of countermeasures is detailed in Table 2.

Table 2: Final list of countermeasures

ID	Countermeasure (name in ViDA)	Countermeasure (name in UK)
1	Speed control	Speed control
2	Traffic calming measures – Road diet (lane width)	Traffic calming - Lane width
3	Traffic calming measures – Road diet (number of lanes)	Traffic calming – Number of lanes
4	Traffic calming measures – Target speed 20 mph	Traffic calming – Target speed 20mph
5	Traffic calming measures – Target speed 30 mph	Traffic calming – Target speed 30 mph
6	Traffic calming measures – Target speed 40 mph	Traffic calming – Target speed 40 mph
7	Traffic calming measures – Target speed 30 km/h	Traffic calming – Target speed 30 km/h
8	Traffic calming measures – Target speed 40 km/h	Traffic calming – Target speed 40 km/h
9	Traffic calming measures – Target speed 50 km/h	Traffic calming – Target speed 50 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)	
14	Intersection channelization removal	Junction channelization removal
15	Mini roundabout	Mini roundabout
16	Diagonal crossings	Diagonal crossings
17	Signalised intersections with a diagonal crossing	Signalised junctions with a diagonal crossing
18	Pinchpoint/ Yield Crossings	Give way crossings
19	Staggered crossings	Staggered crossings

ID	Countermeasure (name in ViDA)	Countermeasure (name in UK)
20	Flush crossings	Flush crossings
21	Protected off-road bicycle lanes	Protected off-road cycle lanes
22	Pedestrian and bicyclist zone	Pedestrian and cyclists' zone
23	Bike streets	Cycle streets
24	Bicycle Lane (on-road) - Edited Urban	Cycle lane (on-road) - urban
25	Bicycle Lane (off-road) - Edited Urban	Cycle lane (off-road) - urban
26	Unsignalised crossing	Unsignalised crossing – urban
27	Signalised crossing	Signalised crossing - urban
28	Unsignalised raised crossing	Unsignalised raised crossing - urban
29	Pedestrian fencing	Pedestrian fencing - urban

Work Package 5 - Disseminating activities

A glossy brochure has been created for the project and will be included on the RSF, EuroRAP and iRAP websites.

A webinar was held on 24th November for practitioners. There were over 70 people from around the world who attended the demonstration of the urban investment plans – the majority of attendees were from the UK however there was also representation from Japan, Thailand, Zambia, USA, Bolivia, Denmark, Georgia, Uganda and Ireland.

Dissemination will continue at various conferences and through future training sessions delivered by the global iRAP team. This will feed into RSF and iRAP's advocacy for 5 Star Cities.

4. RESULTS/FINDINGS

Context

As outlined in Section 3, a pilot study was undertaken building on the work undertaken to identify relevant urban countermeasures in Work Packages 1-3.

A search of the data in the iRAP ViDA software was undertaken to see if there were urban routes which could be used to test the countermeasures. A gap analysis revealed that more iRAP surveys were required.

Liaison with TfGM resulted in two stretches of road being identified, with a Star Rating survey and coding undertaken. This filled the gaps identified within the gap analysis.

The testbed was then created by the iRAP team and the new urban countermeasures tested in a real life situation. The datasets were run on the testbed to identify the locations where the new countermeasures would be triggered. Maps showing these locations were shared with the Local Authorities (Figure 2 below) and feedback was sought.

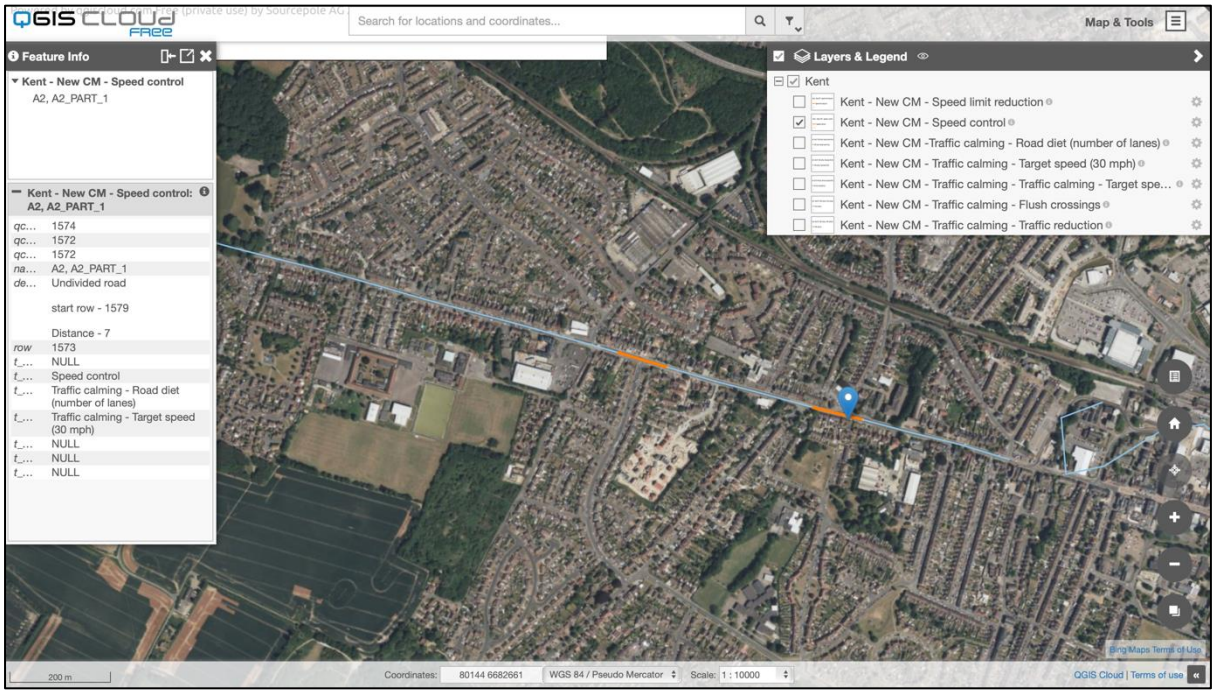

Figure 2: Example of a map shared with Local Authorities

Feedback

A feedback form was shared with the Local Authorities which aimed to provide a systematic way for reviewers from the three cities to provide feedback. The structured questionnaire was designed to identify issues and compare results quickly.

The first section of the form aimed to collect the overall perception regarding the application and suitability of the urban environment's new countermeasure. Reviewers were asked to indicate

whether they 'Strongly agreed', 'Agreed', 'Disagreed', 'Strongly disagreed' or 'Didn't know' to seven affirmative sentences. They sentences were:

1. *The new countermeasures are adequate for the urban environment.*
2. *The new countermeasures proposed will increase road safety for car occupants.*
3. *The new countermeasures proposed will increase road safety for vulnerable road users.*
4. *The new countermeasures represent changes in the urban infrastructure that we already implement.*
5. *The new countermeasures represent the urban infrastructure that we need for our urban area*
6. *The new countermeasures are aligned with the Safe System Approach*
7. *The new countermeasures are aligned with our urban area plans*

The second section of the form focused on the countermeasures triggered for each case. Reviewers were asked to indicate for each countermeasure evaluated if they felt they were 'Extremely appropriate', 'Somewhat appropriate', 'Not sure', 'Somewhat inappropriate' or 'Extremely inappropriate'.

Although the feedback survey form was shared with the Local Authorities, feedback from them was shared in different ways and is discussed in Table 3.

Table 3: Feedback from Local Authorities

Local Authority	Comment
1	The team agreed with sentences 1 to 6 and agreed that the new countermeasures are adequate for the urban environment. They felt that the countermeasures could increase road safety for car occupants and VRUs. 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. They did not know if the new countermeasures are aligned with their urban area plans. With regard to the specific feedback for the new countermeasures, the team classified the countermeasures 'Speed limit reduction', 'Speed control', 'Traffic calming measures – Target speed of 30 mph' and 'Flush crossings' as somewhat appropriate. Countermeasures 'Traffic calming measures – Target speed of 40 mph' and 'Traffic reduction' were considered somewhat inappropriate, while the countermeasure 'Traffic calming - number of lanes' was considered extremely inappropriate. For the three countermeasures considered somewhat or highly inappropriate, additional comments were provided:

Local Authority	Comment
	• 'Traffic calming - number of lanes' - This countermeasure does not make sense. It has been applied at locations that currently only have one lane in each direction. • 'Traffic Calming (Target Speed 40mph)' - Appears in some locations where speed is already 40mph. We would also not traffic calm on roads of 40mph (or above). • 'Traffic Reduction' - With one exception, this countermeasure is unsuitable for these routes as they are strategic in their nature and therefore a countermeasure to reduce traffic would likely only be aspirational. We would be interested to understand the trigger set for this countermeasure, given it did not appear at all on another road when many of the other measures have.
2	Feedback was provided via an excel file and a detailed description of the suitability of the countermeasures for the roads assessed was provided. Key elements of the urban roads such as their bus lane routes were provided. The Local Authority also briefly described changes in the urban infrastructure needed to produce the countermeasure expected effect. Overall, the reviewers agreed with the proposed countermeasures. They felt the Speed control countermeasure was appropriate and could potentially be used to slow traffic on the routes. In the case of 'Traffic calming - Road diet (lane width)', there were some concerns on routes used by many HGVs, but they agreed that the width reduction could provide additional space to implement segregated cycle lanes. Similar concerns were raised for the countermeasure 'Traffic calming - Road diet (number of lanes)', although possible to implement, countermeasures might impact journey times and queue lengths. Another traffic calming measure was also triggered which was 'Traffic calming measures – Target speed 30 mph' which suggested that entry treatments, vertical deflections or horizontal deflections could be used to reduce the operating speed in routes where vehicles are travelling above the speed limit of 30mph. Reviewers suggested that vertical or horizontal deflections might be difficult to implement due to the presence of buses and HGVs, but gateways could potentially be used. In this case study, the model triggered two countermeasures for increased safety in pedestrian crossings. The 'Staggered Crossings' were considered appropriate along the routes. Concerns were raised about 'Flush Crossings' on roads being part of a bus route. There is a potential misunderstanding in what this countermeasure meant to the Local Authority as the flush crossing would not be implemented in the inspected carriageway but on the side road.

Local Authority	Comment
	Finally, the feedback for the 'Traffic reduction' countermeasure was similar to that of Local Authority 1. The reviewers wrote, *'Change in vehicle flow (traffic reduction) would depend on modal shift from car to bicycle/public transport. Having a dedicated bus and cycle-only lane or segregated cycle lane would help with modal shift but there could be an impact on car journey times initially.'*
3	The reviewers provided their feedback on the suggested survey form. The reviewers disagreed that the new countermeasures are adequate for the urban environment and do not think they represent changes in the urban infrastructure they already implement. For the other affirmative sentences in the standard survey form, reviewers said they did not know and were unsure how appropriate the new countermeasures are to the triggered locations.

The feedback from Local Authorities was useful in ensuring that the iRAP Urban SRIP will bring value for assessments in urban areas. The comments provided by the reviewers contributed to finalising the list of the urban countermeasures introduced into the ViDA software.

A number of supporting documents have been provided following the feedback to enable Local Authorities to be able to understand the new urban countermeasures. This includes an excel spreadsheet explaining what the countermeasures are which is provided to Local Authorities using ViDA, a fact sheet detailing the countermeasures and changes to the ViDA user manual.

5. DISCUSSION

Overall, the project went well and there were a number of successes.

1. **Good partnership working – Local Authorities**

   The Steering Group was made up of a number of Local Authorities with whom RSF had worked with before: Hampshire County Council, Kent County Council, Solihull Council and Transport for Greater Manchester. Additionally, Birmingham City Council were involved later in the project in looking at the results of the urban countermeasures suggested. The project required the input from users of the software to ensure what was being suggested was useful and the partnership working made this possible.

2. **Good partnership working – iRAP**

   The developers from iRAP together with the technical team provided a huge amount of effort and input into the project and have created a set of countermeasures which will be invaluable for Local Authorities within urban areas. The team was extremely effective and flexible in their working.

3. **Webinar**

   The webinar was well attended and the presentations were provided by partners iRAP and the RSF team. There was a good question and answer session and attendees appeared to find the session helpful.

4. **Good opportunities to publicise the new countermeasures**

   iRAP have provided a number of news items and the changes have been publicised well within projects being worked upon in the UK. The glossy brochure will be widely disseminated.

6. CONCLUSIONS AND RECOMMENDATIONS

The project has had a number of strands with different teams working on the work packages.

In the early stages, Local Authorities were canvassed to see what new countermeasures they wanted to see in the model, that feedback coupled with the findings of the literature review provided the basis for the new urban countermeasures which were then trialled with the Local Authorities. Following feedback from the Local Authorities, the countermeasures were amended and then included in the software tools in iRAP ViDA.

The software development and testing were a large part of the project and our partners iRAP have been fundamental in undertaking this work.

The urban countermeasures and SRIPs are now being used in 20 schemes and it is hoped there will be at least another eight in the next year that use these new countermeasures, therefore it is considered that the project has been a success and has met its overall objective which was to '*improve the SRIPs generated by the iRAP approach, to ensure the latest thinking and innovation for safety measures for VRUs in urban environments are fully embedded for Road Authorities to use to help them make the case for investment to prevent VRU Fatal and Serious Injuries'.*

The urban countermeasures and SRIP will continue to be promoted by RSF and iRAP and it is hoped that they will be used in other countries in the future.

We would like to thank the Road Safety Trust for funding this work which is already actively being used and 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.

7. APPENDIX A – LITERATURE REVIEW

As part of the project, a literature review was undertaken to review existing literature and standards to consider the effectiveness of urban VRU treatments in different scenarios with a view to expanding the range of urban-specific safety treatments which can be applied by the iRAP protocols. It included a review of literature relating to self-explaining roads, shared space, safe speed, traffic calming and will cover a review of future technologies.

Methodology

A number of the leading, best-practice design guides formed the basis for the review[3]. These included those that were identified in the project proposal, and others which were identified during the course of the review, particularly those relevant to the UK context.

Publications included in the review[4] were:

- The NACTO-GDCI *Global Street Design Guide* (2016) and *Designing Streets for Kids* (2020)
- WRI Ross Centre for Sustainable Cities' *Cities Safer by Design* (2015)
- Transport for London's (TfL) Streetscape Guidance (2019)
- The UK *Design Manual for Roads and Bridges* (DMRB), *CD143 Designing for walking, cycling and horse-riding* and *CD195 Designing for cycling traffic*
- Chartered Institution of Highways & Transportation's (CIHT) *Designing for walking* (2015)
- UK Department for Transport and Communities and Local Government's *Manual for Streets* Section 6.3 (2007)
- UK Local Transport Note 1/20 (Cycling Infrastructure Design)
- UK Local Transport Note 1/07 (Traffic Calming)
- Institute of Transport Engineers' (ITE) Technical Resources on Traffic Calming Measures.

Additional studies and publications were identified and consulted for their relevance to particular issues. The review concluded with discussion and recommendations for urban-specific countermeasures appropriate for application in the iRAP methodology, namely the Safer Road Investment Plan (SRIP).

The learnings gathered from this literature review were used in the SRIP to:

- Recommend countermeasures more appropriate to the urban environment and desirable outcomes

[3] A list of all the publications considered in the literature review can be found in Section 8

[4] Many of the documents more or less contain detailed specifications and guidance pertaining to the design of various facilities. The literature review did not compare the specifics of design unless it was relevant to a specific outcome or application of a safety treatment.

- Recommend more specific types of countermeasures based on road characteristics, user flows and land use, for example, crossing types appropriate to the road context
- Review countermeasure triggers, minimum length, minimum spacing and hierarchy rules
- Identify new countermeasures where appropriate

8. REFERENCES

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