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Development of a Safer Road Corridors Investment Plan in Ukraine: prioritisation on the M12 corridor and assessment of design plans

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Abstract

Supported by the World Bank, EuroRAP AISBL used the protocols devised by the International Road Assessment Programme (iRAP) to select a section of approximately 40km of the M12 in Ukraine as a priority for rehabilitation on the basis of likely fatal and serious casualty reduction and the Benefit:Cost Ratio (BCR) that could be achieved. It was estimated that fatal and serious casualties could be reduced by more than 500 over a 20 year period and that the BCR would be more than 5.

Design plans for this road section were presented to EuroRAP and to its consultant TRL. They found that generally there was a good development of the safety principles discussed during the site visit to the location and that a comprehensive detailed design proposal had been prepared. TRL presented recommendations for amendment to the designs and, where these were practicable and acceptable within current practice in Ukraine, these were accepted.

Generally, it is anticipated that there will be an increase in the Star Rating of the safety of this road section with the proposals as they were presented. The paper notes several opportunities for enhancements to the design that would result in a further increase in the safety rating of the road. Because this project did not involve a full upgrading, some measures (such as provision of median barrier on some dual carriageway sections) will not be incorporated in final plans. Other measures are not acceptable within existing Ukraine design practice.

1. Background

In 2012 EuroRAP AISBL was commissioned by the World Bank to analyse and report on 1519km of the M12, M17 and M18 in Ukraine surveyed by AMSS-CMV, the daughter company of the Serbian motoring organisation.

That work was reported on in August 2013 and is available at <http://www.irap.org/en/about-irap-3/assessment-reports?download=152:eurorap-ukraine-development-of-a-safer-road-corridors-investment-plan> (and also in Russian at <http://www.irap.org/en/about-irap-3/assessment-reports?download=153:eurorap>). The study showed that the roads surveyed were generally single carriageways and in need of rehabilitation. Typically the roads do not have the protection or crash-avoiding provision available in many western European countries – crash

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protection systems such as barriers, modern well-designed intersections and the quality of maintenance is often poor (see Fig 1).

Nevertheless, compared with many Low- and Middle-Income Countries, the running surfaces were relatively good and on substantial parts of the network there was relatively little margin erosion, the carriageway formation was well maintained, with much of the shoulder in reasonable condition.

As with any single-carriageway network, the features that lead to death and serious injury in the event of a crash were, as expected, found to be widely present:

- Lack of head-on protection
- Intersections where brutal right-angled side-impacts may occur
- Hazards such as unprotected trees close to the road

The project produced a Safer Roads Investment Plan of recommendations for these road sections and identified corridors where there would be the greatest benefit in injury reduction.

As part of this prioritisation, targets such as minimum 3-star ratings for roads mean that the improvements will include measures known to reduce risk: head-on, intersection and run-off risk and risk as people travel along or across the road.

During the analysis, themes emerged of the need to provide Safe Intersections, Safe Roadsides, Safe Overtaking and Safe Villages, all with reference to designing to a 3-star safety minimum.



Fig. 1. Elements of the selected route (Section 38) requiring rehabilitation.

From four priority corridors of almost 700km in length, six sections were subsequently identified for early upgrading (table below). These sections totalled 118km in length and showed a range of BCRs from 4.5-6.9 for a

37m USD investment. The iRAP model predicted a saving of around 2500 fatal and serious casualties over 20 years on these sections, more than one fatal or serious casualty per kilometre per year.

Section 38 of the M12, 41km including the town of Letychiv and several smaller settlements, was selected as the first of these to be upgraded, a selection determined by a combination of the potential for fatal and serious casualty reduction predicted in the RAP online software ViDA, the likely Benefit Cost Ratio and the budget available for the work. It was estimated that fatal and serious casualties could be reduced by more than 500 over a 20 year period and that the Benefit:Cost Ratio would be more than 5.

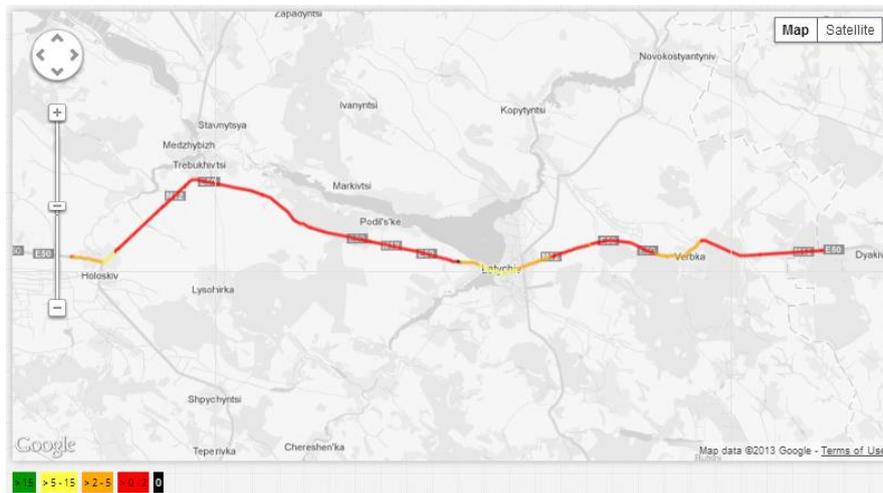


Fig. 2. (Holoskiv to west of Dyakivtsi – casualty savings per km (20 years)).



Fig. 3. Letychiv.

2. Using Road Safety Audit alongside iRAP Star Rating

A question that is commonly asked is how Star Rating designs fits with Road Safety Audit (RSA). The main components are compared in the figure below.

A key point is that RSA is largely qualitative, while iRAP is quantitative. Note in particular that the Star Ratings is a repeatable process, meaning that comparisons can be made through a road project cycle.

However, the two can fit together in a complementary way. Audits can provide an opportunity for very detailed site specific recommendations to be made. For example, about the location on bus stops. They also give a chance

for expert experience to be brought into a project. This type of information can be used to help ‘fill gaps’ in an iRAP assessment.

Table 1. Common topic questions about how Road Safety Audit compares with iRAP surveys.

Topic	Road Safety Audit → Qualitative	iRAP → Quantitative
Method of data collection	On-site visits / design plans	Survey to collect data at 10m to 20m intervals / design plans
Assessment	Checklist Covers broad number of issues	Coding of fixed list of attributes at 100m intervals Application of risk factors
Reporting of risk	Checklist	Star Rating Scores, Star Ratings, estimates of deaths and serious injuries, estimate of economic cost
Recommendations	List of countermeasures and further work	List of countermeasures at 100m intervals, deaths and serious injuries that could be prevented, economic savings

Some examples of issues and recommendations that were not identified in the iRAP assessment but which were identified in Road Safety Audit are presented in the VicRoads (2012) Review of iRAP recommendations for SCDP Corridors and are also presented in this paper.

Table 2: Priority sections for early upgrading – estimated budget costs and predicted casualty savings

Road	EuroRAP section numbers	Length (km)	Predicted killed and seriously injured saved (20 years)	Predicted casualties saved/km (20 years)	BCR	Budget USD Million
M12 Klymkivtsi-Kopystyn	32	33.5	735	22	4.5	5.3
M12 Pyrohivtsi	35	2.8	133	48	5.2	4.3
M12 Holoskiv – west of Dyakivtsi	38	40.6	541	13	5.3	17.5
M12 Dyakivtsi	39	8.8	143	16	5.0	0.9
M12 East of Vinnytsia-Voronovytsya	45-46 (dual)	16.6 (33.3)	716	43	5.6	4.1
M18 Pereval'ne-Alushta* (Estimated values)	21 (part)	16.0	250	16	5.4	4.4
Summary	--	118.3	2518	21	--	36.5

3. Assessment of the design plans

Generally this was a good development of the safety principles discussed in 2104 to prepare a comprehensive detailed design proposal.

General points made included:

- The retention of 2+1 rural layout subject to a 90 km/h general speed limit was not favoured by the consultants without a median barrier of some form. However it was recognised that this was a normally adopted Ukraine standard.
- Similarly, it is understood that the need to install median barrier or dual carriageways is determined in Ukraine regulations by the road category and speed limit. It is only when such roads are reconstructed that the potential to introduce median barrier is considered. This inconsistency needs to be addressed in the regulations.
- The use of priority junctions in this area to change the direction of 2+1 lanes was well considered. There could be more assessment of equalising the balance of overtaking in 2 lanes sections between junctions and removal of short lengths that do not support overtaking.
- The layout of priority junctions with an offset U-turn on two lane divided carriageways is a concern, particularly where the offset distance is short. Opportunities to increase the weaving length on these arrangements should be reviewed. This could also be an opportunity to introduce roundabouts for these types of junctions that would reduce the severity of potential collisions
- There needs to be consistency throughout on the application of signing of speed limits to ensure that they are easily understood and complied with.
- Within 50km/h urban area, the need for extensive vehicle and pedestrian barrier should be reviewed.
- The way in which shared cycle and pedestrian routes are signed should be consistent throughout the scheme.
- The use of all rumble strips through villages is to be omitted.

3.1 Example of the offset U-turn

The full report at <http://www.irap.org/en/about-irap-3/assessment-reports?download=281:ukraine-m12-report> provides more than 40 examples of audit recommendations. Two examples are shown below, illustrating the example of U-turns on divided carriageways and the importance of being aware of vulnerable road-user desire lines. They illustrate the level of detail in Road Safety Audit.

The drawing covers the major interchange arrangement for a side road to a 2x2 lane divided carriageway with the U-turns offset either side of the side road. Combined within this arrangement are pedestrian crossing and bus laybys. It results in a lot of different activities in a relatively short space and for the western U-turn in particular there is a very short distance for any traffic emerging from the side road to cross two lanes of fast moving traffic and the enter the deceleration lane for the U-turn. This is considered a high risk manoeuvre and is an ideal location for use of roundabouts. However, this is a standard arrangement for Ukrainian designs and conforms to regulations.

4. Improving the Star Ratings

Numerous elements of the package of rehabilitation will improve the safety rating on this section of the M12, notably for pedestrians and cyclists in the settlements along the route. It is likely that the work in villages to provide for pedestrians and cyclists will generate several good case studies and it would be important to document and photograph the before and after situations fully.

Several opportunities remain for improving the Star Rating and increasing safety on the route. The images below include general types of locations where implementation or improvements to provision would increase the Star Rating. Some are not implemented because they are either not permitted or not encouraged by existing design practice in Ukraine.

It would be worthwhile reviewing Ukraine design standards and practice and comparing them with those countries leading in road safety.

Opportunities also exist to conduct a Star Rating of the design plans once these are amended and complete. Similarly, it would be useful to conduct a post-construction assessment of the road in 2018 after the work has been completed.

4.1 Examples of how Star Ratings may be improved



Fig. 6. Opportunities for head-on crash reduction exist.



Fig. 7. Continued use of ramped-ends would provide a launch risk for vehicles.



Fig. 8. Opportunities for run-off protection – existing practice is to use clear zones rather than roadside barriers.



Fig. 9. Shoulder sealing is not current practice – vehicles leaving carriageway, over-correcting crossing to the opposing carriageway and then involved in head-on crashes may be a problem.

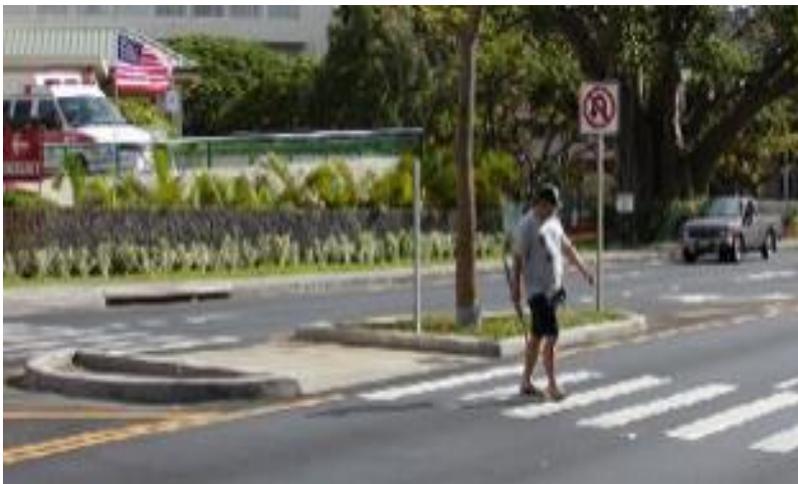


Fig. 10. Median refuges not accepted in current designs but provide protection for pedestrians in other countries.



Fig. 11. Median refuges also provide narrowing protection for turning movements and slow traffic.



Fig. 12. Changes in horizontal alignment slow traffic and can provide precedence for pedestrians.

5. Conclusions

This review of a design proposal builds on work completed in 2012-2014 in selecting a section of the M12 where there are likely to be greatest reductions in fatal and serious casualties and best Benefit:Cost Ratios.

Generally, there have been developments of the safety principles discussed in 2104 to prepare a comprehensive detailed design proposal. Detailed comments and recommendations have been provided on the design proposals.

In many parts of the route, this will result in an improved Star Rating of the safety of the route.

Some opportunities exist for increasing the Star Rating of the safety of the selected road section on both urban and rural parts of the road.

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Reference

1) VicRoads (2012) Review of iRAP recommendations for SCDP (Safe Corridor Demonstration Program) Corridors from SH 20 from Yaragatti to Belgaum, August.