Case Study

Moldova – Cross-sections and mid-block National Road M2-R7 Saratenii-Soroca-Drochia Junction

This case study focuses on the influence that elements of design may have on the Star Rating Score (SRS), the values in the scale that determine which of the Star Rating bands (1-5, with 5 the safest) a road section may achieve. SRS scores reflect risk to individual road users, the higher the score the higher the risk. The case study shows the application of Star Rating for Designs (SR4D) in this process. Its shows how SR4D may assess the safety of the road and elements of the road before construction begins.

The examples are taken from the construction and rehabilitation of the M2-R7 in Moldova (from Saratenii-Soroca-Drochia Junction, 93km) funded by the Millennium Challenge Corporation with the road assessment analysis by EuroRAP and the overall management and construction by URS and others. The location of the road and some “before and after” images from the rehabilitation are shown in Figures 1 and 2.
Case Study

Star Rating for Designs (SR4D)

Star Rating for Designs can be carried out either manually (often using a small number of 100m sections of a route), by running different scenarios in the iRAP software platform ViDA for longer road lengths, or by using the specialised iRAP SR4D app¹, enabling engineers “designers to assess the safety of a road design and improve its star rating before the road is constructed, thus saving lives and preventing serious injury from the outset”. The principles for each method are the same and are listed here within the context of work conducted for the M2-R7 in Moldova.

In this example, scenarios were modelled using different runs in ViDA. In the following sections examples are also shown of particular locations where the proposed design will increase the Star Rating.

The steps in Star Rating the design for the entire road length of the road, and deciding on what the data fields would be after rehabilitation, were as follows:

- The data set for the existing coded road was used as a baseline coding file.
- Datum – all 100m sections of the iRAP survey were related to the reference point used in the design plans, this the standard chainage used by the Moldova State Road Administration.
- Unchanged data fields – certain data fields would not change from the time of the current data set to the post-rehabilitation period. They include features such as “Area Type” and “Land use”. (If preparing a new data file, rather than working from an earlier survey file, it may be necessary to use supplementary plans.)
- Fields where assumptions of the effect of the change can be made – for example, it can be assumed that road rehabilitation will lead to improvement of some road attributes. “Delineation” and “Road Condition” would fall into this category. The existing baseline survey was therefore updated with these attributes coded as improved.
- Some fields could be completed using the tabulated lists provided by the designer – for example, the location of speed limits, barriers/guardrail and pedestrian crossings was therefore added to the update of the baseline.
- Other fields require the inspection of individual road plans or road marking plans – examples include road sections where new pedestrian footway has been installed.
- Delineation, road condition, quality of pedestrian crossing and intersection quality are all assumed to be “good” or “adequate” after safety input in the updated file.

¹ https://www.irap.org/star-rating-for-designs/

Figure 2. Example images of the M2-R7 in Moldova before and after rehabilitation and reconstruction
Results of SR4D for Entire M2-R7 Road Length

The M2-R7 analysis using SR4D showed that the rehabilitation programme would remove the 55% of roads that are currently 1-star for car occupant safety and improve them to at least 2-star, and mean that 38% of road sections after rehabilitation are 3-star or 4-star compared with 15% before rehabilitation.

Improvements for pedestrian safety on the M2-R7 mean that the overall rating of the road moves from 8% 4-star before rehabilitation to 84% 4-star on full implementation of measures.

Rehabilitation of the M2-R7 if fully implemented removes the 78% of 1-star sections for bicyclist safety, converting these at least to 2-star, and presents 17% as 3-star for cyclists.

The detail of this work is available on the iRAP website2.

Road Assessment – Cross-Section Remedies

Here, examples are provided of the effect that different cross-section designs may have on the SRS. Although these are often insufficient to change the Star Rating band (e.g. from 1-star to 2-star) of a particular 100m section, they will be sufficient to reduce the risk and therefore the SRS.

Cross section remedies

Figure 3 shows the design for one of the most common cross-sections used in the M2-R7. Following the steps described above in the section on Star Rating of Designs, the rating of the new good quality designs may be compared with the existing (baseline) road lengths using the iRAP Demonstrator. Other attributes are assumed to have been selectively improved.

Three situations have been compared:

(i) The baseline of a typical poor-quality rural M2 single-carriageway. Road condition and delineation are assumed to be poor, there is no sealed shoulder or rumble strips, roadside hazards are present within 5m and there are no facilities for pedestrians or bicyclists (other than an informal path within one metre of the carriageway)

(ii) Implementation of a rehabilitated carriageway with the cross-section shown in Figure 3 and accompanying improvement in other road features – no hazards within 5 metres, improved road condition and delineation and a footway within 1m of the carriageway

(iii) Implementation of a rehabilitated carriageway with the cross-section shown in Figure 3 with modest additions including central hatching, centre-line rumble strips, a narrow paved shoulder, paved shoulder rumble strips and a footway within 1m of the carriageway for pedestrians.

Operating speed is assumed to be 100km/h. AADT is assumed to be 8,000 vehicles per day, of which 1-5% is motorcyclists and there is minimal pedestrian and bicyclist activity along and across the road section.

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It is noticeable that the SRS and Star Rating and for all road-users improves from in option (ii) from option (i) and then again in option (iii), this showing vehicle occupants and motorcyclists having a 3-star rating and pedestrians and motorcyclists within the 2-star band. Improving the Star Rating by one star is associated on average with a halving with each star improvement in the crash costs per kilometre travelled for vehicle occupants\(^3\) and step-changes in safety benefits too for other road users.

**Conclusions**

This case study shows a method of rating the safety of road sections from design plans. It provides a means by which the safety be objectively assessed before construction begins. In this example, the value of providing protection and reducing crash likelihood is particularly clear for vehicle occupants and motorcyclists. Additional measures would be required to provide pedestrians and bicyclists with a 3-star rating.