Case Study
B-Spain
A-375 Road (CH. 7+450, Seville)

The information detailed in this Case Study was provided by DGT. The A-375 road is located in the South of Spain and connects Utrera city with the A-384 highway (near Puerto Serrano town). The road authority is “Junta de Andalucía”, which is part of the Regional Government of Andalusia (Spain).

The road has one lane in each drive direction and the speed limit is 90 km/h (rural area) for most of the road. This road has been coded (between CH. 0+000 and CH. 45+100) and centre rumble strip, used with central hatching, applied along the road.

The Annual Average Daily Traffic (AADT) in 2018 was between 3,500 and 5,400 vehicles.

Figure 1 shows the road location.

Figure 1. Location of A-375 road case study
Countermeasures Implemented

The network upgrading carried out in 2017 was a central line rumble strips used with central hatching along the road. This road improvement was a pilot project carried out by Spanish traffic management authority (DGT) in 2017. The central rumble strips are 20 cm wide and 1.2 cm deep. This measure was used to reduce head-on collisions and run-off-road crashes (if in the latter case it is implemented on road shoulders) with a low budget, around 9,000 €/km.

Before the network upgrading the road had been having a large number of severe crashes.

Figures 2 and 3 show the road central lining before and after network upgrading in the CH. 7+450.

![Figure 2. A-375 CH. 7+450 (2014)](image1.png)

![Figure 3. A-375 CH. 7+450 (2019)](image2.png)

Figures 4 and 5 show detail of the central rumble strips and hatching after implementation.

![Figure 4. A-375 central rumble strip detail](image3.png)

![Figure 5. A-375 central rumble strip detail](image4.png)

Road Assessment

The risk and safety on the road had been analysed for a single 100m frame (CH. 7+450) and for the entire road section.

**Single frame**

The case study has been analysed by Star Rating Score (SRS) before and after network upgrading, and by assessing the crash history over the an 11-year period. (The SRS is the raw score that combines the individual risk components in the iRAP model and is then used in setting band thresholds when allocating stars in the Star Rating – the higher the SRS the higher the risk.)

The situation in 2008 year (before network upgrading) is compared with the present time.

Before the network upgrading, the Star Rating Score was 8.03 for vehicle occupants, 16.05 for motorcycles, and not applicable for pedestrians and bicyclists. The Star Rating was 3 stars for vehicle occupant and 2 stars for motorcycles.
After the network upgrading, the Star Rating Score was 7.31 for vehicle occupants, 15.34 for motorcycles, and was not assessed for pedestrians and bicyclists. So, from network upgrading to the present time, the Star Rating for vehicle occupants is unchanged at 3 stars and for motorcycles is 2 stars although there is a small reduction in risk as measured by the SRS.

Entire road section

A Star Rating Score has also been provided along the entire length of the road to show the road safety improvements in a single section and in the whole road. Crash data have also been assessed.

Figures 8 and 9 and Tables 1 and 2 show the Star Rating for the entire road section before and after network upgrading.

The Star Rating length results are shown below for the period before network upgrading and for each type of user, expressed in km and percentage of total length.

As can be seen in Table 1, the percentage of the total road length, for vehicle occupants is: 0.00 % for 5 and 4 stars, 38.22 % for 3 stars, 55.41 % for 2 stars and 6.37 % for 1 star.
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Figure 9 shows the Star Rating of the entire road section, after network upgrading. Here, the Star Rating results are shown after network upgrading, for each type of user, expressed in km and percentage of total length.

Table 1 lists the percentage of the total road length, for vehicle occupants: 0.00% for 5, 4 and 1 stars, 38.22% for 3 stars and 67.78% for 2 stars.

<table>
<thead>
<tr>
<th>Star Ratings</th>
<th>Vehicle Occupant</th>
<th>Motorcyclist</th>
<th>Pedestrian</th>
<th>Bicyclist</th>
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<tr>
<td></td>
<td>Length (km)</td>
<td>Percent</td>
<td>Length (km)</td>
<td>Percent</td>
</tr>
<tr>
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<tr>
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<td>6.00</td>
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<tr>
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<td>0.00%</td>
<td>6.00</td>
<td>12.74%</td>
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<td>100.00%</td>
<td>47.10</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Crash Data

Crash injury data (Figure 10) showing casualty severity (fatality, serious and slight) have been assessed for the years 2009-2019 for the entire road section. Both run-off and overtaking crashes are common. Figure 10 suggests that there may have been some traffic disruption during the period of the works in 2017 leading to a reduction in injuries. In the 2-year after period the average number of crashes is lower than the average in the eight years prior.

The main goal of the centerline rumble strip countermeasure is to alert drivers when they drift from their lane. Therefore, this kind of rumble strip helps to prevent head-on collisions and run-off driver side crashes.

The following chart shows the head on and run-off driver side crashes between 2009 and 2019.

The trend of the head-on and run-off driver side has been decreasing over the period of investigation. It is clear that the trend was decreasing before 2017, the year of implementation, but the total number of head-on and run-off driver side collision still follows a continuous downward trend since the rumble strips were provided. On and run-off driver side collision still follows a continuous downward trend since the rumble strips were provided.
Conclusion

The iRAP model shows a slight decrease in the risk for car occupants and motorcyclists as shown by the Star Rating Score after implementation of rumble strips.

After installation in 2017 of central line rumble strips used with central hatching there has been a reduction in total injuries, but the number of fatal and serious injuries is little changed. The risk of crashes remains high, probably because the most common type of crashes continues to be overtaking crashes.

Run-off crashes show a decreasing trend over recent the period of investigation. Therefore, the central rumble strip countermeasure are considered to play a part maintaining the downward trend in both the number of head on and run off driver side crashes.

Further work would be required to assess what other countermeasures would be necessary to reduce the injury toll further and a more complete picture of the crash pattern could be developed by using additional analysis of different crash types before and after implementation and by using a control group of road sections.