The information detailed in this case study has been provided by RSI ‘Panos Mylonas’. National Road 51 is also part of the European Network (E-85) and is the road connecting Egnatia Odos (E-90) with Bulgaria, at the north-eastern side of Greece.

Figure 1. Location of NR 51 within Greece
The road section Mandra-Didymoteicho-Orestiada, part of National Road 51 and E-85, has a length of approx. 39km. It is a single carriageway road, with wide traffic lanes and a hard shoulder.

The terrain is flat and the surrounding land use is agriculture.

In the picture right (1), a typical segment is shown.

Problem Definition

In 2014 alone, 3 fatal crashes (2 head-on collisions) occurred on this road section, 2 with serious injuries and 9 with minor injuries. In total, 3 people were killed, 2 were seriously injured and 9 sustained slight injuries.

In the picture right (2), the basic safety problem (unsafe overtaking) is evident.

Risk Assessment

The iRAP Star Rating survey (2014) classified the whole length of the specific road section as in the highest risk category (1 star).

The safety risk score for vehicle occupants, motorcyclists, pedestrians and bicyclists are shown in Table 1.
The following chart (right) shows the risk worm, obtained for vehicle occupants, before any infrastructure upgrade or countermeasure implementation.

**Treatment Potential**

The infrastructure needs to be upgraded with many interventions and countermeasures to address the many safety hazards.

The single most important countermeasure to counter head-on crashes would be the installation of 2+1 barrier. Due to the available width of the carriageway and the surrounding land use, the cross section transformation to 2+1 is considered the most cost effective countermeasure.

In order to evaluate the effectiveness of the single carriageway conversion into a 2+1 road, the Star Rating protocol was utilized.

The map image below (Figure 3) illustrates the anticipated risk rating after implementation of only a 2+1 median barrier transformation in the carriageway.

The following chart shows the raw risk worm, obtained for vehicle occupants, after the implementation of 2+1 with safety barrier countermeasure.

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**Table 2. Star rating score length per user category (after)**

<table>
<thead>
<tr>
<th>User Category</th>
<th>Star Rating Score Length</th>
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**Figure 3. Star Rating for vehicle occupants (after)**

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**Chart 1. SRS for vehicle occupants (before)**

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**Chart 2. SRS for vehicle occupants (after)**
Results

The iRAP Star Rating protocol is a valuable tool for testing the potential effectiveness of any countermeasure before it is actually planned and implemented.

Figure 4 shows the part of the route where the greatest numbers of fatal and serious injuries would be saved over the next 20 years over the whole length of the identified road section of National Road 51 if only the 2+1 with barrier countermeasure were applied. The percentages show the potential percentage reductions in fatal and serious crashes for the individual sections.

Conclusions

This Case Study describes the potential benefits of the implementation of 2 + 1 road with barrier over a road segment where head-on road crashes occur and the surrounding land is available to implement the carriageway transformation without difficulty.