Improvements of vehicle crash compatibility through the development of crash test procedures (S0214/VE & S0215/VF)

Funding: National (United Kingdom)
Duration: Mar 2003 - Feb 2007
Status: Complete with results

Background & policy context:

Traffic-related accidents are still a major threat to life in the European Union. In 2004 there were 32,951 traffic accident deaths and 251,203 seriously injured casualties in the 15 member states of the EU, out of a population of 377,942,000. Of these road fatalities, 54% were car drivers or passengers, so there remains much potential benefit for improving car occupant safety. Following the introduction of EuroNCAP and the European Frontal and Side Impact Directives, it is widely recognised that improved vehicle crash compatibility offers the next greatest potential benefit for improving car occupant safety.

Moreover the European Commission has set a target for traffic fatalities to be reduced by 50% by 2010 (compared to 2000) and improving passenger car compatibility could be one major step towards that aim.

Objectives:

The ultimate aim of the project is to develop crash test procedures, which once implemented in regulatory and/or consumer testing will lead to reduction in the casualties in car to car and car to heavy truck impacts. The specific objectives are:

For car to car impact:
- to develop a set of test procedures with associated performance criteria to assess a car’s compatibility in frontal impacts;
- to perform an associated cost benefit analysis.

For car to truck impact:
- to develop test procedure(s) with associated performance criteria to assess energy absorbing front underrun protection systems for trucks;
- to provide guidelines for improvement of existing legislation on truck rear underrun protection;
- to perform associated cost benefit analyses.

Methodology:

Crash tests and analysis.

Parent Programmes:
DfT International Vehicle Standards - Department for Transport - Transport Technology and Standards

Institute type: Public institution
Institute name: Department for Transport
Funding type: Public (national/regional/local)

Partners:
- TRL: TRL Limited [UK]
The costs and benefits for improved frontal impact car to car compatibility for Europe (EU15) were estimated. The casualty benefit that could be realised with improved frontal impact compatibility performance was estimated for Great Britain and Germany, by TRL and BASt respectively. As a definite set of test procedures to assess a car’s compatibility has not yet been defined, the study was undertaken based on the assumptions of how a compatible car would perform, which are described previously in this report. The GB and German benefit estimates were then scaled to give the benefit for the EU15 countries. The cost of improved compatibility was estimated by Fiat, based on the costs required to modify a current car to meet assumed compatibility requirements. Using this information, the cost benefit ratio was calculated for Europe (EU15).

The benefit of improved compatibility for EU15 was estimated to be between 721 and 1 332 lives saved and between 5 128 and 15 383 seriously injured casualties mitigated per year. Please note that in 2004 there were approximately 33 000 fatalities on the road in the EU15 of which approximately 54% were car occupants. There are a number of limitations to the benefit estimates, the main one being that the possible benefit of improved frontal impact compatibility for side impacts has not been considered.

The cost benefit ratio, defined as value of benefit divided by cost of implementation, was predicted to be between about 4.5 and 0.5. It should be noted that this cost benefit has been calculated for the steady state, when the entire vehicle fleet is compatible. The benefit will be less during the initial years as compatible cars are introduced into the fleet.

An additional significant finding of the GB work was the high frequency of moderate (AIS2) and life threatening (AIS 3+) injuries sustained by car occupants due to seat belt induced loading. The majority of thoracic injury was not prevented by the injury reduction models. There is an argument that a more compatible vehicle would benefit from an improved crash pulse and therefore it would be expected to see lower seat belt loads and a reduced risk of thoracic injury. The models, by their design, did not prevent injury attributed to seat belt loading, and therefore underestimate the potential benefit that could be seen for this body region. This is important to note, as head and thoracic injury are known to be associated with fatal outcomes.

Technical Implications

This section outlines the recommended work needed to reach the position to make a proposal for a set of test procedures suitable to implement a first step to improve compatibility in regulation and/or consumer testing.

Further definition of compatibility requirements:

- finalise the test severity (EES) for regulation test;
- finalise assessment criteria for regulation test;
- finalise objective assessment procedures to analyse results of car to car tests with respect to:
  1. good structural interaction
2. good compartment strength
3. compatible car
   - finalise a compatibility scale for a rating system.

Further development of test approaches to the point where a decision on the most appropriate set of test procedures can be made:

- for the FWDB test major work items are:
  1. confirm test repeatability / reproducibility
  2. refinement of performance criteria (VSI/HSI)
- for the PDB test major work items are:
  1. confirm that PDB test increases the self protection level of light cars while maintaining self protection level of heavy cars.
  2. continue the development of assessment parameters.
  3. propose and validate assessment criteria when fundamental questions have been answered
  4. propose performance limits when fundamental questions have been answered
  5. confirm test repeatability / reproducibility
- additional accident analysis to answer remaining questions

The GB benefit analysis model predicted that even with improved compatibility thorax injury will still be a substantial problem. Further work is needed to confirm this preliminary conclusion, establish why it is the case (if it is) and propose measures to reduce it. This is an important issue because a possible explanation could be that the injury mechanism in car frontal impacts is no longer predominantly related to compartment intrusion, which is the primary issue that the FWDB and PDB procedures have been designed to address. Hence, it is recommended that this work is performed as soon as possible, in parallel with, or before further development of the test procedures.

Structural width has been shown to have a large influence on a vehicle's performance in car to car tests. However, its relevant in real-world accidents is not known, so a decision whether or not tests should assess it cannot be made. Hence, additional accident analysis

Documents:
- VC Compat Final Technical Report (English)

STRIA Roadmaps: Other specified
Transport mode: Road transport
Transport sectors: Passenger transport, Freight transport
Transport policies: Safety/Security
Geo-spatial type: Network corridors