MIDAS includes the descriptions of models in use by the Commission in support to the policy cycle. MIDAS is developed and managed by the **Competence Centre on Modelling** of the European Commission.

Find out more at https://ec.europa.eu/knowledge4policy/modelling_en
Contact: EU-MIDAS@ec.europa.eu

Factsheet

SWD/2018/190 final

Impact assessment accompanying the document Proposal for a Regulation of the European Parliament and of the Council on: type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users, amending Regulation (EU) 2018/ … and repealing Regulations (EC) No 78/2009, (EC) No 79/2009 and (EC) No 661/2009

Supporting model(s)

VeSTEM

Impact assessment
SWD/2018/190 final

Fact sheet on model contributions

Source: Commission modelling inventory and knowledge management system (MIDAS)

Date of Report Generation: 13/10/2020

Overview

Title
Impact assessment accompanying the document Proposal for a Regulation of the European Parliament and of the Council on: type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users, amending Regulation (EU) 2018/ … and repealing Regulations (EC) No 78/2009, (EC) No 79/2009 and (EC) No 661/2009

Document ID
SWD/2018/190 final

Year of publication
2018

Led by
GROW

Model(s) used
VeSTEM

Additional information on model use for this Impact assessment

The Baseline scenario builds on the EU reference scenario 2016 Energy, transport and GHG emissions : trends to 2050, Luxembourg: Publications Office of the European Union, 2016, doi:10.2833/9127, but additionally includes few policy measures adopted after its cut-off date (end of 2014) and some updates in the technology costs assumptions. The PRIMES-TREMOVE model (see related entry) has been used together with the TRL model VeSTEM to define the Baseline scenario.

VeSTEM was used to determine the cost-effectiveness of three policy options involving the mandatory EU-wide implementation of different sets of vehicle safety measures for new passenger cars, vans, buses, coaches and trucks. The modelled benefits (monetary values of casualties prevented or mitigated by safety measures) and costs (cost to vehicle manufacturers of fitment of safety measures to new vehicles) were compared with a baseline scenario (no action), where voluntary technology uptake continues.

VeSTEM

Full title

Vehicle Safety Technology Effectiveness Model

Run for this impact assessment by

TRL Limited

Contributed to

Baseline and assessment of policy options

Helped to assess the following impacts

Impact area	*Impact category*	*Impact subcategory*
Economic impacts	Public authorities	Governmental administrative burden
Economic impacts	Consumers and households	Prices, quality, availability or choice of consumer goods and services
Economic impacts	Consumers and households	Safety or sustainability of consumer goods and services
Economic impacts	Consumers and households	Impact on vulnerable consumers
Economic impacts	Specific regions or sectors	Significant effects on sectors
Social	Public health and safety and health systems	Health and safety of individuals/populations

Vehicle Safety Technology Effectiveness Model

Fact sheet

Source: Commission modelling inventory and knowledge management system (MIDAS)

Date of Report Generation: 13/10/2020

Overview

Acronym VeSTEM
Full title Vehicle Safety Technology Effectiveness Model

Main purpose
The VeSTEM model allows predicting casualty savings and costs arising from the simultaneous implementation of multiple vehicle safety systems and their interactions in preventing and mitigating of collisions. Model outputs allow evaluating the cost-effectiveness and casualty prevention potential of different sets of systems for the assessment of policy impacts.

Summary
VeSTEM has been developed by TRL within the context of the revision of the General Safety Regulation and Pedestrian Safety Regulation. The model determines the cost-effectiveness of different sets of safety measures to be implemented on a mandatory basis. The combined effect of a set of safety systems may be smaller than the sum of individually predicted effects because the target populations for different systems are partially overlapping but each casualty can only be prevented once. The model allows to arrange systems into a layer structure to avoid such overestimation of benefits.

The modelled benefits (monetary values of casualties prevented or mitigated by safety measures) and costs (cost to vehicle manufacturers of fitment of safety measures to new vehicles) are compared with a baseline scenario, where none of the policy options are implemented on a mandatory basis, but voluntary uptake of safety measures continues.

Six vehicle categories (M1, M2, M3, N1, N2 and N3) are considered across a geographical scope of the entire European Union (28 Member States). The evaluation period covers 16 years to allow for a full cycle of fleet benefits to be captured.

Keywords
Transport , costs and benefits , safety measures , road collisions

Model category (thematic)
Transport

Model home page
https://publications.europa.eu/en/publication-detail/-/publication/ed4aff17-49c5-11e8-be1d-01aa75ed71a1/language-en

Ownership & license

Ownership
Sole copyright [3rd party]

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Licence type
Non-Free Software licence. The license has one or more of the following restrictions: it prohibits creation of derivative works; it prohibits commercial use; it obliges to share the licensed or derivative works on the same conditions.

Details

VeSTEM structure and approach

VeSTEM is a model to estimate the benefits (monetary values of casualties prevented by safety measures) and costs (cost to vehicle manufacturers of fitment of safety measures to new vehicles) associated with policy measures assessed in the context of the revision of the General Safety Regulation and Pedestrian Safety Regulation. The model is implemented in the programming language Python (https://www.python.org/) with inputs and outputs produced in Microsoft Excel spreadsheets.

The model considers as benefits the monetary values of casualties prevented by safety measures, and as costs the cost to vehicle manufacturers of fitment of safety measures to new vehicles. Results are benefit-to-cost ratios (BCRs), based on present monetary values and casualties prevented, compared to the baseline scenario over the entire evaluation period.

A vehicle fleet calculation module determines how the vehicle safety measures disperse into the fleet. The module determines the effect of mandating a measure for all new types, and two years later for all new registered vehicles, on the overall proportion of the fleet equipped. Benefits conferred by a safety measure, that is, casualties prevented, will only be realised by equipped vehicles. However, the legacy fleet will also be affected by active safety measures; for example, if a rear-end shunt is avoided by advanced emergency braking for driving and still-standing vehicles ahead, the vehicle in front, will benefit from the measure even if it is a legacy vehicle. This is taken into account in the benefit calculations.

To simulate the casualties prevented by each measure, an accident data analysis was performed based on Great Britain national road accident data (Stats19) to determine the casualty target population for each proposed measure (input data), i.e. the number of fatal, serious and slight injuries that could potentially be affected by a safety measure based on relevant characteristics of the collision (e.g., collision geometry or contributory factors). The target populations were scaled to EU28 level using weighting factors, based on severity and vehicle categories involved, derived from analysis of the pan-European CARE database. The target populations found are multiplied with effectiveness values for each safety measure (input data), i.e. a percentage value indicating what proportion of the relevant accidents will be avoided or mitigated by the measure. Mitigated casualties (fatal turned to serious casualty, or serious to slight casualty) are added to the target population of the next lower injury severity level for other measures. The casualties prevented are multiplied with monetary values for casualty prevention to calculate the monetary benefit.

The model also addresses the interaction of different safety measures on overlapping casualty groups. To give an example, there are collisions where a driver was exceeding the speed limit, left the lane and suffered a frontal impact. These collisions will be in the target populations for multiple measures, but they can only be prevented once by either one of these systems. This is addressed in the model by removing casualties prevented by one measure from the subsequent target population

of the other measures. The impact of highly effective existing safety measures, which have been mandatory for a few years, but are still dispersing into the vehicle fleet is also modelled to reduce the remaining target populations for the proposed measures.

The cost of a policy option is calculated by multiplying per-vehicle cost estimates (input data) for each measure with the number of new vehicles of each vehicle category across EU28 that are equipped with the measure in the given year of the analysis according to the output of the fleet calculation model. In the economic calculation module, the monetary values of costs and benefits are subjected to inflation and discounting to determine their present value. The present values of benefits and costs exceeding the baseline, calculated for individual years and summed over the study period, are compared in order to arrive at cost-effectiveness estimates.

Input and parametrization
Benefits considered:

- monetary values of casualties prevented by safety measures

Costs considered:

- cost to vehicle manufacturers of fitment of safety measures to new vehicles

Main output
Results:

- Number of fatal, serious and slight casualties prevented
- Benefit-to-cost ratios (BCRs), based on present monetary values and casualties prevented, compared to the baseline scenario over the entire evaluation period.

Spatial - temporal extent
The output has the following spatial-temporal resolution and extent:

Parameter	Description
Spatial Extent / Country Coverage	EU-28
(Spatial) resolution	Combined output for entire EU-28
Temporal extent	2021-2037
Temporal resolution	Year

Quality & transparency

Quality

Question	Answer	Details
Models are by definition affected by uncertainties (in input data, input parameters, scenario definitions, etc.). Have the model uncertainties been quantified? Are uncertainties accounted for in your simulations?	yes	Input parameters having a relatively high associated uncertainty were identified and given upper and lower bounds of variation. These were used to calculate variation in the BCR (from absolute lower BCR to absolute upper BCR).
Sensitivity analysis helps identifying the uncertain inputs mostly responsible for the uncertainty in the model responses. Has the model undergone sensitivity analysis?	yes	Two sensitivity analysis techniques were used: An interval and a scenario analysis were carried out to quantify the range of uncertainty around the best estimate BCR values.
Has the model undergone external peer review by a panel of experts, or have results been published in peer-reviewed journals?	no	
Has model validation been done? Have model predictions been confronted with observed data (ex-post)?	yes	The model has been verified during the course of implementation using dummy inputs and verifying the individual calculation steps data, but the model has not been validated ex-post.

References related to external peer-review and publication in scientific journals:

- No references provided in MIDAS

Transparency

Question	Answer	Details
Is the model underlying database (i.e. the database the model runs are based on) publicly available?	yes	Collision databases used to create input data for the model (STATS19 and CARE) can be accessed at request to the database owner. Other input data was collected from literature and stakeholders and is provided in the project report (see References).
Can model outputs be made publicly available?	yes	Model results were made publicly available in the project report (see References).
Is the model transparently documented (including underlying data, assumptions and equations, architecture, results) and are these documents available to the general public?	yes	General model structure, input data and results are documented in a project report (see below).
Is the model source code publicly accessible or open for inspection?	no	

References related to documentation:

- Cost-effectiveness analysis of policy options for the mandatory implementation of different sets of vehicle safety measures : review of the General Safety and Pedestrian Safety Regulations : technical annex to GSR2 report SI2.733025 : final report. - 10.2873/304129

The model's policy relevance and intended role in the policy cycle

The model is designed to contribute to the following policy areas

- Transport

The model is designed to contribute to the following phases of the policy cycle

- Formulation

The model's potential

VeSTEM can be used to model the future dispersion of vehicle safety systems into the EU fleet and quantify the EU-wide number of casualties prevented by voluntary or mandatory implementation of the systems. The model also allows to monetise the casualty savings (benefits) and calculate fitment costs associated with the systems (cost) and perform cost-effectiveness calculations for policy options including different sets of safety measures.

Previous use of the model in ex-ante impact assessments of the European Commission

Use of the model in ex-ante impact assessments since July 2017.

In the Year	VeSTEM contributed to the Impact assessment called	Led by	By providing input to the	The model was run by	Details of the contribution
2018	Impact assessment accompanying the document Proposal for a Regulation of the European Parliament and of the Council on: type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users, amending Regulation (EU) 2018/ … and repealing Regulations (EC) No 78/2009, (EC) No 79/2009 and (EC) No 661/2009 SWD/2018/190 final	GROW	Baseline and assessment of policy options	*TRL Limited*	The model helped to assess the following impacts: - Governmental administrative burden - Prices, quality, availability or choice of consumer goods and services - Safety or sustainability of consumer goods and services - Impact on vulnerable consumers - Significant effects on sectors - Health and safety of individuals/populations

Bibliographic references

- *Cost-effectiveness analysis of policy options for the mandatory implementation of different sets of vehicle safety measures : review of the General Safety and Pedestrian Safety Regulations : technical annex to GSR2 report SI2.733025 : final report. - 10.2873/304129*