

The SafetyCube DSS is the European Road Safety Decision Support System, which has been produced within the European research project SafetyCube, funded within the Horizons 2020 Programme of the European Commission, aiming to support evidence-based policy making. The SafetyCube Decision Support System provides detailed interactive information on a large list of road accident risk factors and related road safety countermeasures. A Quick Guide on using the SafetyCube DSS, with instructions on how to browse the system, make a search and further refine the results, is available for download [here](#).



**SafetyCube (Safety CaUsation, Benefits and Efficiency)** is a research project funded by the European Commission under the Horizons 2020, the EU Framework Programme for Research and Innovation, in the domain of Road Safety. The project started on May 1st, 2015 and will run for a period of three years.

The primary objective of the SafetyCube project is to develop an innovative road safety **Decision Support System (DSS)** that will enable policy-makers and stakeholders to select and implement the most appropriate strategies, measures and cost-effective approaches to reduce casualties of all road user types and all severities in Europe and worldwide.

### Funding Reference:



SafetyCube is a project financed by the European Commission: Innovation and Networks Executive Agency (INEA).

### Disclaimer

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# The SafetyCube Road Safety Decision Support System

## A Quick Guide to Search for Risk Factors & Measures



## Introduction

SafetyCube (Safety CaUsation, Benefits and Efficiency) was a European Commission supported Horizon 2020 research project (2015-18) with the objective of developing an innovative road safety Decision Support System (DSS) for a wide range of users – from practitioners to decision makers.

## What is the SafetyCube DSS?

The SafetyCube Decision Support System (DSS) is the first global system with knowledge of both road safety risks and measures. It brings together European and international evidence on what causes crashes and injuries on our roads – and what are the interventions that have shown to effectively mitigate these threats. Furthermore, it suggests links between those risk factors and the respective countermeasures.

## What is new about it?

Most available systems and repositories so far are compilations of interventions and their impacts on crashes. The DSS, for the first time in the history of road safety work,

- holds comprehensive and interlinked information both on **crash risks and measures** so that users are directed from problems to solutions on a user-friendly graphical interface
- locates both risks and measures in complex **taxonomies**, mapping the whole road safety domain, across the fields of human behaviour, infrastructure, vehicles, post impact care, and – with a special focus – the issue of serious injuries
- makes sure that users with various backgrounds can benefit from the vast knowledge contained in the system by casting scientific evidence on every risk and every measure (or groups thereof) into comprehensive **synopses**, i.e. text documents with:
  - Summary, including colour code (ranking the riskiness of a problem or the effectiveness of a measure), abstract, and review of the scientific evidence
  - Scientific overview: a detailed description of study results
  - Supporting document: literature search & list of relevant studies
- provides summaries & links of all **available studies** on dedicated results pages

## Where is the evidence from?

The SafetyCube partners have been querying all commonly available scientific literature databases such as Scopus, TRID, Google Scholar, Science Direct, Taylor & Francis Online, and Springer Link. In addition, national literature and evidence from In-depth crash databases such as GIDAS have been exploited.

## Step 1: How to dispatch a query? The Search Page

You can find the SafetyCube DSS at the following link: <https://www.roadsafety-dss.eu>

The SafetyCube DSS provides you with **five** alternative options for a tailor-made access to the vast amount of knowledge - we call them **entry points**:

- **Keyword search**: search for your topic by entering a keyword (free text)
- **Risk factors**: search for a crash risk factor through the SafetyCube taxonomy
- **Measures**: search for a road safety intervention through the SafetyCube taxonomy
- **Road user groups**: search for crash risk factors or interventions for a specific road user group
- **Accident scenarios**: search for crash risk factors or interventions for a specific accident scenario

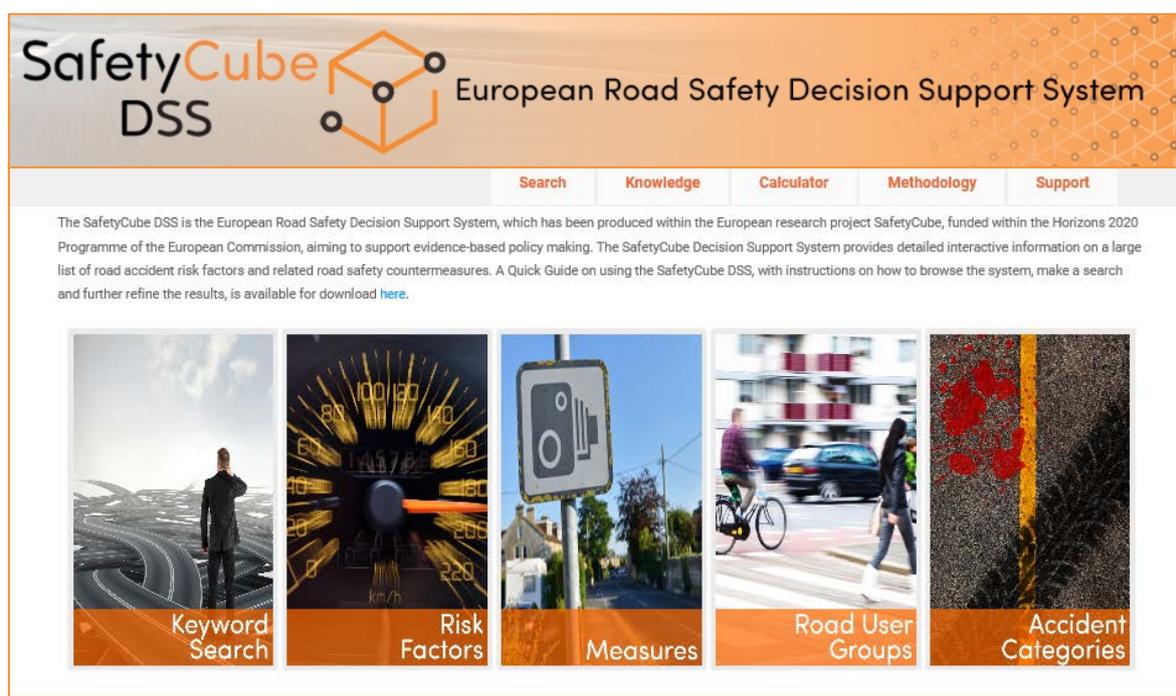


Figure 1: The Query Page

Upon selecting one of the entry points, the system will provide you with different options to specify your query. Figure 2 gives an overview on the different screens the system will bring forward – depending on your choice – together with examples of further results from the system (Results Pages, Synopses, Individual Study Pages).

# The Search (Home) Page



Figure 2: Overview of the DSS's query / search pages, Results Pages, Synopses, and Individual Study Pages.

## OPTION 1: KEYWORD SEARCH

Upon selecting “Keyword Search” the system lets you type in a keyword in free text and – as you type – will show you all potential matches in the database (see left part of Figure 3). Once a keyword is entered (or selected from the dynamic pop-up list), the system will respond with adequate subsets of risk *and* measure taxonomies for further selection (see right part of Figure 3). Selecting one of the two taxonomies’ entries (risk factors or measures) will take you further to the respective results page (see next main chapter on Results Page hereunder).

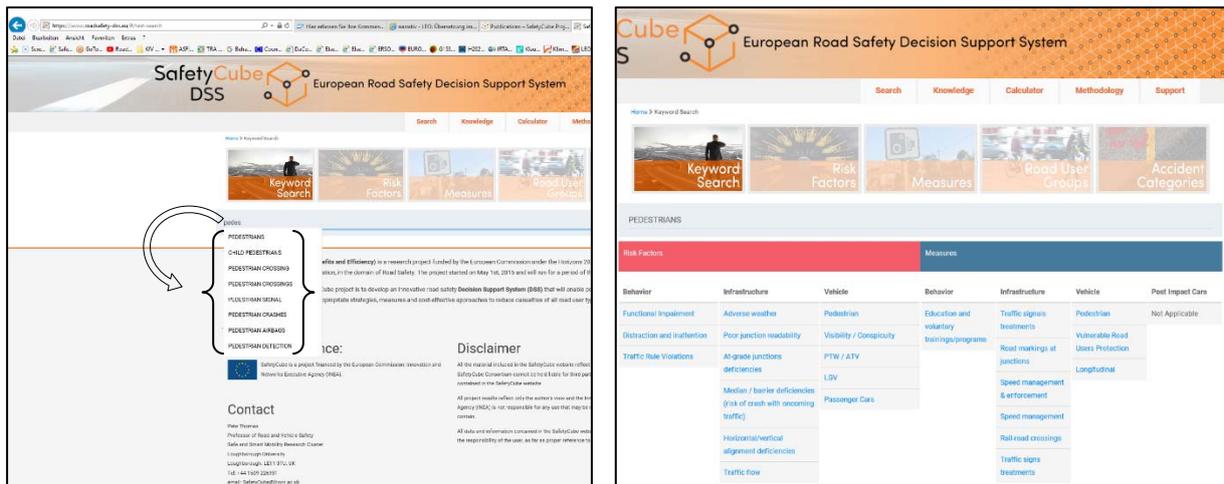


Figure 3: Left: An example for Keyword Search. Already as the word “pedestrians” was only partly typed in (“pedes”), the system suggested various potential matches in the database; “PEDESTRIANS” was then selected from the list of suggestions. Right: adequate subsets of risk and measure taxonomies for further selection

## OPTIONS 2 AND 3: QUERYING RISK FACTORS AND MEASURES

When “Risk Factors” is selected as entry point, the SafetyCube taxonomy of crash risks will open, sorted by the domains “Behaviour”, “Infrastructure” and “Vehicle” (see Figure 4). Likewise, if the entry point “Road Safety Measures” were selected, the SafetyCube taxonomy of measures would appear (see Figure 5).



Figure 4: Risk Factors Search example: the SafetyCube taxonomy of crash risks on the DSS, with the three available pillars of “Behaviour”, “Infrastructure” and “Vehicle”.



Figure 5: Measures Search example: the SafetyCube taxonomy of road safety measures on the DSS, with the previous three pillars plus "Post Impact Care".

Selecting one of the taxonomy's entries will take you further to the respective results page (see next main chapter on Results Pages hereunder).

#### OPTION 4: QUERYING ROAD USER GROUPS

If you want to inquire about crash risks or countermeasures specifically related to a road user group, you may want to enter via the road user groups query (see Figure 6 **Error! Reference source not found.**). As for keyword search (above), the system will respond with adequate subsets of risk *and* measure taxonomies – in relation to that road user group – for further selection. Selecting one of the two taxonomies' entries will take you further to the respective results page (see next main chapter on Results Pages hereunder).

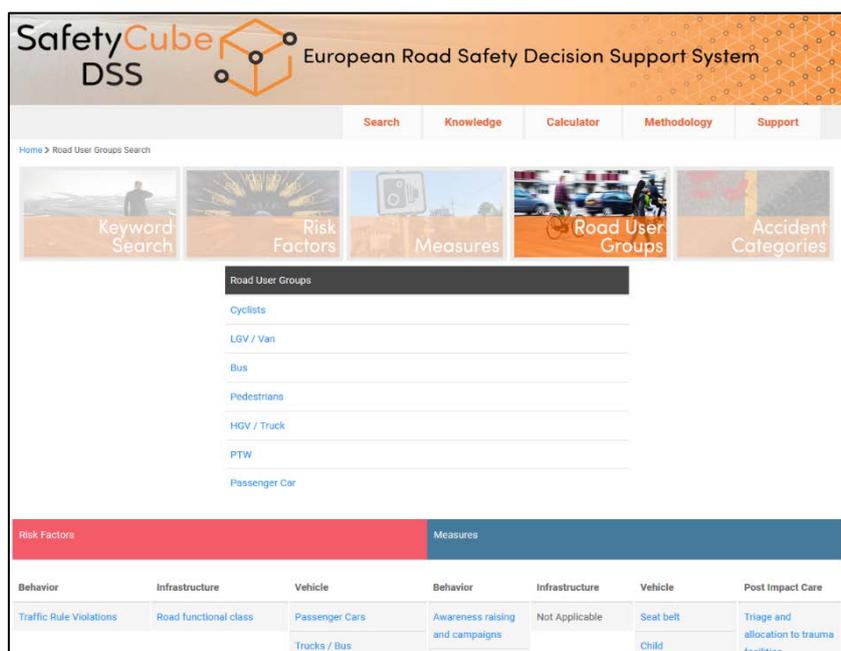


Figure 6: Road User Group Search example: By choosing 'pedestrian' from the list, the system responds with SafetyCube taxonomies on risk factors & measures specific to pedestrians.

## OPTION 5: SEARCHING FOR ACCIDENT CATEGORIES

The final search option consists of searching for Accident Categories, as shown in Figure 7. This is somewhat similar to the previous option, in that it constitutes a shortcut for crash risks or road safety measures pertinent to a specific accident category. The system will then respond with adequate subsets of risk and measure taxonomies – in relation to that accident category – for further selection. Selecting one of the two taxonomies' entries will take the user further to the respective results page.

Risk Factors			Measures			
Behavior	Infrastructure	Vehicle	Behavior	Infrastructure	Vehicle	Post Impact Care
Speeding	rain	Visibility, Conspicuity & Blind Spot Issue	Distraction	high risk sites identification	Airbag protection (Roof, curtains...)	Not Applicable
Inappropriate speed	frost and snow	Risk of injury in Rollover	Speeding	road safety audits implementation	Alcohol Interlock (ALC)	
Sensation Seeking	wind		Seat belt	road safety inspections implementation	Frontal airbag	
Drunk driving or drunk riding (cyclists/mopeds)	inadequate friction		Young offenders, drivers		Drowsiness and Distraction	
Not enough sleep	uneven surface		Young/novice			
	poor visibility - darkness					

Figure 7: Road User Group Search example: By choosing 'pedestrian' from the list, the system responds with SafetyCube taxonomies on risk factors & measures specific to pedestrians.

## Step 3: The Results Page

Upon selecting an entry on one of the above lists (*risk factors* or *measures*), the main results page will appear (see example for risk factor "Work zones" hereunder, Figure 8)<sup>1</sup>.

The results consist of

- Short **introductory texts** and the **colour code(s)** from the analyses of one or more available SafetyCube synopses, describing the risks or the effectiveness of measures
- Links to one or more available SafetyCube **synopses** on the issue (pdf link button(s) next to the colour code)

<sup>1</sup> The following examples were extracted from the DSS in March 2018. When you query the system yourself, results may have different appearance and/or content, as the DSS constantly develops further, new studies are being added and improvements following the SafetyCube quality assurance processes are implemented.

- A table listing the **available meta-analyses and other coded studies** in the SafetyCube database together with their main characteristics such as title and source, design, country, and year of publication.
- Selecting a study from the table will lead the user to the individual **study page**.
- Depending on the selected domain, **adaptive search filters** are available on the left side of the results page. Filters include: keyword, specific risk factor (corresponding to the most detailed taxonomy level), road user group, road type, country. The keyword filter appears only when entering from the “keyword” or “road user group” entry point, and allows the user to “un-filter” the results and obtain all the studies related to the risk factor or measure (and not only those related to the keyword or road user group).
- A button which links to **related measures** (if the results page is in the risks domain) or to **related risk factors** (if the results page is in the measures domain).

The screenshot displays the SafetyCube DSS interface. The header includes the logo and the text 'European Road Safety Decision Support System'. Below the header is a navigation bar with links for Search, Knowledge, Calculator, Methodology, and Support. The main content area is titled 'Search Results' and shows a list of search results for the keyword 'WORK ZONES'. The results are filtered by 'Specific Risk Factor' (small workzone length, high workzone duration, insufficient signage), 'Road User Group' (ALL, BUS, CAR, HDV, LDV, PTW), 'Road Type' (ALL, MOTORWAY), and 'Countries' (UNITED STATES). Two results are shown: 'Presence of workzones-Workzone length' (RED /RISKY) and 'Presence of workzones-Workzone duration' (YELLOW /PROBABLY RISKY). A 'RELATED MEASURES' button is visible, along with a note: 'Select a specific risk factor from the filter on the left, to obtain results on related measures'. Below the results is a table with 6 studies.

ID	Title	Source	Year	Design	Countries
198	Analysis of driver injury severity in single-vehicle work zone crashes	13TH WCTR, JULY 15-18, 2013 - RIO DE JANEIRO, BRAZIL	2013	OBSERVATIONAL	UNITED STATES
319	Development of crash-severity-index models for the measurement of work zone risk levels	ACCIDENT ANALYSIS AND PREVENTION 40, 1724-1731	2008	OBSERVATIONAL	UNITED STATES

Figure 8: The Results Page of risk factor “work zones”

## RELATED RISK FACTORS / MEASURES

With regards to the related risk factors / measures function, considerable and systematic effort has been made for the appropriate linking of risk factors and road safety measures. This feature is important to assist DSS users in:

- (a) learning which risks can be remedied by which types of measures and
- (b) learning which types of risks will be reduced by a particular measure.

The "related risk factors / measures" button is activated only once a "Specific Risk Factor" or a "Specific Measure" is selected from the adaptive search filters on the Results Page on the left. Selecting one related risk factor / measure from the list will cause a table listing the available synopses and studies in the SafetyCube database for the related risk factor / measure to appear. Adaptive search filters are also available on the left side. Then, selecting an entry of the table will lead the user to the individual study page (see next main chapter on *Individual Study Page*).

An example is presented in Figure 9. Initially, "Distraction and inattention" was selected as a general risk factor topic. Then "Distraction within vehicle or within the riding or walking situation" was selected as a specific risk factor. When using the "related risk factors / measures" button, the system provides several related measures from the SafetyCube taxonomies. The results for each measure appear after selecting it; in the example "Installation of median" was selected.

The screenshot displays the SafetyCube DSS interface. At the top, the logo reads "SafetyCube DSS European Road Safety Decision Support System". Below the logo is a navigation bar with buttons for "Search", "Knowledge", "Calculator", "Methodology", and "Support". The main content area shows "Home > Related Measures" and "Related Studies for 'Distraction within vehicle or within the riding or walking situation'". A sub-header states: "The following measures are related to the risk factor you selected. Select a measure from the table below to see the available SafetyCube results." Below this is a table with four columns: Behavior, Infrastructure, Vehicle, and Post Impact Care. The "Infrastructure" column is expanded, showing a list of measures including "Installation of median", "Increase median width", "Change median type", "Implementation of rumble strips at centerline", "Shoulder implementation (shoulder type)", "Increase shoulder width", "Change shoulder type", "Safety barriers installation", "Change type of safety barriers", "Create clear zone / remove obstacles", "Increase width of clear zone", and "Implementation of edge-line rumble strips". Below the table, there is a "Countries" filter set to "FRANCE" and a "SafetyCube Synopses" section. The synopsis for "Installation of median" is highlighted, showing a "LIGHT GREEN (PROBABLY EFFECTIVE)" rating. The synopsis text reads: "The installation of medians is found to reduce injury accidents, but not property damage only accidents. The effect is greatest for the most severe accidents. The measure seems to be less effective at road intersections than road segments." Below the synopsis is a table with columns: ID, Title, Source, Year, Design, and Countries. Two entries are shown, both with ID 530, Title "Guard rails and crash cushions", Source "THE HANDBOOK OF ROAD SAFETY MEASURES, NORWEGIAN (ONLINE) VERSION", Year 2014, Design "BEFORE-AFTER", and Countries "FRANCE".

Figure 9: Example of the Related Risk Factors / Measures Function

## SYNOPSIS

Within SafetyCube, many synopses were developed for risk factors and road safety measures. Synopses are targeted at a wide range of users with various backgrounds and professions and provide comprehensive analyses of scientific evidence of the examined topics.

The synopses are pdf documents (size between 10 and 70 pages), available for free download from the DSS Results Page of each topic (pdf icon next to the risk factor or measure title). Every synopsis contains three sections, each with a specific purpose and function:

1. **Summary:** a two-page overview, including colour code (ranking the magnitude of a risk or the effectiveness of a measure), abstract, and overview of the scientific evidence.
2. **Scientific overview:** a five-page document, with detailed background information and description of study results, and relevant analyses, either quantitative (meta-analyses or vote-count analyses) or qualitative (review-type analyses).
3. **Supporting document:** with no page limit, including a full record of the literature search and study selection criteria, the full list of relevant studies, as well as detailed comparative tables of study designs and results (if applicable).

An example Synopsis Page for the risk factor of "work zones" is provided in Figure 10.

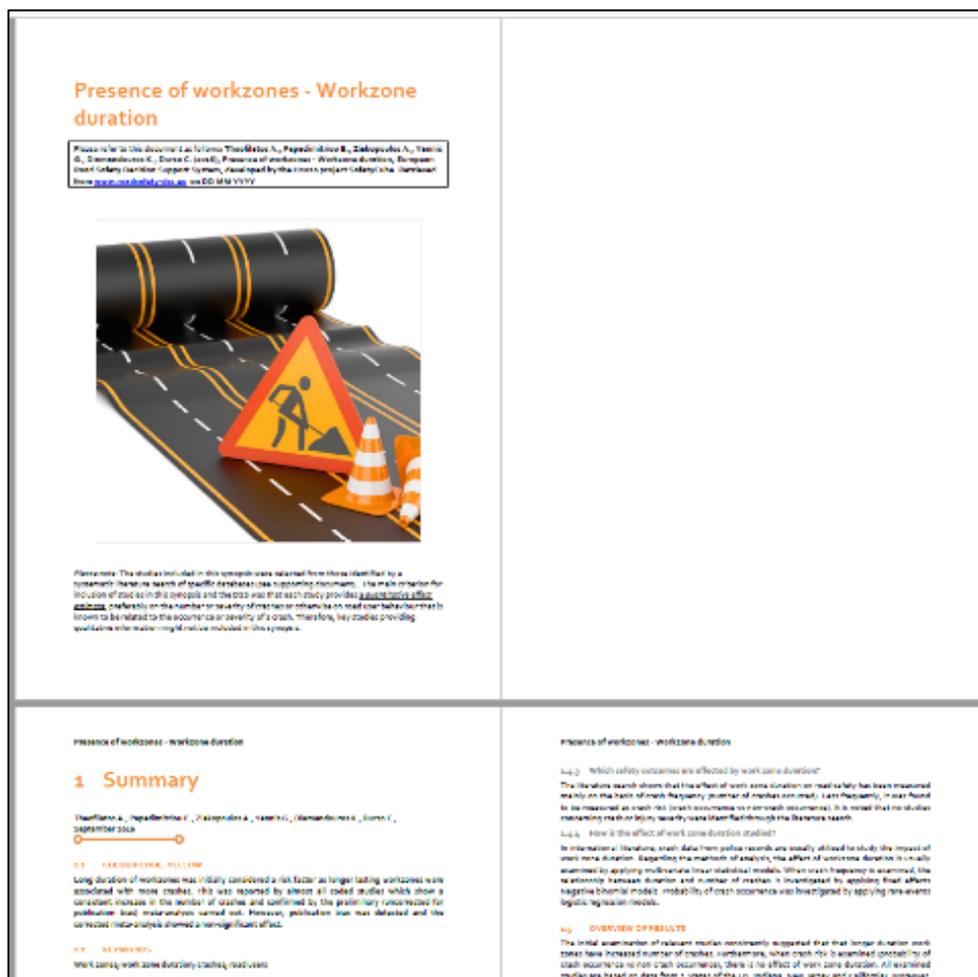


Figure 10: Indicative screenshot of the Synopsis file of risk factor "Presence of work zones - Work zone duration"

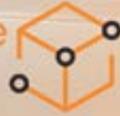
It is noted that not all synopses include information for all road user groups, and therefore some will not appear when entering from the “keyword” or “road user group” entry point. On the other hand, some synopses include separate information for different road user groups, and / or a different colour code for different road user groups, if applicable. All the synopses produced are also listed and available for download via the Knowledge tab of the SafetyCube DSS.

## Step 4: The Individual Study Page

Upon selecting one of the studies in the above Results Page, the Individual Study Page opens, providing information on

- the study abstract (as it appears in the original publication),
- the related URL,
- a table of all risk / measure safety effects available in the study containing:
  - test and reference conditions (e.g. helmet vs. not helmet)
  - types of outcome (e.g. injury severity)
  - types of estimate (e.g. CMF, odds ratio)
  - statistical significance indicators where applicable
- summary
- description of potential methodological issues or biases

The summary provides an outline of the main study features and findings as noted by the SafetyCube expert who analysed and coded the study. The same experts noted potential methodological issues or biases, in studies where they were observed. An indicative study page of a coded study for the risk factor of traffic flow is shown in Figure 11; only the first effect rows are visible due to space constraints.



## Estimating the relationship between accident frequency and homogeneous and inhomogeneous traffic flows.

Hiselius, L.

### Abstract

This paper estimates the relationship between accident frequency and the traffic flow empirically treating the hourly traffic flow in two different ways, as consisting of homogeneous vehicles and as consisting of cars and lorries. Rural roads in Sweden are studied using Poisson and Negative Binomial regression models. It is found that important information is lost if no consideration is taken to differences between vehicle types when estimating the marginal effect of the traffic flow. The accident rate decreases when the traffic flow is treated as if homogeneous. However, when cars are studied separately the result suggests that the accident rate is constant or increases. The result with respect to lorries is reversed, indicating a decreasing number of accidents as the number of lorries increases.

<https://doi.org/10.1016/j.aap.2003.11.002>

### Summary

Data from 83 rural road sections in Sweden from 1989 to the middle of 1995 is analyzed. The traffic data is hourly based traffic flow (for each direction, but not per lane), separately for cars and lorries. Injury accidents, excluding intersection accidents and accidents involving animals, are analyzed, and daylight accidents are studied separately (showing the same results as all accidents, this analysis has not been coded). For the four road types analysed, approximately 160-600 accidents are in the dataset. In the poisson regression analysis, hours with similar traffic flows are aggregated. A negative binomial model was also used, but distributional assumptions do not seem to affect the results, and poisson results are presented and coded. Generally, an increasing amount of lorries is found to be associated with lower accident frequency (controlling for car volume), while the opposite is found for volumes of cars. This tendency is found both for all accidents, single vehicle accidents and multi-vehicle accidents. The study analyzes four types of roads separately, and finds larger effects on for motorways and roads with speed limit 70 km/h and road width 6-9,7m, than for other road types (speed limit 90 km/h and road width 6-7,9 m; road type with speed limit 90 or 110 km/h and road width 8-13 m without separated road lanes). The author notes that a small sample size, and low volumes of lorries relative to cars may be an issue.

### Limitations

Extent	Motivation	Type
MAYBE A PROBLEM	AS NOTED BY AUTHOR, LOW ACCIDENT FREQUENCY PER UNIT OF TRAFFIC FLOW INDICATES LOW POWER. THE AUTHOR ALSO NOTES THAT THE FLOW OF LORRIES IS A FRACTION OF THE FLOW OF CARS.	GENERAL: SMALL SAMPLE

### Basic Study Information

Topic: RISK FACTOR

Year: 2004

Source: ACCIDENT ANALYSIS AND PREVENTION, 36, 985-992.

Design: OBSERVATIONAL CROSS-SECTIONAL

Countries: SWEDEN

Keywords: TRAFFIC: STATISTICS & NUMERICAL DATA FORECASTING MODELS RURAL POPULATION HUMANS REGRESSION ANALYSIS SWEDEN TRAFFIC TRAFFIC: PREVENTION & CONTROL BINOMIAL DISTRIBUTION ACCIDENTS THEORETICAL

### Effects

Effect No	Outcome	Exposure	Group Type	Effect Group	Effect Estimator	Effect Estimator Specifications	Sample	Estimate	Estimate Lower Limit	Estimate Upper Limit	Conclusion Comments
1	ACCIDENT				SLOPE	POISSON REGRESSION, HGV, RURAL ROAD, LIMIT 70		-2.66			SIGNIFICANT POSITIVE EFFECT ON ROAD SAFETY
2	ACCIDENT				SLOPE	POISSON REGRESSION, CAR, RURAL ROAD, LIMIT 70		3.62			SIGNIFICANT NEGATIVE EFFECT ON ROAD SAFETY
3	ACCIDENT				SLOPE	POISSON REGRESSION, HGV, RURAL ROAD, LIMIT 90		-0.94			SIGNIFICANT POSITIVE EFFECT ON ROAD SAFETY
4	ACCIDENT				SLOPE	POISSON REGRESSION, CAR, RURAL ROAD LIMIT 90		1.43			SIGNIFICANT NEGATIVE EFFECT ON ROAD SAFETY
5	ACCIDENT				SLOPE	POISSON REGRESSION, HGV, RURAL ROAD, LIMIT 90,110		-0.77			SIGNIFICANT POSITIVE EFFECT ON ROAD SAFETY

Figure 11: The Individual Study page for a study concerning "traffic flow" as a risk factor