

Investigating the impact of reduced maximum speed limits on traffic accidents in urban and rural areas in the Netherlands

TIL6022 project Group 9

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Introduction

In March 2020, the Dutch government implemented a policy reducing the maximum speed limit on motorways from 130 km/h to 100 km/h during daytime hours (6:00 AM to 7:00 PM) to mitigate nitrogen emissions, while also impacting traffic safety (Rijkswaterstaat, n.d.). This study aims to assess the impact of this speed limit reduction on traffic accident rates in urban and rural areas of the Netherlands. There will also be a distinction between the different types of accidents, either fatal, injury or merely material damage. Through data processing, an exploratory analysis and visualization we aim to uncover patterns and trends in accident rates within both densely populated and less urbanized regions. This analysis aims to contribute valuable insights into traffic safety and to inform future traffic safety measures in varying area densities.

Research objectives

The main research question reads as follows:

What is the influence of the introduction of reduced maximum speed on the number of accidents within an urban area, compared with a rural area in the Netherlands?

This question will be answered using the following sub-questions:

- 1. How has the number of traffic accidents changed in urban areas after the implementation of reduced maximum speed limits?*
- 2. How has the number of traffic accidents changed in rural areas after the implementation of reduced maximum speed limits?*

3. *What other factors might contribute to changes in accident numbers in urban versus rural areas?*

Factors to be investigated:

We aim to explore the following aspects that might impact accident rates differently in urban and rural areas:

- Number of involved parties per accident.
- Object types involved in the accident.

Data sources

Primary Dataset: "Verkeersongevallen - Bestand geRegistreerde Ongevallen Nederland 2014_2023" compiled by Rijkswaterstaat. This dataset consists of two subsets:

- **ongevallen.txt** – This file provides detailed information about each accident, including distinctions such as weather types, number of involved parties, and the allowed maximum speed at the incident location.
- **wegvakken.txt** – This file contains information on the location of each incident, including municipalities, and road types.

Population Density Dataset: "Bevolkingsdichtheid, 2024" from CBS, used to classify municipalities as urban or rural.

Data pipeline

The data pipeline, as represented in the flowchart, consists of several key phases to process and analyze traffic accident data. Each stage corresponds to a specific task in the pipeline.

Data extracting: Retrieve detailed accident data from "Verkeersongevallen - Bestand geRegistreerde Ongevallen Nederland 2014_2023" and geographical data from "wegvakken.txt." Collect population density data from "Bevolkingsdichtheid, 2024" to classify municipalities.

Data collection and integration: Compile accident data for incidents in both urban and rural settings, ensuring inclusion of attributes such as accident outcomes and speed limits. Merge datasets using common location and date attributes.

Data transformation and preprocessing: Filter data to focus only on accidents with recorded speed limits and details about the number of involved parties. Limit the dataset to accidents with specified outcomes: fatal, injury, or property damage.

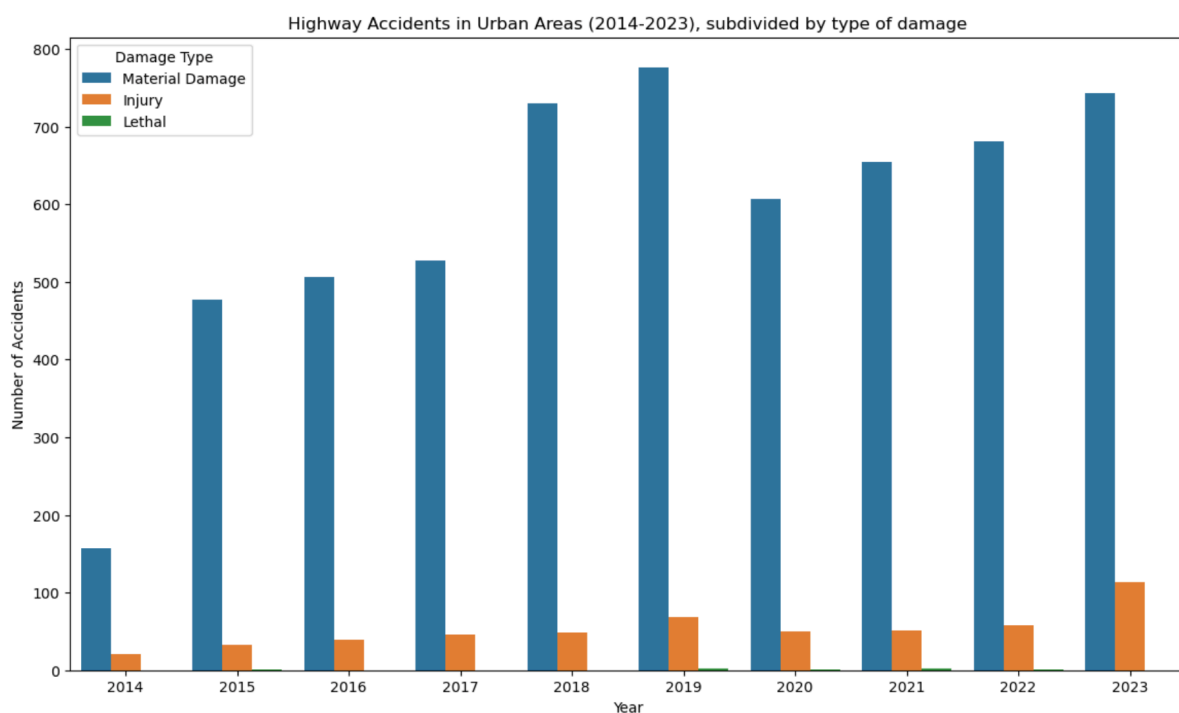
Data analysis and visualization: Analyze accident outcomes across different speed limits to reveal trends in urban versus rural areas. Produce a series of charts, each representing comparisons across both areas for the selected factors.

Geographical boundary and time scale

The study focuses on the most urbanized municipalities—The Hague, Leiden, and Haarlem—and the 35 least urbanized municipalities. The analysis spans from January 1, 2014, to December 31, 2023, providing a comprehensive view of traffic accidents over a decade. This time frame allows for a comparison of accident rates before and after the implementation of the reduced speed limit in March 2020.

Note that the timescale over which the study is considered is different from the information from the *“Bevolkingsdichtheid, 2024”*, however the order of the least and especially the order of the most dense municipalities have not changed considerably in the last 10 years. On top of this, *“Bevolkingsdichtheid, 2024”* will solely be used to select the studied municipalities, these do not by definition have to always have been the most and least dense municipalities over the full timespan of the study.

Analysis on the number of traffic accidents in urban area



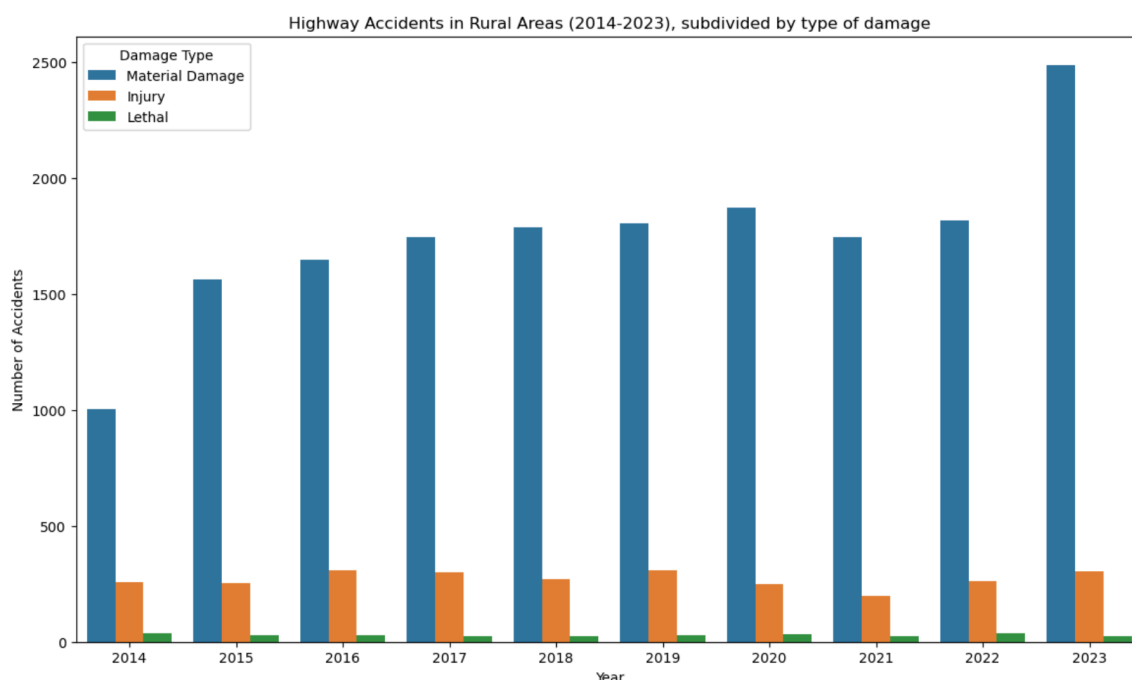
The graph shows the number of traffic accidents on highways in urban areas in the Netherlands from 2014 to 2023, with accidents broken down by type of damage: property damage, injury damage and fatal accidents. The most striking pattern in the graph is that the number of property damage accidents is by far the highest throughout the study period. This suggests that many accidents in urban highways result in damage to vehicles and infrastructure without serious bodily harm or fatal consequences.

Injury accidents are less frequent than property damage accidents. This category remains fairly stable with no major fluctuations, which could mean that road safety has remained somewhat consistent in urban areas despite the introduction of the reduced speed limit.

Fatal accidents account for a very small proportion of total accidents and occur sporadically. This low number reflects the relatively low probability of fatal crashes on urban highways, possibly due to lower speeds and more regulated driving conditions compared to rural highways.

An interesting observation in the graph is that despite the introduction of the reduced speed limit on highways in 2020, there is no clear decrease in the total number of accidents. The number of accidents with property damage remains high, and there is even a slight increase in injury accidents in 2023. This could imply that lowering the speed limit has not directly led to a significant improvement in road safety in terms of reducing crashes. It is possible that other factors, such as traffic density, infrastructure, and human behavior, play a larger role in preventing crashes in urban areas.

Analysis on the number of traffic accidents in rural area



The bar chart shows the number of highway accidents in rural areas from 2014 to 2023, categorized by type of damage: material damage, injury, and lethal accidents.

Since the reduced maximum speed limit was implemented in 2020, the expectation would be a decrease in accidents over time. Material damage is by far the most common type of accident in rural areas, consistently accounting for the majority of incidents each year. From 2020, there is a slight reduction, since the maximum speed limit. Accidents resulting in injuries show a relatively stable trend over the years. Although there is a minor decrease from 2020 onwards. Lethal accidents are the least frequent among the three categories, showing very low numbers each year. There is little variation over the period, and the fatal accident rate remains steady despite the speed limit reduction.

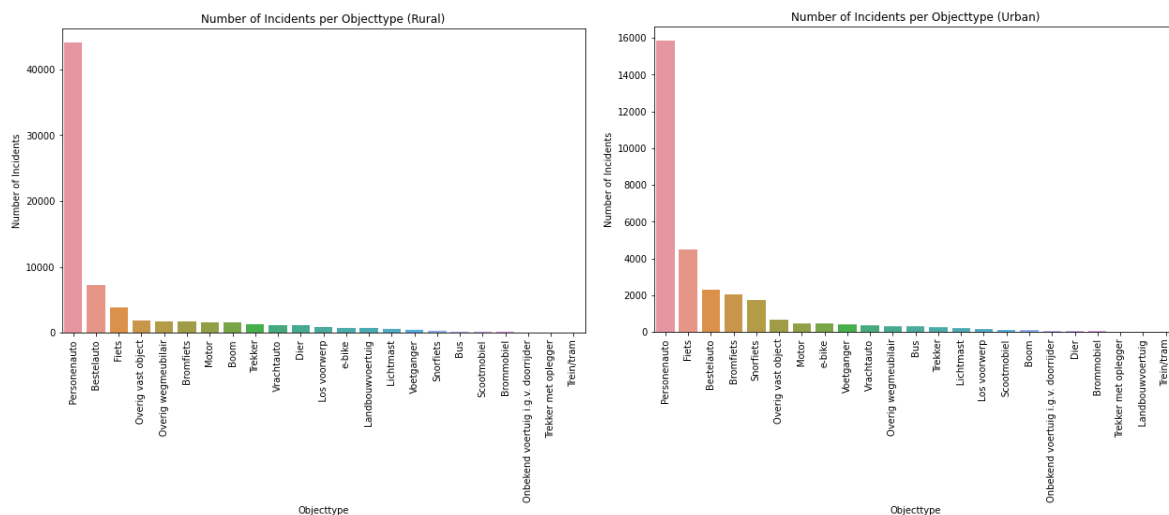
Despite the policy change to lower maximum speeds on highways, the data suggests that traffic accidents, particularly those causing material damage, have not decreased and may

even be increasing. This trend raises questions about the effectiveness of speed reduction alone in enhancing road safety in rural areas. It may indicate that additional safety measures—such as improved road infrastructure, increased awareness campaigns, or stricter enforcement—might be needed to achieve a meaningful reduction in accident numbers, especially for incidents involving material damage.

Analysis on other factors contributing to change in number of traffic accidents

The type of object involved in the accident

The bar graphs for rural and urban areas reveal that "Personenauto" (passenger car) is the most frequently involved vehicle type in accidents, making up a significantly large portion of incidents in both areas. In rural areas, passenger cars contribute to over 60% of incidents, whereas in urban areas, they make up about 52.4%.



The pie charts below provide a clear visual breakdown of the proportion of each object type involved in accidents across urban and rural areas. We will zoom in on different vehicle types.

This graph shows the number of parties involved in traffic accidents in urban and rural areas. In both areas, accidents involving one or two parties are most common. In urban areas, accidents involving one or two vehicles are predominant, probably due to lower speeds and crowding. However, rural areas show more frequent multi-party accidents, which may be due to higher speeds and less controlled traffic conditions. This emphasizes that traffic measures must be tailored to the specific conditions in urban and rural areas to effectively improve traffic safety.

Conclusion

This study concludes that lowering the speed limit from 130 km/h to 100 km/h on highways in the Netherlands has had a minimal effect on road safety. The analyses of traffic accidents showed that the number of accidents with material damage remains the highest. This applies to both urban and rural areas. In addition, other factors, such as vehicle types and the number of parties involved per accident, have a significant influence on the frequency and severity of accidents.

In urban areas, most accidents were primarily limited to one or two parties involved, while in rural areas, they more often involved multiple parties. It was also found that specific vehicle types, such as agricultural vehicles, played a greater role in accidents in rural areas. However, these are likely to be less affected by the speed reduction, as they drive less fast on their own. Passenger cars remain the most involved in accidents in both areas, indicating the need for additional measures specifically targeting this category.

In conclusion, speed reduction alone is not sufficient to significantly improve road safety. Additional measures could be considered, such as improving infrastructure or stricter enforcement.

For the other object types part:

- In both rural and urban areas are passenger cars the most involved in accidents. This means that speed limit reduction can have a significant impact on the number of accidents.
- Some unique object types, like agricultural vehicles ("Landbouwvoertuig"), are more present in rural areas. Since these vehicles are typically slow-moving, the reduction in the maximum speed limit likely has little direct influence on accidents involving them.

Contribution Statement

Xyrian Brooijmans: Data collection and processing, merging data files, graphs on number of parties involved.

Ole de Groot: Graphs of accidents before and after maximum speed reduction and differentiating between the results of the accident.

Minke Groenendijk: Background research, research questions, writing report and analysis on research questions.

Maud Hendriks: Report writing; analysing results and writing conclusion

Renzo van den Brink: Research on Dataset, division between rural and urban, graphs on Objecttypes.

Reference list:

Centraal Bureau voor de Statistiek (CBS). (n.d.). Dashboard bevolking: Regionaal - Inwoners. Retrieved 2-10-2024, from <https://www.cbs.nl/nl-nl/visualisaties/dashboard-bevolking/regionaal/inwoners>

Rijkswaterstaat. (n.d.). Maximumsnelheid. Retrieved 4-11-2024, from <https://www.rijkswaterstaat.nl/wegen/wetten-regels-en-vergunningen/verkeerswetten/maximumsnelheid>

Rijkswaterstaat. (n.d.). Verkeersongevallen - Bestand geRegistreerde Ongevallen Nederland. Data.overheid.nl. Retrieved 2-10-2024, from <https://data.overheid.nl/dataset/9841-verkeersongevallen---bestand-geregistreerde-ongevallen-nederland#panel-description>