Data-driven and project-oriented working

Road safety as a service

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Abstract

To support the decentralized road safety policy in the Netherlands, a total approach of support and software has been set up: Road Safety as a Service. As a result, the use of the software increased. To be risk-driven, in line with the national policy, a barrier had to be overcome: many local authorities do not have the knowledge and capacity to convert available (big) data into a data-driven and risk-based road safety policy. With the algorithm developed in-house, the VIA Clustered Road Network, the information from complex data links is now also easy to use. This has led to concrete projects and new signals.

Keywords

Big data, data driven policy, software, decentralized policy, capacity building

Decentralized approach to road safety

In the Netherlands, we have a long history of effectively tackling road safety. An important role is played by the local road authority (municipality). Steering towards a regional and local approach through national policy: decentralization. It has been like this since the start in the 1970s. A national accident file was deployed to tackle 'black spots'. A standard manual plus a subsidy scheme for carrying out the study and measure were introduced.

Many black spots were tackled and eliminated during that time. Picked the low fruit. New policy, Sustainable Safety, came to work more structurally on road safety and the current policy goes one step further with 'risk-based approach'. Decentralization is still the plan, but local governments are less involved. This coincides with a changing (local) government, an increasing number of road casualties due to changes in traffic, a lack of objective information to work risk-driven and a lot of competition between municipal policy topics.

'Data mountain'

A list of black spots is no longer sufficient for Sustainable Safety, including road categorization and risk-based working. This doesn't need to be a problem because new techniques and automation make a 'mountain' of data available that can be used for road safety. It creates the expectation that the approach to road safety is now suddenly easier. The problem, however, is that many local authorities (a total of 344 municipalities, of which 17% between 100,000 and 50,000 inhabitants and 74% with less than 50,000 inhabitants) do not have the knowledge and capacity in-house to perform data processing, analysing and translate it into road safety information. Many municipalities often lack a traffic expert, let alone someone specifically for road safety. The risk that this creates is populism (as reported by the media) and road safety policy is determined ad hoc.

Barrier to overcome: many local authorities do not have the knowledge and capacity to convert available (big) data into a data-driven road safety policy.

This paper describes the way in which this barrier was taken, how support, communication, monitoring, and data management is implemented, and led to a contribution to road safety.

Road Safety as a Service

To give road safety a new impulse, the STAR (Smart Traffic Accident Reporting) initiative has been established as a Private Public Partnership of the National Police, the Dutch Association of Insurers and VIA Software. That means collecting qualitative data, processing the data into useful information, and translating it into practical applications. The solution was found in developing software as a service (SaaS) package for local road authorities and police so that everyone has access to the same figures and information: capacity building by using software. Standard software that supports the work process, is easy to use, is constantly being maintained and improved and is affordable for small local authorities.

Facilitate decision making process and implementation process

The software was initially free of charge, so the rollout of the software went smoothly. However, it soon became apparent that software alone will not make the difference. More needed to be done to get road safety on the agenda of local authorities. The 'Hamburger model' (Gielingh W.F., 1988). was used for this. The 'hamburger' stands for the goal: a proactive regional and local road safety policy that leads to projects. The 'bread halves' for a top down and button up influence through a combination of communication and support.

The bread on top of the hamburger is aimed at agenda setting by informing local government administrators and citizens. STAR regularly approaches the media with its own research to address a topic. National media offers a wide range of local government administrators. Easy tools have been developed for administrators to facilitate the decision-making process. For example, BLIQ, a customized safety report for all road authorities, has been launched. The Current Accident Report website with daily traffic accident updates is open to government officials, NGO volunteers and citizens.

The bread under the hamburger is aimed at supporting civil servants who implement road safety policy. The Digital Partner, ready-made software tools such as the Dashboard and CROSS, has been developed for this (see Figure 1: The Digital Partner, ready-made software tools). In short: **Road Safety as a Service**.

Figure 1: The Digital Partner, ready-made software tools

Effective support

That the total approach of Road Safety as a Service works is apparent from the figures with which the use of the software is monitored in detail. To manage usage, a monitoring dashboard has been set up that focuses on three main groups:

- Data management, including a feedback loop to the police for quality improvement
- Account management, including an anonymous quarterly report to management on usage
- Information management, including the successful sending of news items

It is of course impossible to say whether the use of the software is high, after all there is no comparison. It is also impossible to say whether high use leads to an effective improvement in road safety. On the other hand, now that almost all municipalities and police teams regularly consult the software and this use is still increasing, this is an essential step to get grip on road safety. See Figure 2: the monitoring Dashboard shows, among other things, the number of work sessions (65,900 in 2021) and the total time worked in the entire software (3 years and 195 days).

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Data-driven and project-oriented work

Effectively improving road safety requires a good understanding of accidents, speeds, traffic intensities, road and environmental characteristics, etc. With this data, road safety can be mapped to recognize and deal with accident concentrations and risk situations. To support such a data-driven work process for road safety, the solution had to be found for automated national processing of various data sources to translate into local project-oriented work.

To translate data into information that is suitable for users with limited knowledge and experience in the field of data management and road safety it is necessary to report the data at the level of project information. To translate the (composite) data into project information, it is clustered into one 'information carrier'. We distinguish between two levels:

- Clustered geographic data, e.g. CROSS
- Clustered non-geographic data, e.g. the accident DNA

Clustered geographic data

By superimposing geographic data in a GIS, a puzzle is created of many small pieces of information distributed over the entire road network, making it almost impossible to determine objective - automated - problem situations. The challenge for clustered geographic data is that geographic data is often very different: point, segment, direction, or area information. In addition, various digital maps are used to display the data: HERE, OSM, Google Maps, and TomTom, etc. This data management challenge, to be able to work with multiple geographical data in a project-oriented way, has been solved with an in-house developed system: the VIA Clustered Road Network (VCRN). See Figure 3: an example of how the VIA Clustered Road Network (VCRN) algorithm fully automated divides the complete nationally road network into clusters of intersections and road sections to combine different data types into a mutually comparable reporting level.

VIA Clustered Road Network (VCRN)

The VCRN divides the entire road network into clusters. A cluster is a composite location of an intersection or road section that can be approached as a coherent whole. In practice: so that each distinguishable part of the road network, a cluster, can be tackled as one project. Clusters of connecting roads (national, regional & local) and roads in areas have been derived for the road network based on the trinity of 'function-design-use'. This classification makes it possible to report to policymakers at a higher level of abstraction with the aim of identifying and prioritizing. For the selection and implementation of projects, the detail clusters have been derived, which together form a route of the connection network or a composite area.

A cluster is in fact an 'information carrier' on which very different information can be taken together and combined. The process is fully automated so that the clusters for the entire Dutch road network are determined and regularly updated. The result is a unique and comprehensive database that enables reliable analyses and benchmarks on a municipal scale.

Figure 3: an example of how the VIA Clustered Road Network (VCRN) algorithm fully automated divides the complete nationally road network into clusters of intersections and road sections to combine different data types into a mutually comparable reporting level

Proven effective but politically sensitive road safety insight

Application of VCRN in combination with the implementation process (Hamburger model) and the smart combination of data into applicable information has shown good results. Two different applications were used for this:

1. Road safety map, CROSS, with Top 10 of unsafe locations for every municipality and region
2. Comparative research into the safety of intersections for cyclists

Example 1: Road safety map

The first application is CROSS, a combination of accident and speed data. An accident score and speed score are derived from the detailed data per cluster. By crossing the two scores in a matrix of four quadrants, each with its own priority, a safety assessment is made. The result is publicly available as a top 10 list and road safety map for every municipality, region, and province. The map and the top 10 list are also included in the BLIQ report for municipal councilors.

The result of publishing accident and speed data in one map and a top 10 list of hazardous locations is that several projects have already been carried out. This information is collected through user feedback or media posts. Figure 4: media articles about the impact of CROSS including an example of how this renewed view on safety has led to a concrete measure; the headline of the newspaper articles reports: “The most dangerous road in (province) Gelderland is being overhauled for millions”

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Example 2: Comparative research

The accident figures for cyclists are worrying, especially at intersections. This, in combination with the strong and rapid changes in traffic, has raised the question: is the cyclist still safe at the intersection? It was decided to set up a comparative study to investigate the safety of different intersection types.

To gain quick insight, available big data was used: accident data, Floating Car Data with traffic flow and GIS with Functional Road Class, intersection types, speed limit and administrative information. For this VCNR was used to bring the data together at the level of all intersections in the Netherlands. See Table 1: number of intersections in the Netherlands by function and type according to the VCRN algorithm.

	Main intersection	Between intersection	Minor intersection
Normal intersection	12.541	94.027	457.912
Roundabout max. 50 km/u limit	1.736	1.170	610
Roundabout > 50 km/u limit	1.532	454	83
Traffic light	3.499	2.304	102

Table 1: number of intersections in the Netherlands by function and type according to the VCRN algorithm.

The result of the research is very striking: roundabouts in built-up areas appear to be the most unsafe type of intersection (see Figure 5). A completely new signal, that has yet to be scientifically tested, has had already a lot of impact among road safety professionals. The subject is now on the agenda via blogs (traffic journal Traffic Science) and a workshop (National Traffic Congress) so that it will be followed up.

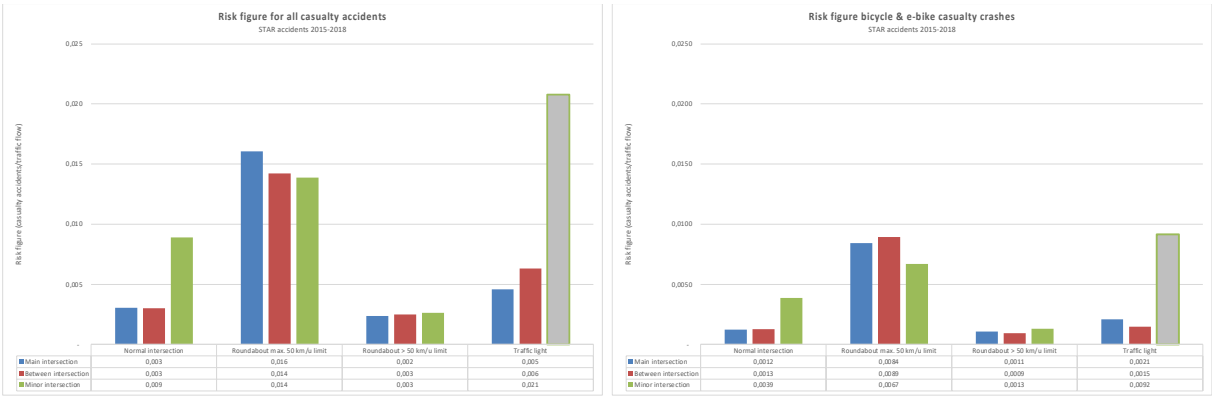

Figure 5: Comparison of the risk figure of normal intersections, roundabouts with max. 50 km/h (with priority for cyclists as a guideline) and with >50 km/h (with no priority for cyclists as a guideline) and intersections with traffic lights; roundabouts with a 50 km/h limit have the highest risk figure if all casualty crashes are assessed (left graph) but also if only casualty crashes involving cyclists are assessed.

Findings

Road Safety as a Service as a formula for total support works as evidenced using the software. Especially if information from complex data links, such as the VCRN, is easily accessible, this leads to concrete projects and new signals.

Literature reference

- Gielingh W.F. (1988). General AEC Reference Model (GARM). Report No. IBBC BI-88-150, TNO, Delft.

Website references

- STAR (Smart Traffic Accident Reporting): www.star-traffic-accidents.eu
- Current accident report: www.star-traffic-accidents.eu/en-GB/Map
- CROSS map: https://bliq.via.software/en-GB/NLD/2022_06/
- BLIQ report (ENG): https://www.via.nl/data/en-GB/a129c8c.pdf

- VIA Software: www.via.nl