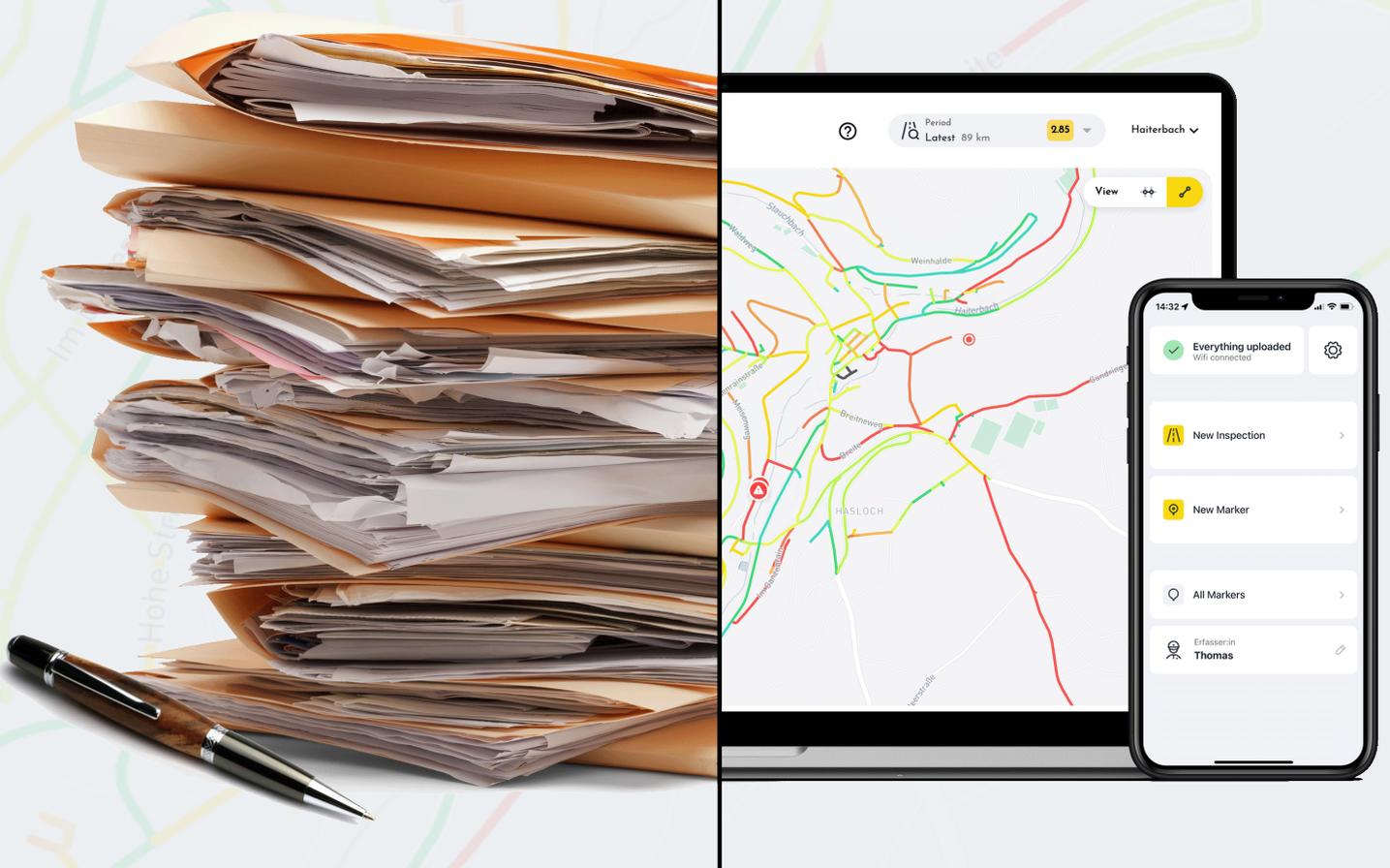


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Countering skilled labor shortages and optimizing municipal processes:

Digital road inspection: a key component of road safety in municipalities



Digital road inspection: a key component of road safety in municipalities

1. Introduction

Ensuring road safety is the key official duty of cities and communities. Municipal staff must ensure that road users on any public routes and spaces are protected against potential dangers - a challenge that is almost impossible to overcome. This issue has also reached new levels of political awareness. In May 2021, Germany's Federal Ministry for Digital and Transport adopted a common mission statement for added road safety together with federal states and municipalities: "Safe mobility – everyone's responsible, everyone joins in".

Implementing these requirements in reality is often difficult, as Germany's Federal Highway Research Institute (Bundesanstalt für Straßenwesen, BAST) discovered in a survey of road maintenance depots. Staff shortages and inefficient processes make fulfilling the duty of care especially difficult. In many municipalities, road inspection is a time-consuming and exclusively manual task.

This white paper examines whether and how a digital road management system can solve the challenges of regular, systematic road inspection in practice. Qualitative client interviews and vialytics road management system data on usage across Germany were used as the basis for data before developing subsequent recommended courses of action.

2. Background and defining the problem

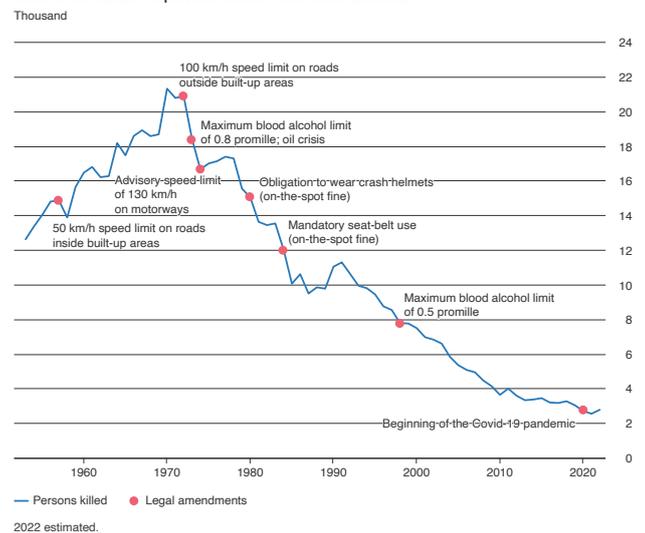
In 2022 Germany's Federal Statistical Office recorded 2790 fatalities due to traffic accidents. That's 220 more than in the previous year. Germany is therefore moving away from "Vision Zero," the future vision of 0 fatalities. In order to further reduce this figure in the future and to make roads even safer, the Federal Ministry for Digital and Transport developed the "Road Safety Pact," which combines the program of the federal government and federal states, municipal and rural district safety concepts as well as the strategies and approaches of non-public stakeholders under one umbrella. In order to achieve the common goal of 40 percent fewer fatalities by 2030, a total of 12 action areas were established which comprise all aspects of public life.

Under their mission statement "Safe mobility – everyone's responsible, everyone joins in," policymakers are making one thing clear: Road safety is a task for society as a whole, one that can only be achieved through the participation of all those concerned. Municipalities play a key role with their comprehensive responsibilities for road safety as well as the personal liability of public officials in the event of violations.

2.1 Staff shortages in municipalities require a new way of thinking

Municipalities rely on sufficiently well-trained staff in order to be able to implement every measure to comply with their duty of care. However, studies such as one conducted by the consultancy firm PwC warn of a substantial shortage of

Trend in the number of persons killed in road traffic accidents



© Statistisches Bundesamt (Destatis), 2023

Germany's road safety has been on the increase since the 1970s, which requires effort on every level.

skilled workers in the future. While German companies are also experiencing this risk, public authorities are likely to be particularly heavily affected. Public administration could be short of over one million people, in other words, one-sixth of the projected staffing needs by the year 2030, with severe consequences for public life and the secure future of German society. The study recommends reducing the demand for labor in municipalities as a potential solution to this development. One approach would entail optimizing the range of services, which would entail assessing which services actually need to be provided by the state. The second key approach aims to make administrative processes more efficient. Digitizing processes and closer cooperation with private-sector companies were named as main recommendations.

2.2 Road safety is no trivial matter

The official duty to ensure road safety protects road users against potential hazards caused by the condition of public traffic areas used for their intended purpose. This duty is not regulated in detail by law. Instead, it was developed pursuant to the case law § 823 of the German Civil Code and is based on the principle that anyone who creates a safety hazard in their area of responsibility or allows it to persist must also take precautions to inform of the hazard and to avert it. Road safety requirements vary depending on the type of traffic permitted on the road; in other words, areas and spaces for all motorized and non-motorized road users in moving and stationary traffic.

Road sections are deemed dangerous if they are not identifiable or not identifiable in good time and which can lead to an accident as a result, even if road users act with due caution. The road construction authority with a duty of care is therefore obliged to regularly monitor the road using road inspection pursuant to road laws as well as recital 62 of the General Administrative Rules for Road Regulations, §45 para. 5. They must also regularly carry out road assessments on foot or by car in order to identify potential damage and hazards..

Germany has been following the EU Directive on road infrastructure safety management (2008/96/EG) to maintain road safety since 2010. This directive stipulates safety audits of infrastructure projects, safety classifications, and management of road networks in operation as well as regular safety inspections of the entire road network (see image on the right). The following section looks at road inspection in road construction authorities in particular.

Four road safety processes in Germany

- Road inspection by road construction authorities
- Traffic observation
- On-site accident investigation
- Road network safety analysis

2.3 Road inspection duties

First and foremost, road inspection focuses on obvious flaws in the road's condition. Numerous other damages to public spaces must be examined as they lie within the public administration's area of responsibility (see image on the right). Any roads, paths, and squares within the area must be included in the inspection. Internal directives of the federal states regulate individual aspects. The frequency of monitoring depends on the roads' significance to transport and their potential hazards. Weather conditions or incidents must also be taken into account. Germany's Federal Association of Road and Traffic Engineers (Bundesvereinigung für Straßenbau- und Verkehrsingenieure) recommends weekly inspections of traffic routes that do not experience significant usage. Areas with a very high degree of use should be inspected two to three times per week. The broad range of responsibilities and regular inspection intervals demonstrates the high degree of time and staff resources required by the duty of care.

Defects to examine:

- Damages to lane area
- Differences in elevation
- Clearance profile and visibility splay
- Free of obstacles
- Drainage function
- Road signs and road facilities

2.4 Practical shortcomings in road inspection

Despite the clear outline of requirements, substantial shortcomings can be identified in the practical implementation of road safety, especially when it comes to road inspection. Following a large-scale investigation, Germany's Federal Highway Research Institute (BAST) reported that most road maintenance depots document their road inspections on paper using standardized lists and manually record the time of inspection, coordinates, and descriptions of defects. After the inspections, the complete lists must be archived to serve as evidence in the event of liability. During conversations with staff, administrative tasks such as documentation, reporting, and logging were criticized as being particularly time-consuming and preventing staff from turning their attention to more important operative responsibilities.

"Over the course of our conversations, it became clear that road maintenance staff had reached the limits of their capacity and that without additional staff or technical support, no further tasks can be taken on without compromising on quality in other fields of activity."
- from a report by Germany's Federal Highway Research Institute, issue V 287, p. 60¹⁰

Furthermore, the administrative bodies that were examined do not follow any standardized road inspection processes, which requires a high degree of independence and induction from the member of staff. This makes it unnecessarily challenging for untrained staff to carry out these duties. There are tremendous differences in road safety management, even among neighboring road maintenance depots. During the survey, it wasn't just the execution of road inspections that were considered problematic, but also the time pressure that results from complex and comprehensive documentation. "The increasingly complex requirements and provisions in individual areas reinforce this issue [during road inspections]. Overall, developments in recent years have meant that road maintenance is partially limited to the bare minimum" (see BAST, p.60). If there is no ideal self-organization within a department, this can quickly lead to grave errors in road inspection..

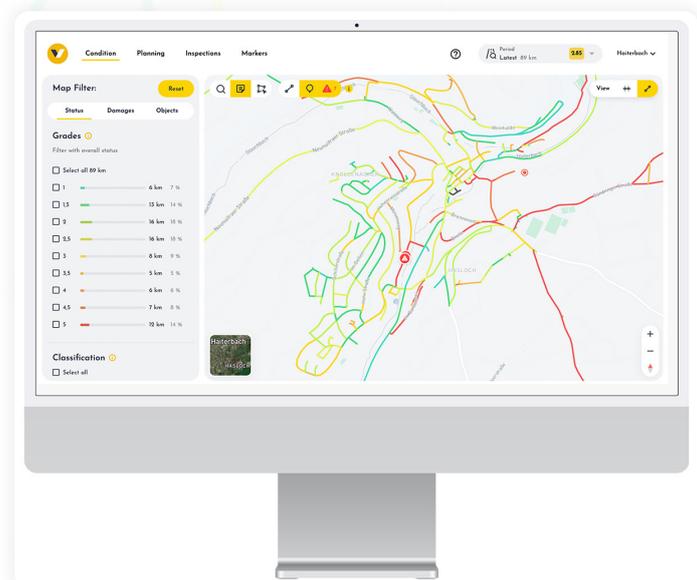
3. Digital Road Management Systems (RMS) as a solution

These findings provide a systematic explanation for the causes of the lack of road inspection enforcement. Road maintenance depots won't see their area of responsibilities diminish in the future, which means there is a tremendous growing need for optimized processes during inspection and subsequent documentation. A possible solution to the problem is to acquire a digital tool that provides untrained or new members of staff with a quick introduction to road inspection thanks to intuitive use while also relieving more experienced users of a large part of their documentation tasks.

3.1 The vialytics System

vialytics GmbH has recognized this need and has therefore invented an intelligent road management system (RMS) product category. The vialytics system consists of two core components: a smartphone app and the corresponding desktop web system.

vialytics digitizes conventional road inspections using pen and paper as an RMS and automatically provides an objective analysis of the road surface thanks to an integrated algorithm. The data collected in this manner can be used to plan short and long-term measures in the integrated planning system and to organize annual budgets and implementation statuses in just a few clicks.



3.2 Collecting data with a smartphone

The smartphone app is used to collect data while road maintenance depot staff are out on the road in their community. During the assessment drive, the vialytics smartphone is attached behind the windshield of the municipal vehicle and takes a picture of the road space every four meters. The image data captured in this manner is first pixelated in accordance with the GDPR using artificial intelligence developed by vialytics, ensuring that no faces or license plates can be



The vialytics system enables digital road inspection on foot as well as in the car or on a bicycle using a smartphone and steering wheel button.

recognized. The AI subsequently analyzes 15 categories of asphalt damage using the images.

During the road inspection, the vialytics smartphone serves as a smart documentation tool in just four steps (see image on the right). Staff take one or several photos of the damage and directly add any crucial on-site data, such as priority, category, and implementation status. The app's simple user interface makes the process faster even during the inspection and completely eliminates the need for subsequent manual archiving thanks to automatic and permanent storage in the vialytics system. The vialytics partner municipality in Esslingen, Germany, reported up to 50 percent reduction in time spent on road inspection. The vialytics app can be used on foot, in the car, or on a bicycle using a simple button on the steering wheel or handlebar.

Road inspection in just 4 steps:

Step 1:

Open vialytics app and select "New Marker"

Step 2:

Photograph damaged area with smartphone

Step 3:

Enter category, comment, and priority

Step 4:

Save and close vialytics app

3.3 Planning renovation measures and organizing tasks in the web system

Any data collected using a smartphone is automatically transferred to the vialytics web system on a computer. This online application can be accessed from any computer with the right login details, meaning the system can be used by multiple administrative bodies simultaneously, making it easier to work across departments. Condition surveys and road inspection results are clearly depicted on a map view and are immediately available for further processing, thanks to time stamps and GPS coordinates. Renovation measures can be planned using the system, allowing assignments to quickly be delegated to the colleagues responsible. At the same time, the dense image network provides a digital image of the municipalities, which enables virtual walk-throughs. Citizens' concerns can often be answered directly through the system without having to reassess the area in question.

The vialytics system can be tested as part of a zero-obligation free trial. A vialytics expert will demonstrate how to use the interface during an appointment and provides practical implementation support. Following the first inspection, results will be presented to discuss the collected data and quickly identify measures.

3.4 The vialytics road management system in action in Westerstede, Germany

Up until 2022, the city of Westerstede in the north of Germany handled its duty of care on paper. Every road in the municipal area was documented and subjectively assessed four times per year. By introducing the vialytics RMS, the city was successfully able to digitize this process. Members of staff particularly appreciated that the data is neatly sent to a system, which made road inspections significantly easier. They also use the smartphone app to record defects “ad interim” beyond the 3-month cycle while simultaneously having more time to remedy these defects.

“Road safety has substantially increased through our in-depth work with the program, as potholes in the road and similar issues can be identified sooner and therefore be handled within a relatively short space of time.”

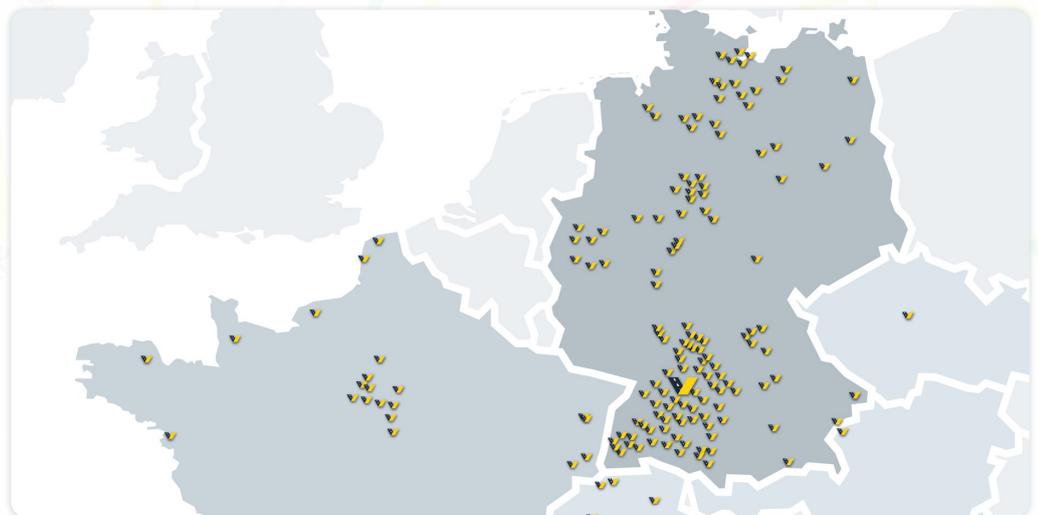
- an interview with Ramize Choti from the city of Westerstede

The additional quantity of information therefore effectively results in added road safety for the city of Westerstede. Acute damages in particular can be repaired at short notice thanks to the fast capture process. The city is thereby launching a preventative road safety measure that can identify and repair damage as it emerges. Overall, they said the administrative work is now more pleasant, and the workload has been reduced using the vialytics system.

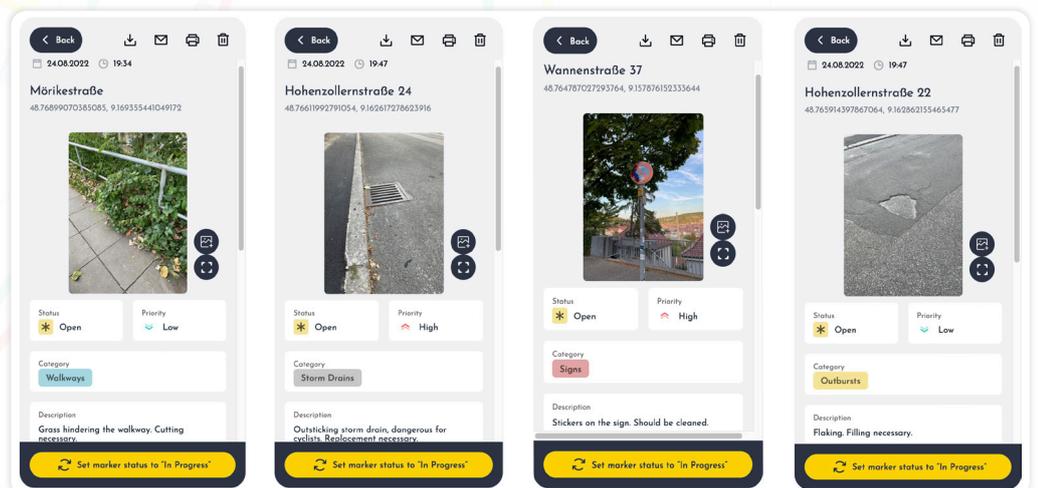
3.5 Emerging digital road inspection

Case studies of this type can be found all across the vialytics map, from major cities with 1000 kilometers of road networks to small communities with a handful of inhabitants. Over 300 partner municipalities in 6 countries now rely on the vialytics RMS for their road safety.

In total, almost 20,000 markers in over 500 categories have been placed during road inspection and inventory processes, corresponding to 63.5 markers per municipality. Visibility splays and playgrounds, banister rails, curbs and sidewalks, manhole covers and water inlets, road signs, potholes, excavations, signaling equipment, green spaces, garbage cans, or benches - you can efficiently and reliably document any inventory and damages on the roads.



Over 300 partner municipalities in 6 countries now rely on the vialytics system (see above image) and actively use the marker function during road inspections (see below image).



4. Summary: The future of safe roads is digital

In order to solve the challenges of the future and mitigate the considerable shortage of skilled workers, public administration efficiency and services must increase to the same extent. This requires a rethink. The political will to improve safety on Germany's roads across authorities and federal states with the new Road Safety Pact while promoting digitization should therefore be regarded as a positive development.

What often sounds impossible in municipal practice despite all the planning and promises is already becoming a reality in many employees' working world thanks to new digital tools. Members of staff of cities and communities that use digital road management systems for road maintenance benefit from significant time savings, lower costs, and the great feeling of having done everything for the sake of safety in their local area. At the same time, the new software category allows data that was previously viewed separately, such as municipal excavation management, to be intertwined with the maintenance and upkeep of transport routes in a common interface.

The vialytics system has emerged as an ideal tool for the most important processes in building authorities and building yards. Close cooperation with over 300 partner municipalities has confirmed the need for vialytics' solution. At the same time, members of staff are continuously requesting new functions to expand the range of applications through new AI developments, for instance.

One thing is certain: Virtual replicas of cities and municipalities still offer untapped potential that will only fully unfold through users' creativity. Bring on the digital future.



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51 JFK Parkway
First Floor West
Short Hills, NJ 0708

www.vialytics.com | info@vialytics.com

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