VIANOVA

NEW APPROACHES TO ROAD SAFETY:

How Vianova uses connected vehicle data to create safer streets

About the author

Meet Alexander Pazuchanics, Vianova's Head of Product & Policy—a seasoned advocate for road safety and urban mobility. With a Master's degree in Public Management from Carnegie Mellon University, Alexander has shaped impactful policies throughout his career.

He is the Former Mobility Solutions Manager for the City of Seattle. Before that, he worked as Assistant Director for Policy, Planning, and Permitting at the City of Pittsburgh's Department of Mobility and Infrastructure.

Alexander leads all road safety projects at Vianova, overseeing initiatives from Transport for London to the City of Zurich. Widely recognized for his thought leadership, he authored "Pittsburgh's Smart City Vision: SmartPGH", outlining a comprehensive vision for smart and safe urban environments.

As a key figure at the intersection of policy, technology, and urban planning, Alexander continues to champion road safety, leaving a lasting impact on communities and cities worldwide.

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Why Talk About Road Safety?

The United States continues to head in the wrong direction, with traffic fatalities increasing by 18% over the past 4 years. In Europe, a decade of decline in roadway fatalities was halted in 2021, with deaths increasing by 6% over the prior year.

There are multiple reasons why collisions are increasing in the United States and the European Union. The move toward more active modes is producing great dividends in terms of quality of life and environmental sustainability. But it is also exposing the inadequacy of infrastructure for pedestrians and cyclists, with pedestrian motor vehicle crash fatalities increasing by 80% since reaching their low point in 2009 and accounting for 17% of crash fatalities.

Additionally, the changes in vehicle form have produced larger, heavier, deadlier vehicles, a trend likely to continue as electric vehicles and their large batteries represent a larger share of automobiles on the road.

Safe streets are core to our mission to use technology to create better cities. People's perception of safety on the road affects their willingness to switch to active or more space-efficient modes such as walking, cycling, and shared mobility. In other words, unsafe roads are stunting global progress towards achieving decarbonization. We can't hope to meet ambitious climate targets without reducing the frequency and severity of collisions, particularly in urban areas.

As a company sitting at the nexus of transportation and data, at Vianova we feel like we are uniquely positioned to contribute meaningfully to the discussion of new approaches to tackle road safety.

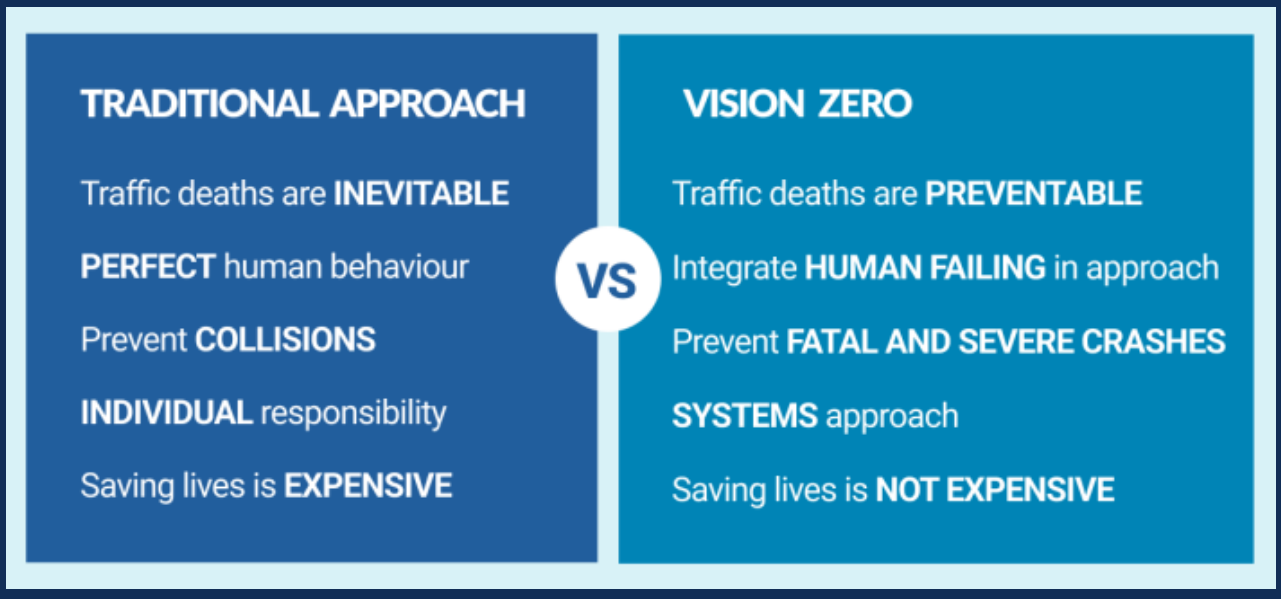
We work with dozens of cities in Europe and around the world, giving us a window into the mindset of some of the most forward-thinking governments in the world. We've been working with connected vehicle data since our founding, gaining an appreciation for how to use it to answer questions that traditional data collection might leave out.

The Vision Zero Approach

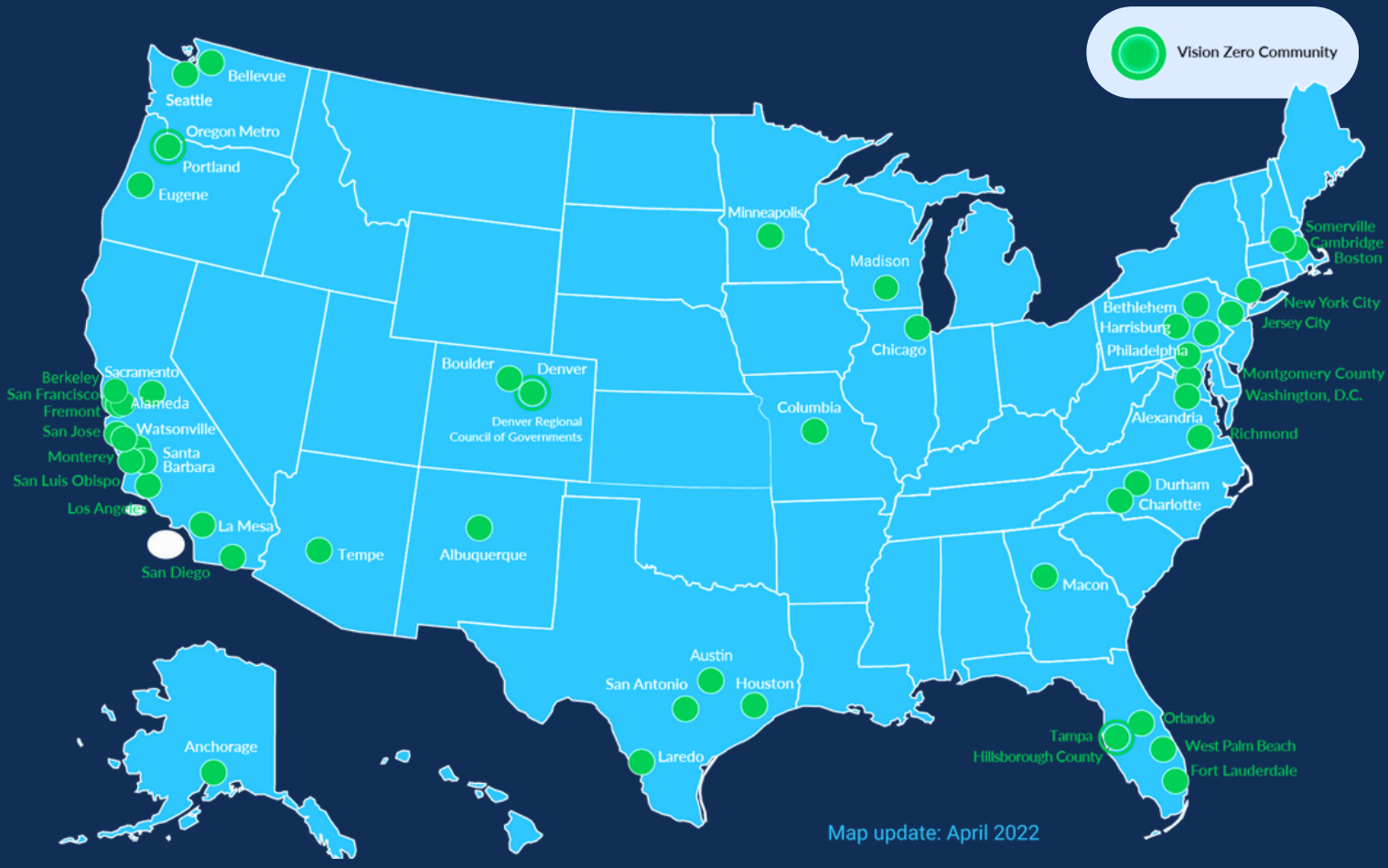
The modern road safety movement could be dated to the creation of the Vision Zero goal by the Swedish parliament in 1997. Both a genuine target and an ethical stance, Vision Zero takes the perspective that no deaths or serious injuries should occur on the roadway.

Vision Zero acknowledges the humanity (and fallibility) of drivers - if collisions are going to occur, techniques are necessary to minimize their severity and their effects on the drivers and other travelers around.

The Vision Zero approach (though not necessarily always the results) has taken on increasing attention in recent years. A commitment to zero fatalities, often combined with a target year, is an increasing feature of city transportation plans across Europe and the United States.



What is Vision Zero? - source: Vision Zero Network



The Vision Zero network in the United States. source: Vision Zero Network

Is Vision Zero an attainable, realistic goal?

The answer depends on the level of financial investment, political capital, and technological advancement cities and industries can make in the coming years. As low-hanging fruit opportunities disappear, it becomes increasingly difficult to make progress and the need for more effective targeting becomes more important.

The Anatomy of a Collision

To reduce the number of collisions, it's necessary to understand why they occur. The frequency and severity of collisions or crashes are attributable to several different factors:

- the actions and attentiveness of one or multiple travelers
- the types and conditions of the vehicles
- the conditions of the infrastructure, and more generally the conditions outside (lighting, precipitation, etc.)
- the presence or absence of vehicles, objects, or people

For some factors, a national or even international approach is most effective in reducing risk. For example, the weight and acceleration speed of a vehicle is largely determined by industry standards or regulation. However, cities, departments and other road authorities can still intervene in different ways to reduce the impact of various factors. For example, safety features such as bollards, lane dividers, or speed bumps can reduce the lethality of a collision.

Road safety strategies typically center around the combination of three different techniques:

Education:

Producing more attentive, more empathetic, and better-trained travelers across all ages and all modes. Education techniques are broad, including everything from signage and marketing campaigns to bicycle safety classes and in-vehicle notifications.

Enforcement:

Imposing fines and penalties for unsafe behavior, as well as using regulations to change the behavior of travelers. Increasingly, enforcement is applied using automated technology such as cameras or GPS transponders to increase its reach, as well as to limit interactions between travelers and law enforcement.

Engineering:

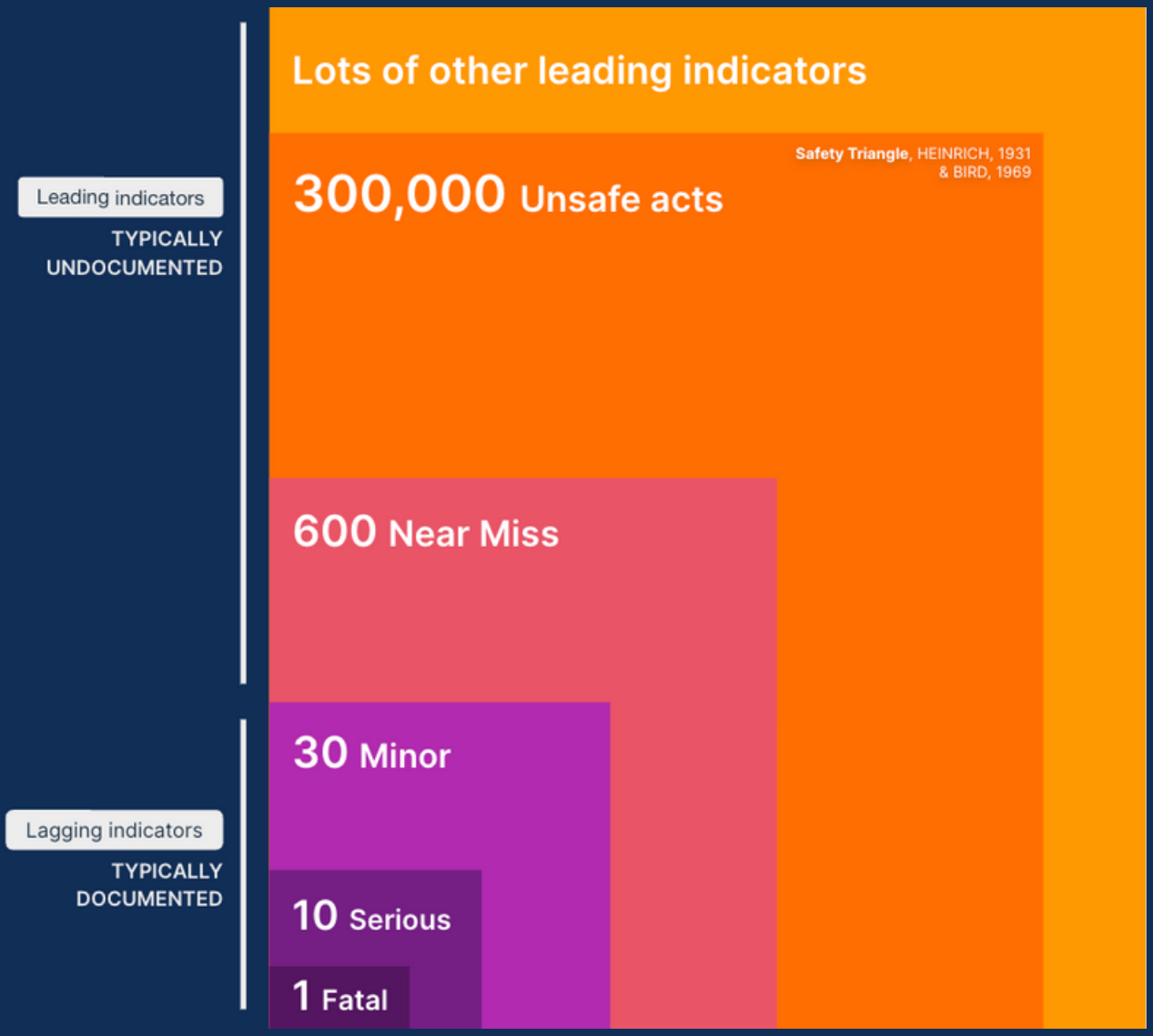
Designing and implementing new configurations within the road to create a safer environment. These techniques can vary from low-effort, “tactical” interventions such as line striping or bollards, to more comprehensive changes to intersection configuration and signalization, and even the separation of different modes.

Prioritizing Investment

The right engineering investment can pay dividends for safer roads and can have ancillary benefits such as increased comfort for vulnerable road users, air quality improvements, and more vibrant urban life. But prioritizing investment is incredibly challenging, with the needs far outweighing the resources. Budgets remain largely static, even as the window to achieve Vision Zero targets shrinks. And so local governments must be more attuned to achieving the best return on investment, while also being more strategic about how those decisions are made and subsequently evaluated.

Today prioritization is largely a function of collision history, as the location of collisions represents a readily available data source. The conditions present at this location caused at least one serious collision, indicating that problems are likely to continue in and around this spot.

However, an over-reliance on historical collisions can leave jurisdictions making suboptimal decisions. At a philosophical level, intervening in areas where collisions have already occurred can sometimes represent “fighting the last war”, and making a reactionary decision only after a serious incident has occurred. Collision data can be subject to bias, a lack of information, or even incorrect information, which may result in incorrect conclusions.



Designed based on the accident triangle, also known as Heinrich's triangle or Brid's triangle.

Additionally, the data set of serious or fatal collisions, though unacceptable by the standards of Vision Zero, still represents a small data set in absolute terms. There is a risk in drawing conclusions from such a small dataset, particularly since it represents the top of a pyramid with significantly more observations.

This concept, referred to as “Heinrich’s Triangle” or “Bird’s Triangle”, has existed in the realm of industrial safety for much of the 20th century, and is also applied to road safety. For every serious or fatal collision, there are an order of magnitude more events that “could have been” collisions under different circumstances. The hundreds of near-miss events, but for a small change in the other input variables, may have led to a serious or fatal collision.

Finally, collision data typically represents the past of a world that is rapidly changing. While multiple years' worth of collision history is typically used in safety planning, the data can miss significant changes regarding the **Way**, the **Where**, and the **Why** people travel.

Significant trends in recent years include a shift to heavier, quieter electric vehicles, the introduction of shared, dockless bikes and scooters which increases the population of vulnerable road users, a change in work habits (as the result of COVID and post-COVID employment), and new housing development. That means that the best historical data may no longer be collected over years, but over months.

The appropriately weighted inclusion of these other factors should be critical to making a determination about risk. Instead of relying on only a few dozen or hundreds of observations, millions of events can be tracked, making abnormal behavior more evident.

Changing the Paradigm

Vianova has developed new tooling and data solutions to respond to these challenges. The goal is to “show the rest of the iceberg”, creating a richer understanding of all of the factors and events that might have turned into collisions, and are creating a barrier to the safe streets we want to see. By bringing more types of data to the table and harmonizing them, we are hoping to round out the picture of risk and provide more flexibility to prioritize more intelligently and efficiently.

Identifying risk is not necessarily the same as making predictions. The numerous factors involved in every serious or fatal interaction ensure that genuine prediction is quite difficult. As mentioned previously, the goal should not be only to use the model to assess where collisions have occurred, but rather to identify the areas where large numbers of indicator risks are present, providing a more proactive and comprehensive view of risk.

Additionally, a risk-based approach also supports changing the perception of safety, especially by vulnerable road users. When the majority of cyclists and pedestrians cite the inadequacy of infrastructure as a reason to not travel on two feet or two wheels, it becomes critical to help assuage the feeling of unsafety as well as the reality. A risk-based approach provides a more comprehensive picture of multiple factors that may make a traveller feel unsafe, and alongside public feedback, can be a powerful tool for identifying areas of need.

Our Approach: Risk Aware

Author's note: Vianova frequently iterates on the development of the Risk Aware product as additional capabilities become available. The methodology is current as of the time of publication of this document.

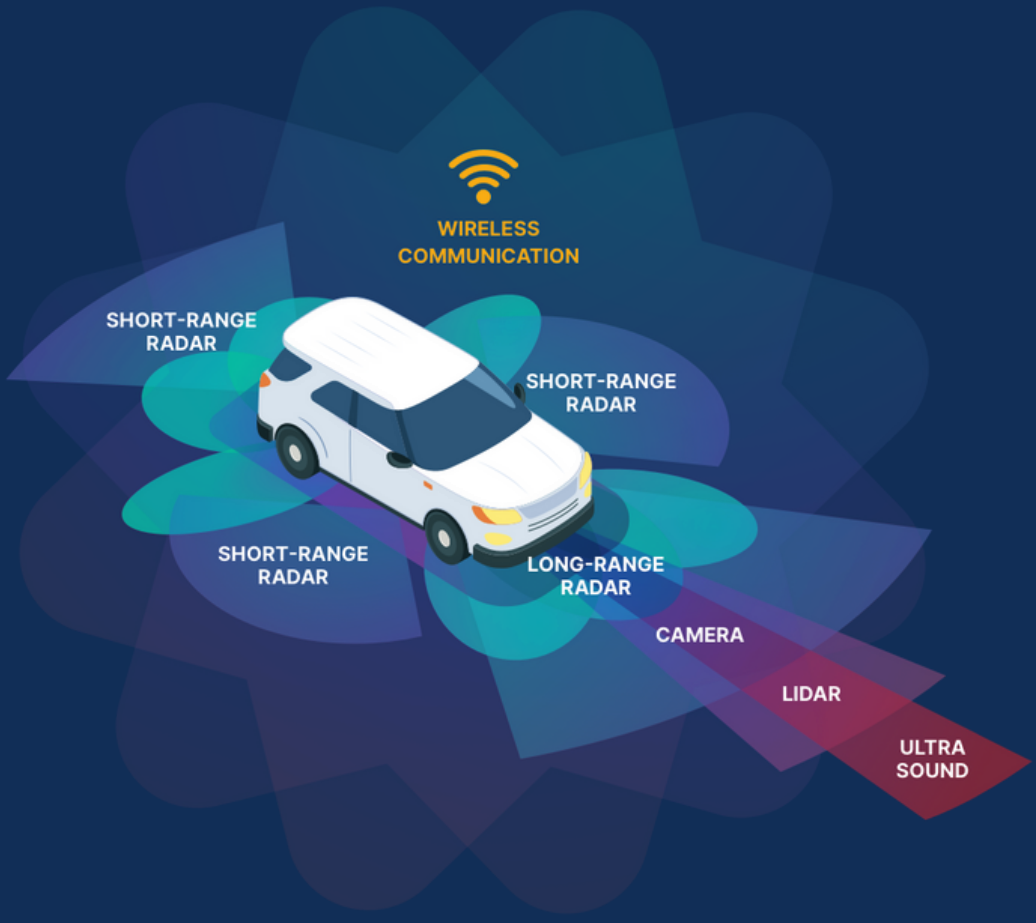
The Promise of Connected Vehicles

The development of IoT (Internet of Things) technologies has introduced significantly easier access to data generated by connected vehicles. Vehicles such as cars, trucks, and vans are now equipped with a range of sensors that are able to provide data about positions, speeds, and headings, or the use of features such as windshield wipers, turn signals, and brakes. This type of data is available either directly from the vehicle manufacturer or from after-market fleet management services. Vianova works with data OEMs and data aggregators representing approximately 40 million vehicles generating data in the United States, as well as approximately 30 million vehicles generating data in Western Europe, representing a broad swath of vehicle makes and models.

Connected vehicle data is not limited to information about cars and trucks. Increasingly, the use of cellphone telematic data or on-vehicle sensors has introduced new data about the behaviors of pedestrians, cyclists, and micro-mobility users. This data is often less comprehensive but nevertheless provides insights into the density of vulnerable road users and some additional behavioral information.

There are several advantages to the use of connected data, particularly in comparison to empirical data collection (manual observations or the use of cameras or sensors). Empirical data collection cannot cost-effectively be done over a wide area, whereas connected vehicle data covers the entire geography in which vehicles travel. Additionally, empirical data collection typically does not allow the ability to go “backward in time”- it is not possible to collect data before you know that you want to collect it.

In contrast, connected vehicle data is being collected regardless of whether its use is known, providing the ability to go backward and evaluate time periods in the past. And because connected vehicle data is always collected, it represents observations of both abnormal and normal behavior, helping to better understand the ratio between behaviors.



Safeguarding User Privacy through Aggregation and Anonymization

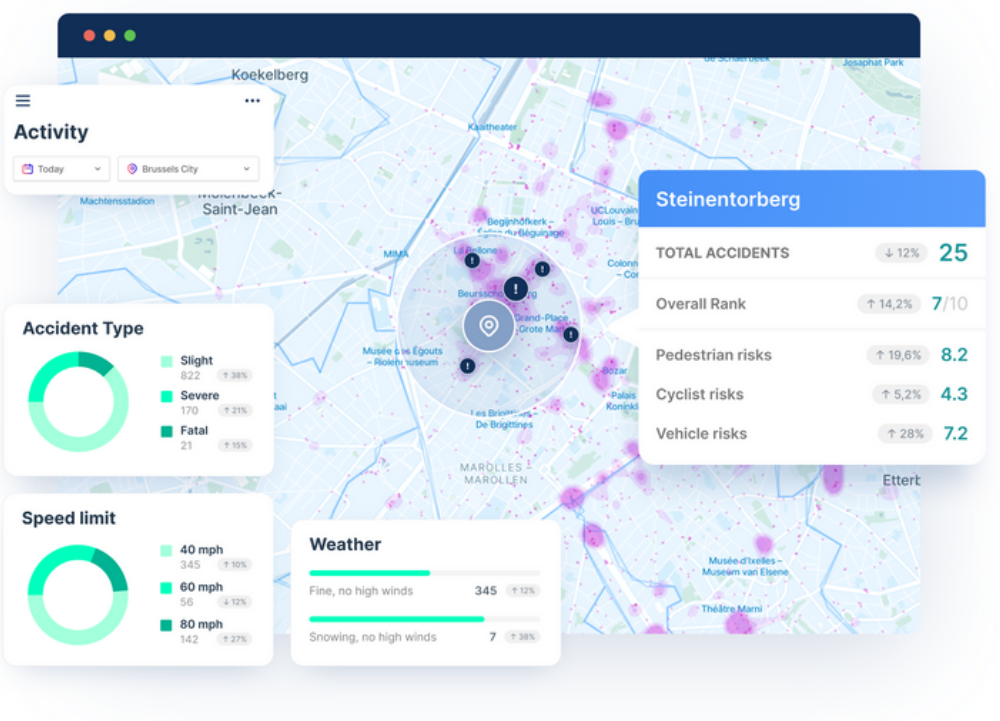
It is important to implement strategies to protect individual user privacy while unlocking the value that connected data can provide. Even when users provide consent to the use of their data for a broad range of purposes, governments can feel uncomfortable making use of data that could ultimately be re-identified to a specific user.

Two techniques, aggregation and anonymization can be used in parallel to generate insights while reducing privacy risk, especially in the context of GDPR. Aggregation is the idea of bucketing data in a sufficiently large geographic area, with a sufficiently large time range, while ensuring the buckets have a minimum number of observations, making it difficult to identify a single traveler based on observation.

For example, for most analyses, Vianova aggregates data to the street segment level, a geography of approximately 100 meters in length, with each street segment typically containing hundreds or even thousands of unique observations. Anonymization is the idea of removing the possibility of reidentification of individual unique users.

Conclusion

The use of connected vehicle data in risk identification and safety development is an exciting and iterative new development. As a software as a service and data solutions as a service company, Vianova is excited to continue to improve on the use of new data sources to help make prioritization decisions easier and to better document improvements to the road network. Achieving Vision Zero will take a comprehensive effort, incorporating new strategies and techniques to build safer streets for all travelers.



Want to learn more about our methodology?
Interested in making roads safer in your city? Contact us!

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