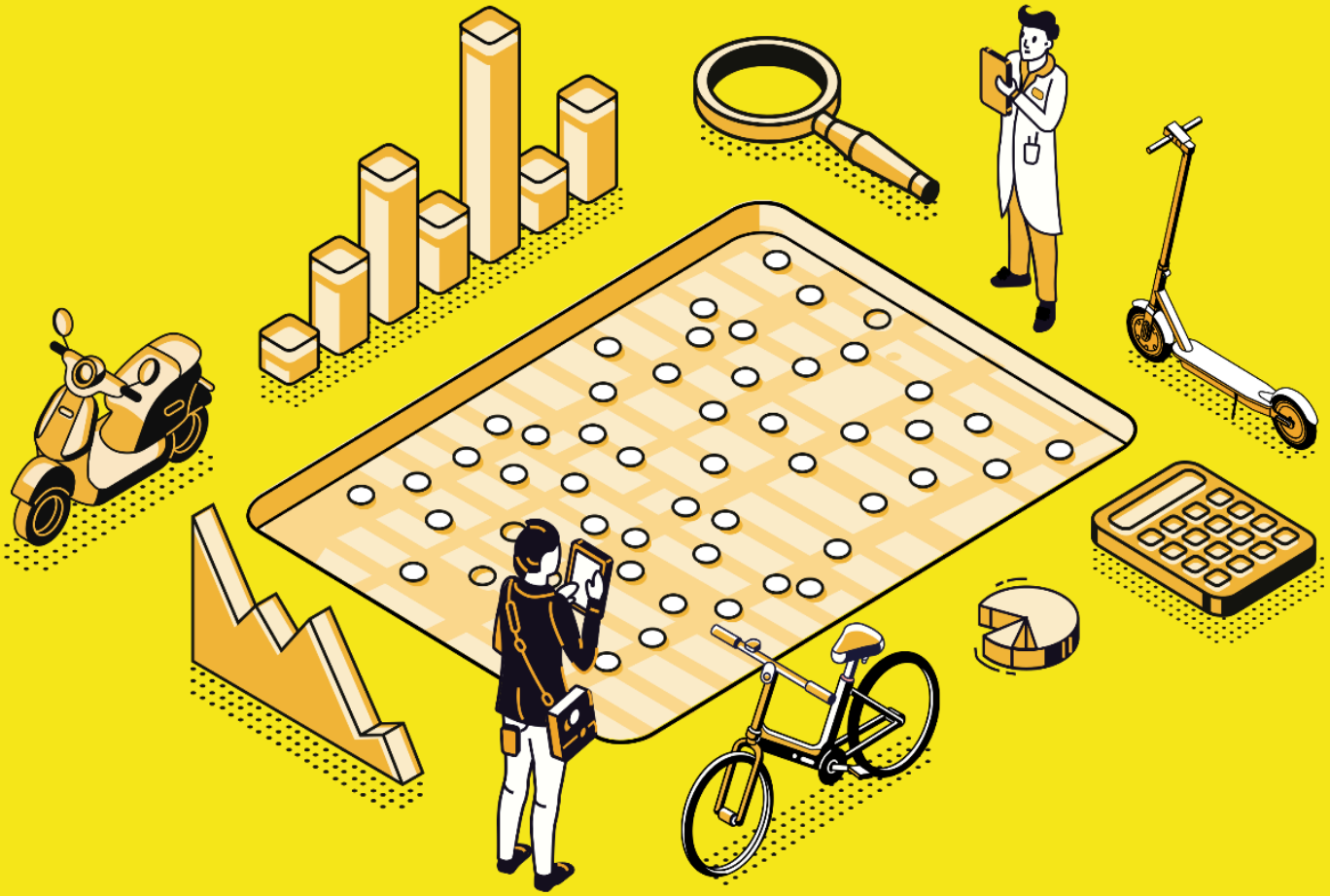

MassDOT Roadway Safety RFI

Response submitted by Vianova, LLC

VIANOVA

MARCH 2024

Executive Summary

Vianova is pleased to provide the following response to MassDOT's road safety RFI. Herein, we provide insight into our company's approach to solving road safety problems through the lens of Area of Interest 2: Movement Telematics. We also suggest some ways MassDOT could potentially improve its use of data to identify and track road risk across the Commonwealth, particularly where Vulnerable Road Users are concerned.

Vianova is the leading provider of data-driven mobility management solutions. Today we work with more than 60 city and regional governments around the world. Our diverse team of 33 people hails from 16 countries and brings to bear a range of professional experience, including transportation planning, urban planning, data science, software engineering, and product development. Since our founding in 2019, we have established ourselves as a trusted partner to governments and mobility companies alike.

In the past year, we have expanded our use cases to include road safety planning with the introduction of Risk Aware, a data product built on vehicle behavior and VRU data that enables the identification of areas of increased risk, and the tracking of intervention impacts. We have likewise expanded our software's capabilities to enable the in-depth querying and collation of disparate data sets.

We welcome the opportunity to provide your team with an overview of our products and services, and to answer any questions that arise from your review of this proposal. If you have any questions, please contact:

Jonathan Lachance, Head of Market Development, North America
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Thank you for your kind consideration, and for your commitment to improving road safety in Massachusetts.

Sincerely,

Thibault Castagne, CEO
Vianova, LLC

Table of Contents

1. Research Questions

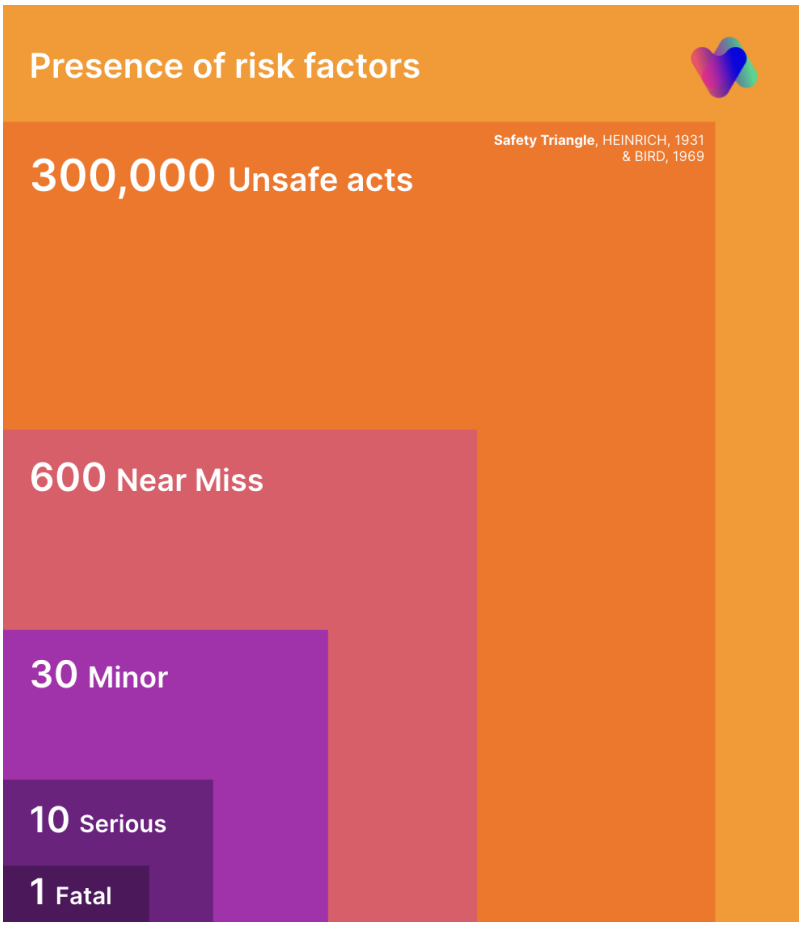
1.1. Is there a geographic correlation between different types of poor driving behavior (speeding, distraction, harsh braking, etc.)?

Vianova typically works with three different risk factors related to driving behavior as part of its risk evaluation - the frequency of overspeeding relative to total traffic (what share of vehicles are going above the speed limit?), the intensity of that overspeeding (by how much over the speed limit are overspeeding vehicles traveling?), and heavy braking. In general, speeding behavior and heavy braking are not strongly correlated to one another in the precise geographies we typically use to evaluate road segments (approximately 100 yards). Additionally and unsurprisingly, harsh braking tends to be more frequently associated with intersections, while speeding tends to be associated with straight-away segments.

Roads in Central London with heavy braking and speeding both appearing in the top 1/5th of all roads

Risk factors are not necessarily strongly associated with fatal collisions. However, this fact is primarily a function of the massive disparity in the volume of risk events to the number of collisions. For this reason, it is important to use risk events as a

precursor of crashes. The more risky behaviors we observe, the greater the chance that crashes will result.



Heinrich's Theory of Accident Causation is widely applied to understand the ratio of risky behaviors to serious crashes and fatalities

1.2. How might we use telematics to inform traffic signal timing and phasing to improve safety for Vulnerable Road Users?

Historically, signal timing is managed through a simulated model of traffic behavior, validated using camera or loop detectors at certain intersections. However, the distinct advantage of telematics data is a ubiquitous, plentiful data source not only at the areas where detectors have been installed, but at virtually every potential location.

Telematics provide granular insights into vehicle behaviors, enabling transportation planners to better identify and analyze patterns of risk across a road network. These

deeper insights can support the implementation of more precise, need-based adjustment of traffic signal timing and phasing.

Vianova's Risk Aware road safety data product includes Connected Vehicle Data, Vulnerable Road User data (generated through the observation of pedestrians and cyclists via connected mobile tech), and historic crash data to provide a comprehensive assessment of risk across every road segment and intersection in a region. (We can also enhance the Risk Aware model with additional relevant geospatial data sets coming from the public or private sector). Vianova delivers Risk Aware to end users at their preferred frequency, as near-real time updates or as summary data sets covering days, months or years. Vianova's telematic data also covers a substantial portion of drivers - depending on the market, our data is representative of between 12-20% of vehicles on the road. The data can be filtered to focus on specific vehicle types (passenger, light truck, etc.) or fuel types (gas, diesel, electric), and day of week or hour of day. Because this data can be analyzed across a broad range of parameters, end users are able to derive precise insights into vehicle behaviors at the road segment level. Looking at cumulative historical data reveals high-level patterns in vehicle behavior, and real-time data can provide insights into emerging issues as they unfold.

Vulnerable road user telematics enables transportation planners to better understand the relative risk of roads in different locations and even at different times. For example, two identically configured intersections may experience similar high-risk driving behaviors, but the presence of more VRUs at one of these intersections would suggest that it is a riskier location than its twin. A single road segment may demonstrate fluctuations in risk over the course of a single day; for instance, the street in front of a school may see its risk go up during drop off and pickup times because of the increased volume of vehicles and pedestrians.

Because telematics provide a greater degree of precision to planners' understanding of risk across vehicle type, geography, and time, planners can use these insights to implement signal timing/phasing adjustments validated by empirical data. Because we are able to provide telematic data at a large geographic scale, this data can be used to understand regional traffic patterns, enabling the enhancement and harmonization of cross-jurisdictional signal coordination.

Pedestrian events in Central Paris demonstrate the relative density and need for dedicated infrastructure and signal phases

1.3. How can we improve the MassDOT method for VRU risk scoring?

MassDOT currently assess VRU risk using a combination of roadway attributes and community-based factors that are associated with higher crash risks. With the exception of the vehicle volumes, however, the risk scoring is based entirely on either the presence or condition of infrastructure or the sociodemographic characteristics of the surrounding neighborhood. While both of these data categories are incredibly valuable, they may not provide the precision necessary to prioritize effectively.

We suggest that the roadway attributes incorporated into this analysis do not necessarily reveal the pieces of the safety puzzle that are most impactful to the VRU experience. Other roadway attributes such as speed limit, crosswalk distance v. crosswalk timing, the presence (and functionality) of streetlights are dynamic and may play an important role in determining safety outcomes.

Vianova would also posit that many of the community-based factors are proxies for two major factors: density and poverty. Denser areas are generally higher-risk by virtue of sheer numbers - odds are higher that something will happen if there are more people and vehicles interfacing. And poor areas tend to have higher risks because of the larger proportion of pedestrians relative to cars, as well as a higher likelihood of underserviced or insufficient infrastructure.

Unfortunately, knowing that an area has a higher proportion of service industry workers sheds little light on the specific problems that put those workers at risk when they are VRUs. And, as illustrated on page 16 of the 2023 Massachusetts Vulnerable Road User Assessment, overlaying all of these factors in dense areas like Boston and Cambridge does little to help screen out portions of the road network that are lower risk, or help prioritize the higher-risk ones.

While Vianova wholeheartedly supports an equity-informed approach to improving safety outcomes, there are several reasons we would urge MassDOT to enrich its VRU risk scoring with telematic data. First, by observing patterns of vehicle behavior across geography and time, and correlating those with a richer array of roadway attributes (as discussed below), MassDOT will be able to understand which of those attributes are correlated with dangerous driving behaviors (if at all).

And finally, it is critical to use cellphone based telematic data to identify where disadvantaged travelers are going, not just where they are coming from. Even acknowledging inherent biases in cellphone based data, it is still valuable to understand that travelers are at risk even in areas outside their home neighborhoods- and that improving safety in a high income area may, in fact, improve safety outcomes for disadvantaged travelers.

2. Other Questions

2.1. Demonstrate that you can conflate your data insights to MassDOT's road inventory file (see MassDOT Assets below) and to Open Street Map or describe in some detail the process required to do this for roadway segments and the estimated time involved to do so.

As part of Vianova's standard data integration process, we will typically conflate all road safety datasets to the OpenStreetMap's road database, in order to render the different measures aggregated at the road segment level (see this Knowledge Base article for reference). In the instances where clients provide their own road database, we can similarly integrate any other dataset with that road database for visualization purposes in the different features of the platform as demonstrated below.

We have set up a Vianova demo platform environment focussing on Essex county, in order to exemplify the key steps of the process:

1. Data Integration: we have exported the following MassDOT data sets into the Vianova platform:
    - Road Inventory 2021 from the MassDOT open data portal
    - 2023 crash data from the Impact crash data portal
    - Municipalities boundaries from the MassDOT open data portal

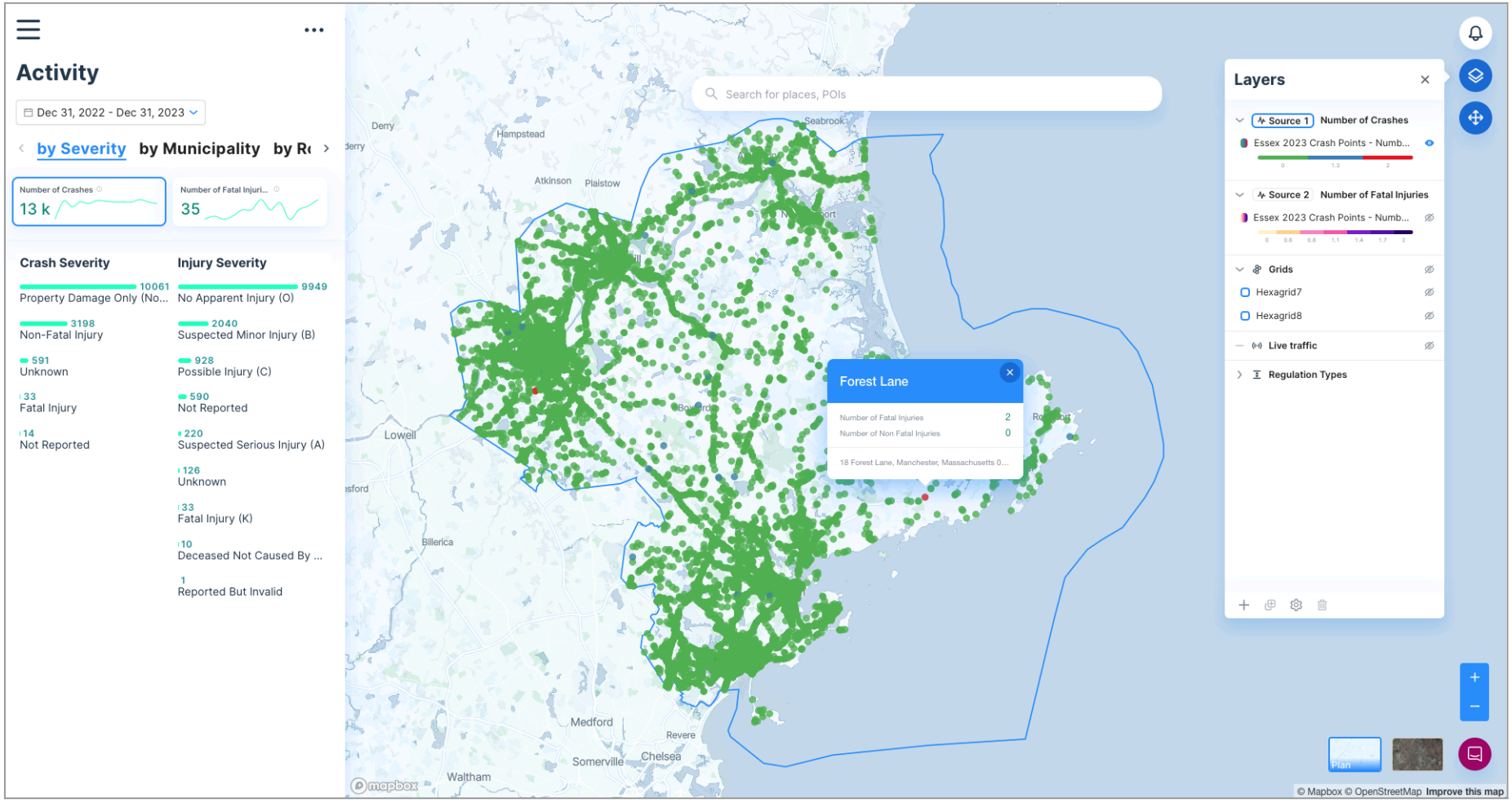
    Using the platform's data import features, the different data sets have then been integrated into the platform. Please note that the import features can be used directly by MassDOT users (see this Knowledge Base article about importing zones for instance), but your dedicated Customer Success Manager will integrate all the required data at the time of onboarding.
2. Data Rendering: in order to visualize the data, we then leveraged the custom layers in our platform's Activity page (see this article) and the Reports page (see this article) to generate sample visualizations. Again, these are self-serve features, but your dedicated Customer Success Manager will configure the platform according to your requirements.
3. Customization & Formatting: finally, each of the visualizations have been customized and formatted leveraging the numerous platform capabilities that enable any user to cater for their specific requirements:
    a. Amend titles, descriptions and tooltips
    b. Compute custom metrics

c. Create a variety of chart types
d. Format size and color
e. Define specific filters and controllers

Please see the sample visualizations below, as well as the different features of the platform in action in this short demo video.

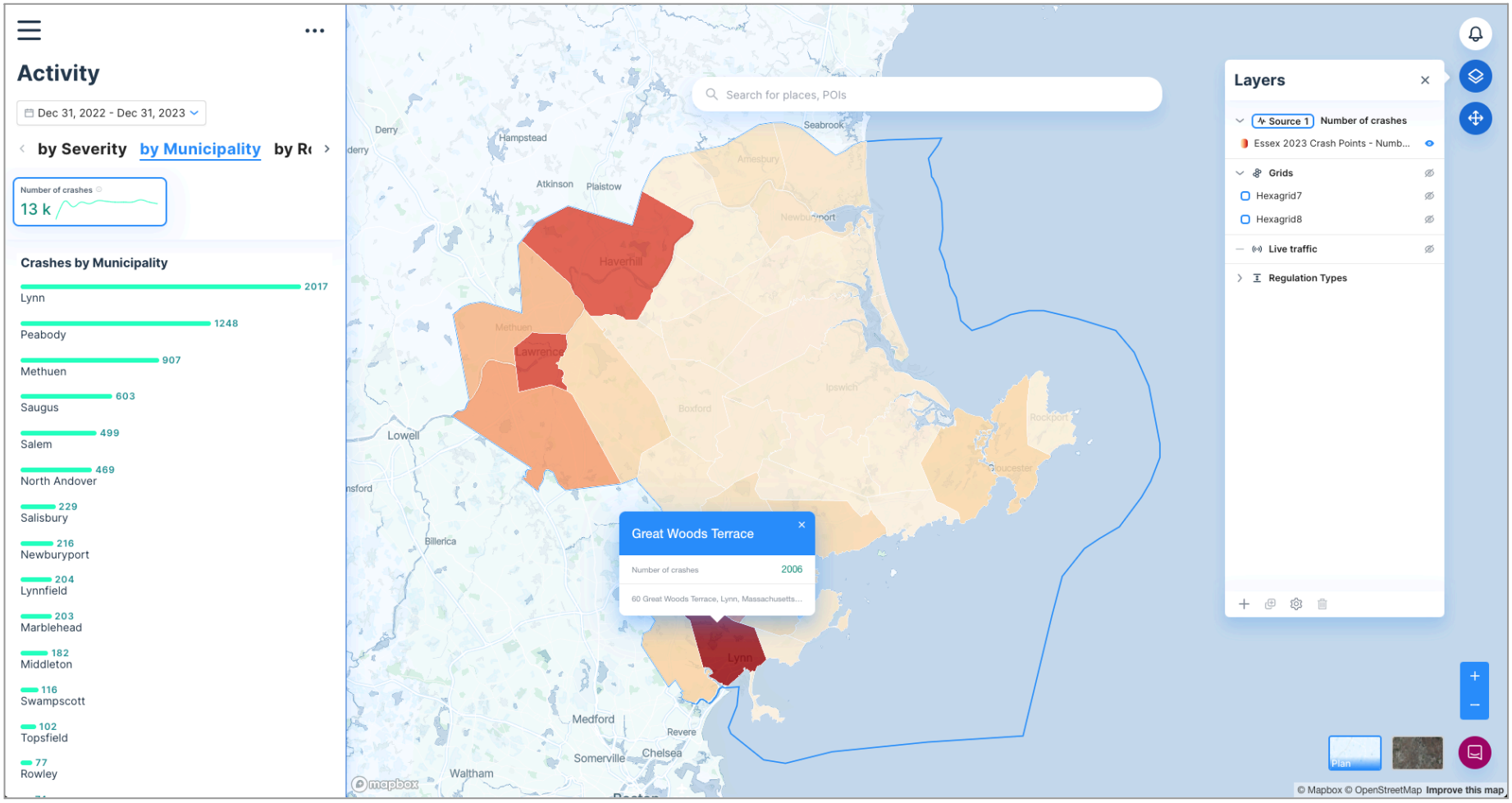
Crashes by Severity

This visualization in the Activity page shows all the 2023 crashes in Essex county as dots on the map. The color legend has been customized to show the crashes that have resulted in fatal injuries in red. The dots can be filtered using the Crash Severity and Injury Severity parameters on the left panel.



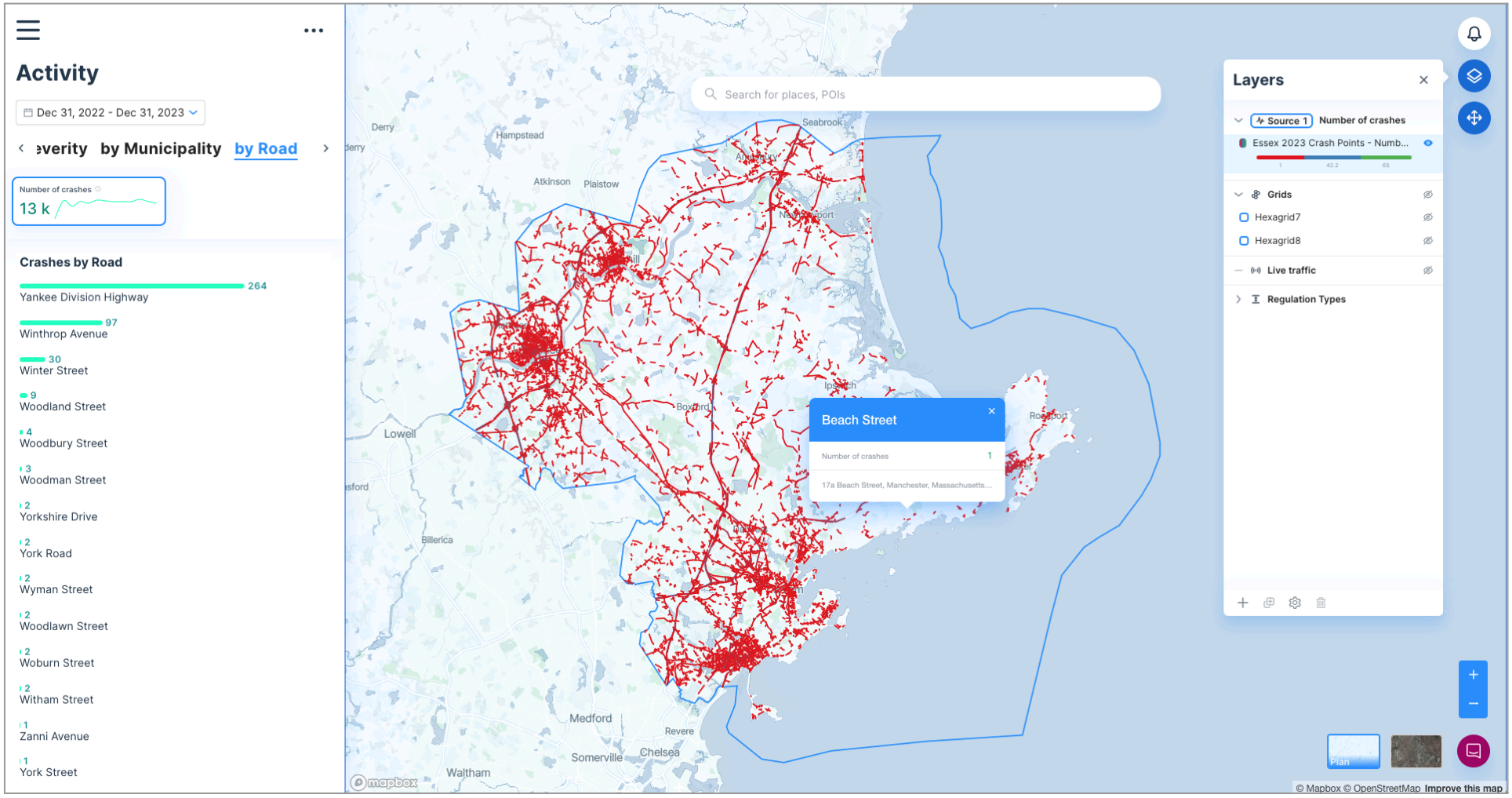
Crashes by Municipality

In this example, the 2023 crashes are aggregated and visualized by municipality zones with a color legend based on the number of crashes. The municipalities are sorted in descending order of number of crashes in the list in the left hand side.



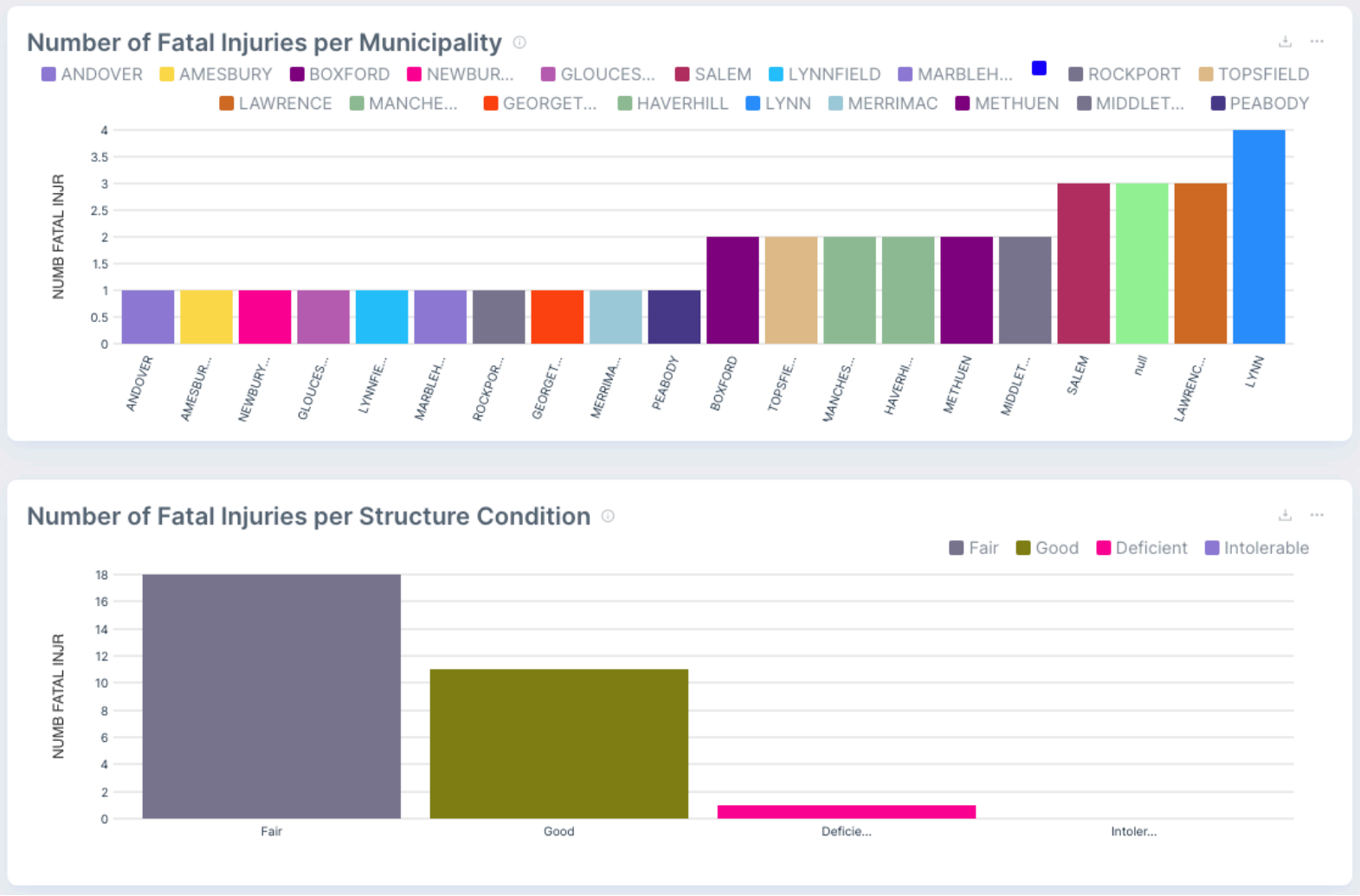
Crashes by Municipality

This visualization highlights all the road segments (based on the MassDOT road inventory, as described above) where crashes have occurred. Clicking on a road segment will indicate the number of crashes for that segment in a tooltip.



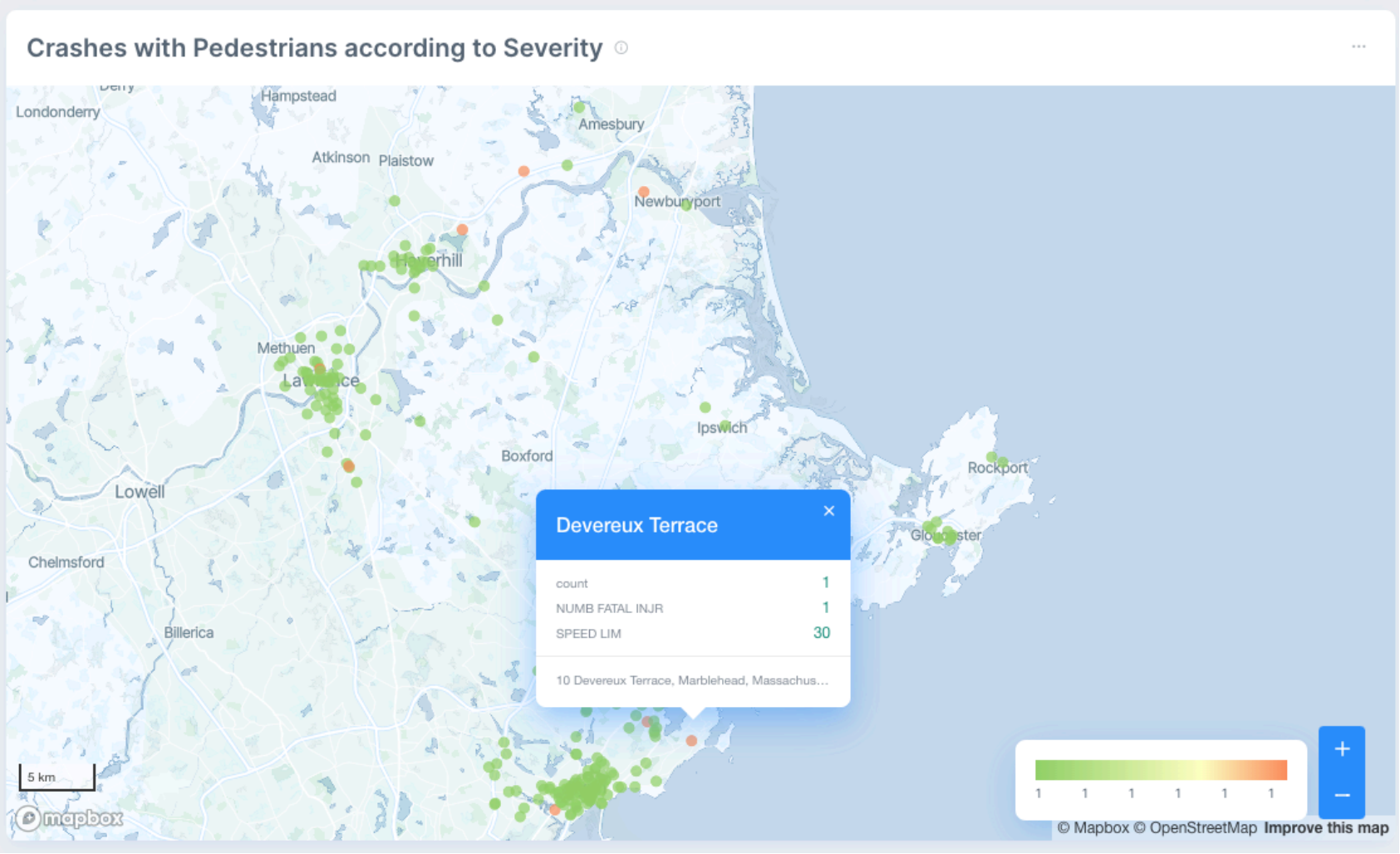
Number of Fatalities

The below charts were produced using the Reports feature of the platform. It shows the number of fatalities according to two dimensions: municipalities and structure condition.



Crashes with Pedestrians

Diving deeper in the data, this map rendered in the Reports feature shows the number of crashes that have involved pedestrians. The dots colored in red indicate crashes that have resulted in fatal injuries.



2.2. Please describe how you protect and preserve privacy with your product.

Vianova primarily serves public transport authorities and various government entities. Given our role, we manage sensitive and business-critical information on a daily basis for over 60 authorities whose data management practices are under more scrutiny than private enterprises. Consequently, ensuring the security of our platform is fundamental to our operations and we have implemented stringent processes so we can lead our industry by example.

We are proud to be **SOC 2 Type 1 certified.** We are also currently in the process of getting our SOC 2 Type 2 certificate and expect this certification to be in place before the start of the project in May. In addition, as a company founded in Europe, we have robust procedures in place to ensure we are **compliant with European General Data Protection Regulations**, often seen as the world's most rigorous data protection regulations, since our inception.

This section provides an overview of the standard platform security practices we have adopted at Vianova.

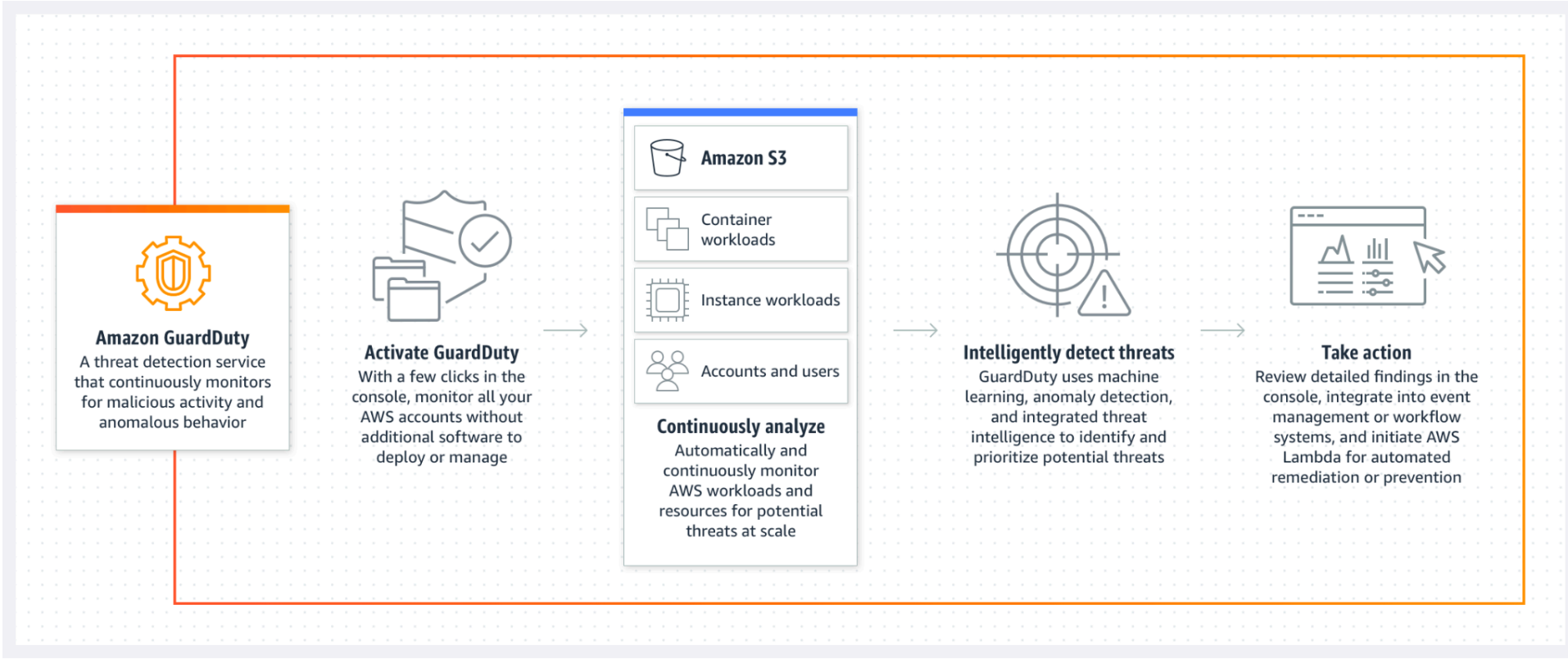
Environment Isolation

At Vianova we apply strict environment isolation to nullify the risk of unintentional data overlaps and system interference. Our production environment is considered as a sanctuary where nobody should be able to access outside of automated processes. By default we apply the bastion strategy, meaning that the platform is only accessible via the protected HTTP endpoint that is the only exposed and controlled gate to the platform from an internet connection.

We use an (AWS) Organizational Unit in order to physically separate environments, deployments and access.

Active Threat Detection

So that we can be proactive in detecting threats and enhance data protection, we have an active and continuous malicious network activity detection based on fingerprinting and usual access patterns. We have activated Amazon GuardDuty threat detection service.



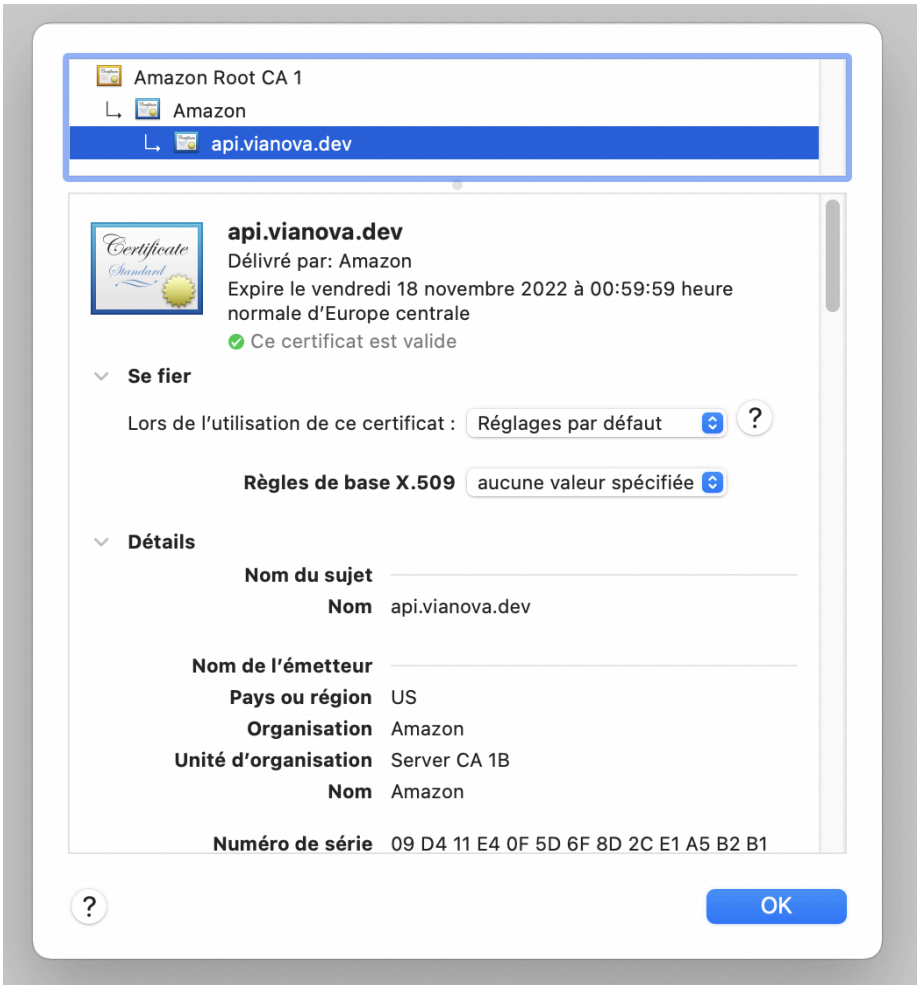
Amazon GuardDuty Process

Securing data - at rest and in-transit

We have implemented strict encryption procedures for data both at rest and in-transit.

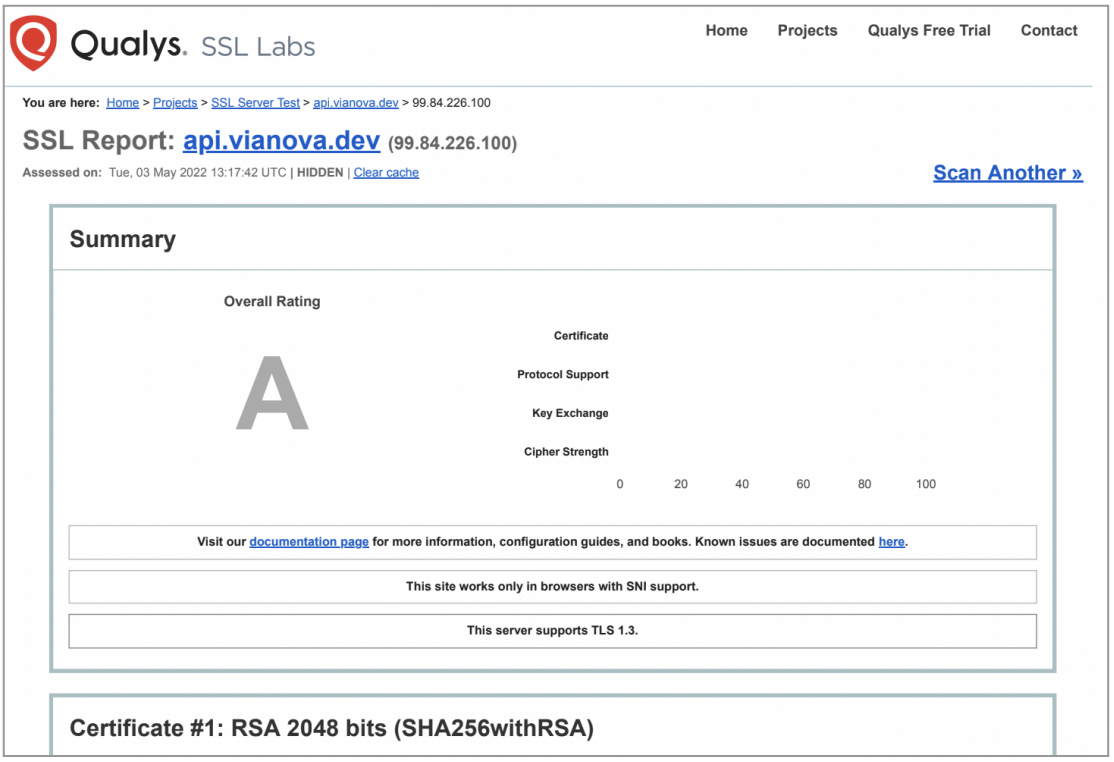
Data at rest is by default encrypted in the different storage that we have. We use Vianova dedicated certificates to ensure maximum security.

For data in transit, by default, all communication inbound and outbound from the Vianova platform is encrypted using the latest security layers. We use standard and public certificates for our HTTP endpoints and accept TLS 1.3 only



Valid SSL certificate

Independent analysis of SSL certificates quality shows an A rating and TLS 1.3 support.



Analysis of SSL certificates

Data access

Vianova has a process in place to ensure access to data is only provided to the appropriate personnel.

Inside Vianova

Accessing data is restricted to mandatory personnel. All data is backed up in external platforms that are not accessible to Vianova employees. This setup ensures that in case of data loss, we are able to fully recover all the needed information. All data access requests are logged via an audit trail and protected in a separated organizational unit.

Outside Vianova

All access outside vianova is done via a unique entry point that is secure and protected with multiple layers of security:

1. DDOS protection
2. WAF protection
3. TLS

4. Oauth2

Please refer to the following public document for more information: Secure login at Vianova (shareable)

Platform attack mitigation

The platform is protected by 1 unique public entry point, HTTPS API, protected with multiple security layers:

1. Business data access requires an account on the platform. Accounts are actively monitored and any suspicious activity will be reported or even blocked on Authentication.
2. Our cloud provider actively mitigates Layer 4 TCP (DDoS) attacks.
3. Our API is protected by TCP layer 7 security equipment. We have an active Web Application Firewall that will block massive requests and apply rate limiting.

Operational Security

Individual access

All access to the platform and toolings are made with the maximum security level. All our accounts are individually attributed with 2 Factor authentication (2FA) to prevent brute force attack.

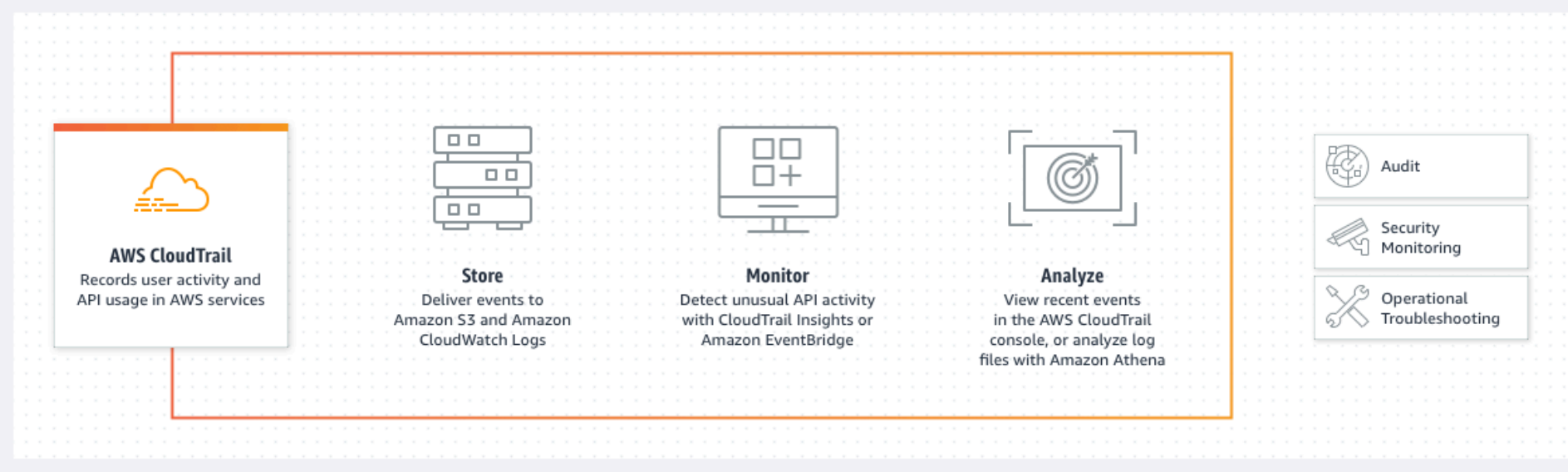
RBAC

At Vianova we apply Role Based Access Control to access technical environments. By default an employee will have no role. He will be able to access resources by endorsing a specific role via our SSO platform linked to our cloud provider. It reduces the pain of managing technical accounts or shared secrets. It's one unique way of accessing a particular service or environment, secured with 2FA.

Vianova can set up customized role types that restrict access to personal shared mobility user data.

Auditing

Vianova implements both automated and manual auditing processes to ensure traceability. Regarding automated auditing, All actions executed on the technical side of the platform are logged in the audit trail so we are always able to trace individual actions in our cloud infrastructure. Additionally, Vianova's has been already audited and tested by external and internal auditors.



AWS Cloudtrail Auditing

Onboarding and Offboarding Process

We run a strong process on onboarding and offboarding to ensure that all individual access has been removed to people that are not working at/for Vianova anymore.

Continuous security

We apply secure coding practice. Our code is continuously scanned to detect :

- Risky coding pattern (SAST)
- Depencies security issues (CVE)
- Containers are audited and scanned at build
- Secret detection
- Platform is audited every month (Prowler)

Those security assessments are running continuously via our CI/CD pipelines in order to ensure we always deploy secured applications and code.

For more details please refer to our secure coding guide.

2.3. Please explain your business model or models for working with government transportation authorities.

Vianova's cloud-based SaaS software platform is purpose-built to support a range of transportation policy and planning use cases. Our mission is to provide government agencies with tools to convert data from mere numbers on a spreadsheet into actionable intelligence. Vianova is proud to serve more than 60 government transportation authorities around the world, including small cities (Culver City, California), large cities (Transport for London), whole regions (various French departments) to whole countries (the Netherlands).

Our approach to supporting transportation agencies is built on the following guiding principles:

- Mobility technology is changing faster than governments can procure it: The rapid expansion of transportation modes and their technological underpinnings holds immense potential for cities to address climate and equity goals, reduce traffic, improve safety for all road users, and optimize the use of

valuable public space. However, the pace at which these new technologies arrive on the scene can leave government agencies racing to adopt or regulate them before they become obsolete. That is why Vianova built our platform to be "future proofed" - capable of ingesting and analyzing any data set or standard.

- Customization is a cornerstone of our service: No two jurisdictions are exactly alike, and we trust that our government customers know their jurisdictions better than we do. That means that we customize our platform and our data products to reflect our end users' needs, whether that means building bespoke reporting features or adjusting the weighting of our models to better reflect local circumstances.
- Solve first, sell later: While we are in business to make money, the Vianova team is composed of planners, policy nerds and data scientists who are deeply interested in our customers' challenges. Our sales process prioritizes finding the right solution for the problem and budget.
- We're in it for the long haul: While our product team is always going at top speed, we are familiar with the pace of procurement processes. Our team (including our sales people) will work with your team in advance of contracting to develop the optimal solution for your needs. We are happy to offer short-term pilot projects to provide proof of concept in advance of any major procurement.

Vianova offers products and services at different levels to ensure that the agencies we serve get the most out of our platform while being mindful of your budget:

- Platform access - Our platform enables you to manage a range of projects covering different use cases in a single interface. Whether you are working on a single project in one jurisdiction, or multiple projects covering the whole Commonwealth, our platform lets you set access controls for different team members or organizations.
- Data products: We offer several standardized data products to support road safety and logistics use cases. We can also create customized data products. In the context of this RFI, we would be able to create a consolidated data set combining telematic data, vulnerable road user data, and the data sets that MassDOT already uses in its road safety planning efforts. Depending on your needs, project scope, and budget, you can also purchase "right-sized" data sets to support a deep-dive into data from a specific timeframe. Our platform is also designed to let you add data to a project as needed.

- Customer Success: As part of your SaaS subscription you will benefit from our comprehensive Customer Success program to ensure that you achieve your objectives according to schedule and that you derive optimal value from our solutions. The program includes:
    - Full onboarding project management, data integration, platform configuration and user training;
    - Access to our core services: knowledge base, upgrades, bug fixes, product updates and technical support;
    - A dedicated Customer Success Manager who will work with you on driving your success plan and organize regular business reviews, operational touchpoints and user focus groups.

Vianova Customer Success Program

Core Services
Knowledge Base
Upgrades & Bug Fixes
Product Updates
Technical Support

Customer Success
Dedicated CSM
Success Plan
Periodic Business Reviews
Regular Touchpoints
User Focus Groups
Custom Platform Config.

Onboarding
Project Management
User Training
Standard Data Integration
Standard Platform Configuration

- Professional Services: If your project requires deeper platform customization, data analysis, advisory or bespoke data products, we can provide additional professional services at an hourly rate.

Pricing for data products and platform access are based primarily on your jurisdiction's population, ensuring that our products are accessible to jurisdictions of all sizes. We offer discounts for multiple jurisdictions that want to pool resources to stretch funds.

2.4. If relevant, please share how MassDOT would be involved in developing the product or if there are any opportunities for customization.

Vianova believes that its users represent the best source of information on how the product should evolve. There is a robust, trans-atlantic community of users who can both learn from each other and also shape the direction of the product. Vianova would welcome MassDOT's participation in our formalized and informalized user feedback sessions, working directly with our Product Development team to shape the direction of the product and provide feedback about beta features.

In order to ensure that MassDOT has a direct hand in implementing the data products and analyses that make the most sense for the Commonwealth, Vianova would convene a stakeholder group of Vianova team members and key MassDOT staff that would undertake the following activities:

- Define project KPIs and develop a quarterly project roadmap
- Pool data resources - MassDOT and Vianova would align on the data sets to include in the risk model. Vianova would handle data harmonization and custom data set development
- Model customization: Together, MassDOT and Vianova would identify key metrics for inclusion in the risk model and Vianova would adjust metric weighting per MassDOT specifications.
- Dashboard development: Vianova would develop visualization and reporting of KPIs for key audiences (internal teams, local teams, public, executive, etc.) per MassDOT's specifications. Vianova has a wide array of templates based on our work with other customers that we can use as a starting point,
- The working group would participate in quarterly check-ins that would include:
    - Roadmap review: Discuss results of work completed; revisit incomplete work
    - Customer feedback: Product asks and CS, product feedback
    - Data monitoring: review recent data trends for statistically significant shifts in risk or specific risk factors, and adjust the model accordingly

Additionally, MassDOT would gain access to the broader Vianova user group, including some of the most successful and innovative cities and regions in Europe. Clients such as Transport for London, Lyon, and Amsterdam provide regular feedback on product requirements in order to shape our offerings. This unique, trans-atlantic perspective allows MassDOT to learn from peers using Vianova's products and services to deliver safer and more sustainable transportation options in globally-renowned programs. Vianova conducts regular peer-learning sessions in an effort to expand knowledge of best practices, provide feedback for the product roadmap, and interact with both Vianova's in-house experts and our external technical advisors. MassDOT would gain access to this community, as well as an invitation to regularly participate in the collaborative semi-annual product roadmap planning process.

2.5. Please indicate the monthly volume of drivers/vehicles reflected in your data for Massachusetts roadways and the estimated percentage of drivers out of all of those on the roadway represented in your dataset.

As a multi-source data aggregator, Vianova works with automotive manufacturers, telematics companies and location based data providers to collect anonymised traffic and driving behavior data.

Our latest count of monthly active drivers in the Commnwealth of Massachusetts is **900,000**. Based on data available on the FHA website, we can collect and process data from approximately **17% of all drivers** in the Commonwealth.

2.6. Indicate if you have a demonstration with Massachusetts-based data that you would like to present in a workshop with MassDOT staff. Please include the topic you'd like to address and a few sentences on what you want to share.

Vianova would like to provide a demonstration of how we would approach assessing risk in the Commonwealth, with a focus on one city. In order to remain lean, Vianova's business model works on a "just in time" delivery of the raw data necessary for creating data products such as Risk Aware. We are happy to produce a sample environment using data within the Commonwealth if requested, and have also demonstrated in prior answers our technique for visualizing and analyzing publicly available data in our platform.

We are additionally happy to share results from some of the global leaders in road safety which have worked with Vianova to develop our tooling including Zurich, Lyon, and Transport for London.