WINTER MAINTENANCE

Smarter, Made Simpler: How Fleet Telematics Help Drivers Safely Navigate Through Winter

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Challenges And Demands In Winter Operations

While many are enjoying the fun of the winter season, a group of people are working around the clock to make sure our transportation network can run smoothly. In Canada, winter is often accompanied by rough weather conditions like snow blizzards, which create extraordinarily challenging conditions for drivers, cyclists and pedestrians. The snow and ice built up from winter storms pose significant safety risks requiring winter operations teams to do everything they can to mitigate risk and ensure safety for all.

For winter operation fleet managers, the pressure is high. They not only need to mobilize available resources and assets to clear the roads efficiently but also have to consider other operational factors, such as keeping costs low, minimizing environmental footprints and ensuring operational transparency to the public. It's hard to get everything right, especially giving the fact that the team needs to complete all the work within a short time frame. The public holds high expectations for winter operations and expects the roads to be cleared before rush hour. Given the complexity of the urban road network, fleet managers must establish a well-organized plan and workflow to service all the road segments in an orderly fashion. Luckily, technologies can play a pivotal role in every step of the operation to help lessen fleet managers' stress and workloads.

Telematics is one of the leading technologies available to help fleet managers handle the most challenging tasks. It provides all-around support that assists fleet managers in monitoring real-time vehicle location, status, health, drivers' performances, dispatching and rerouting vehicles, managing compliance and accountability issues, responding to liability claims and providing full maintenance and back end support to the fleet. Telematics is not an isolated technological component but rather a well-connected system that enables wireless communication between different hardware parts and software platforms. We are going to unveil in detail how telematics solutions provide targeted support to tackle fleet managers' key pain points in the winter service field. The telematics innovation will also give us a glimpse into what the future of winter service operations will look like.

Telematics: Your Challenges Answered

We will look at a few key areas where the vast majority of winter service fleet managers have previously encountered issues and difficulties in dealing with winter weather. In each of these fields, telematics offers unique solutions that conquer some of the fleet manager's biggest headaches. By connecting each of the smart hardware and software pieces through the internet of things (IoT), telematics creates an ecosystem that streamlines the winter service procedures from start to finish.

Visibility

Fleet managers cannot effectively monitor and manage operations without having first-hand information about where each vehicle is. Countless fleet managers have reported that lack of visibility to the entire system hinders their ability to respond to unexpected service disruptions and the effectiveness of resource allocation. Without a real-time visual display of the asset location and status, it will be difficult for fleet managers to know which segment of roads has been serviced and the current progress of snow clearing work. Fleet managers then have to frequently communicate with each operator of each asset to understand their progress and confirm their location - a highly unproductive and time-consuming requirement.

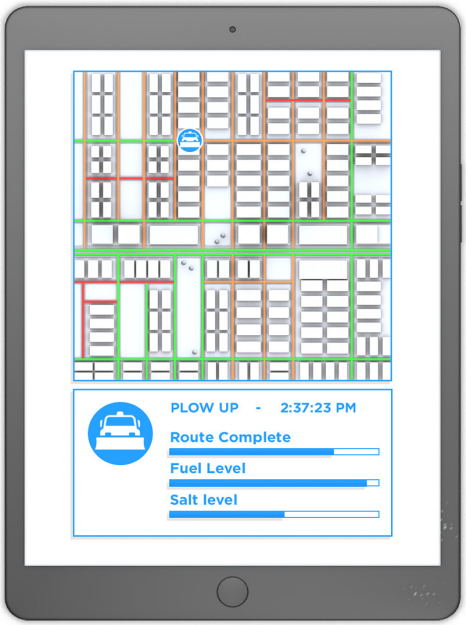
As the urban road networks become increasingly complex, especially in major metropolitans, fleet managers cannot afford to miss any information during peak operational times. Any single issue, if not being resolved promptly, will cause delays to entire operations, generating backlogs that may seriously affect public travel experiences in winter.

Thus, there is nothing more important thanproviding fleet managers with a clear and convenient all-in-one real-time trackingmap that presents all the critical information that fleet managers need.

Solutions

Telematics is the foundational tool that makes high-precision real-time tracking possible in the real world. It is capable of handling some of the most demanding tasks and takes the whole visibility aspect of the operation to a new height. The customized mapping tool is the telematics' answer to address winter service fleet managers' greatest concerns. The high GPS update rate of the telematics system guarantees an ultra-low-latency asset tracking experience, enabling fleet managers to follow the entire operation, a specific asset or a group of assets with great ease. Through adopting an intuitive and easy-to-identify colour-coded framework, the map can show when roads have last been plowed or salted during the winter. These are necessary and valuable information for fleet managers as they can make informed and data-driven decisions of whether to deploy resources to plow or salt specific road segments again based on the snow accumulation and the last service time. This move will dramatically drive-up public satisfaction as it helps to keep the community roads free of ice and snow throughout the day.

With a modern mapping tool and a colour-coded user interface, fleet managers have the ultimate view of the fleet status and are always kept up-to-date on all events.But the power of telematics can go far beyond this. A core feature of the telematics system is providing an unrivalled level of customization to the fleet managers. Winter service operations, unlike any other industry, involves the use of a vast number of specialized equipment, and asset operators must adhere to a broad set of unique rules and guidelines.

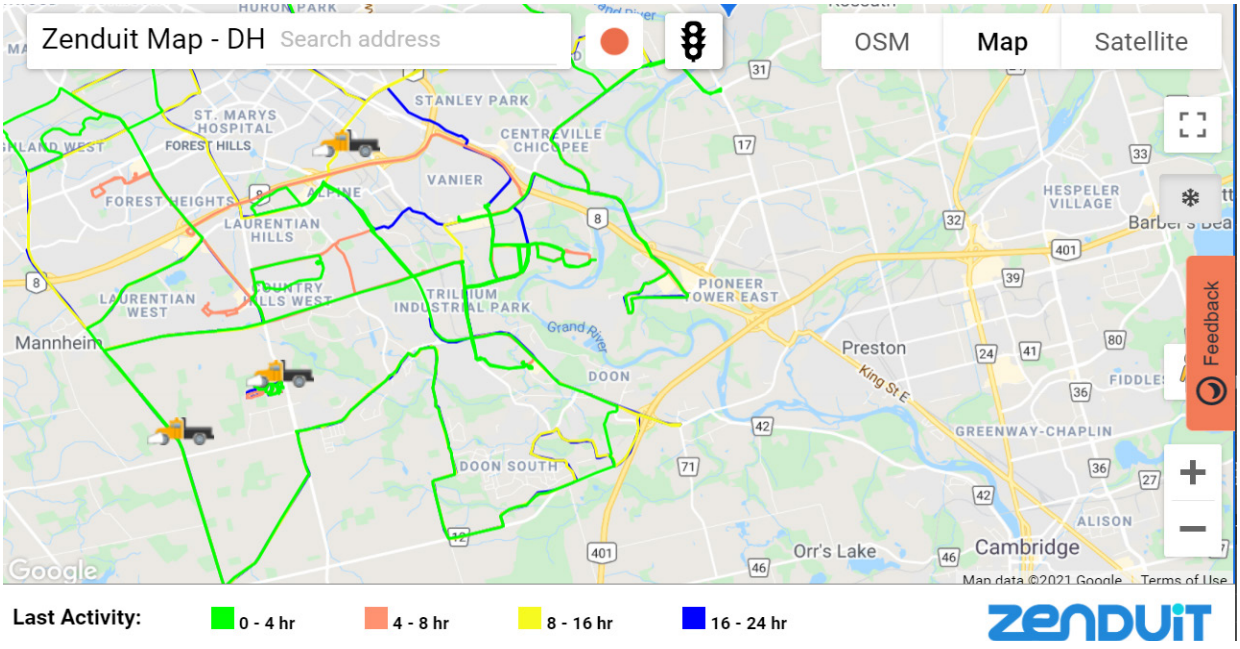


That's why fleet managers want a highly customizable system so they can edit any tracked rules, service zones and compliance standards to design the system that works best for them. Telematics solution providers respond to the fleet managers' demands by incorporating an easy-to-use map builder tool into the mapping and tracking system, which greatly expands how fleet managers can use and do with the platform.

The map builder also lets fleet managers decide which specific metric they want to track and display on the map, so they can focus on the metrics they value most rather than being distracted by other non-essential information. We have put together a list of a few things that you can edit and customize in the map builder:

- Fleet managers can divide the service areas into multiple work zones and easily filter out assets currently located in any designated zone
- Fleet managers can develop tracked rules, so any vehicle's rules violation will be recorded and reported to the fleet managers
- Fleet managers can sort out assets by assigned routes, giving them a clear indication of whether the asset operators follow their assigned routes and which routes require extra resources to be deployed
- Fleet managers can select any assets or a group of assets to track their historical trips, vehicle status, equipment status and other vehicle health metrics, such as engine health, tire pressures, etc.

What is listed above are just a few examples of what fleet managers can do with the map builder tool.



The option is truly limitless, and it's up to each winter operation fleet manager to customize the map into the one that is most useful and productive for them.

During the operation, a common scenario that fleets are at risk for is unexpected equipment breakdowns. In the winter operation field, speedy response to an unexpected situation is crucial in minimizing the disruption's impacts. After an unexpected event happens, the communication between asset operators and fleet managers is key as fleet managers need to quickly understand the nature and severity of the issues and develop proper solutions in addressing them. However, in many cases, miscommunication between operators and fleet managers impedes the ability for appropriate actions to be taken. This is where telematics can assist in making these communications effortless and problem-free. The asset operator can simply report the issue through an onboard telematics device or their mobile device. The message will be instantly transferred to the fleet manager's end and automatically generate an alert on the operation maps. Fleet managers can also get a notification on their mobile device, so they won't miss any critical event on the go.

The unexpected event reporting procedures can be further improved and optimized when connecting telematics systems with the vehicle's onboard sensors. Any equipment malfunction or abnormal reading can be automatically captured by the sensors, which directly triggers the alert and automatically notifies both asset operators and fleet managers. Through automating the entire reporting procedures, fleet managers can receive the most up-to-date information at the earliest time, which gives them opportunities to adjust services and reallocate resources to fix any issues. In the winter maintenance field, time is money, and ensuring issues are being addressed promptly is critical in minimizing service delays and improving overall operational efficiency.

Dispatching & Navigation

At the heart of the fleet operation is dispatching. In many ways, fleet dispatching can be decisive to the operations' efficiency, productivity and costs.

How to implement complex winter maintenance operations in an organized fashion while deploying the appropriate level of resources to each area, is a key consideration for fleet dispatchers. Prior to adopting telematics solutions, fleet dispatchers have repeatedly experienced difficulties in planning out the work zones and unit areas. The lack of digitalization in the operation planning phase makes it difficult for dispatchers to communicate and demonstrate the operation plan to each asset operator. It will also be an immense challenge to provide operators with instructions on topics such as which route they should take to complete the work in the shortest time.

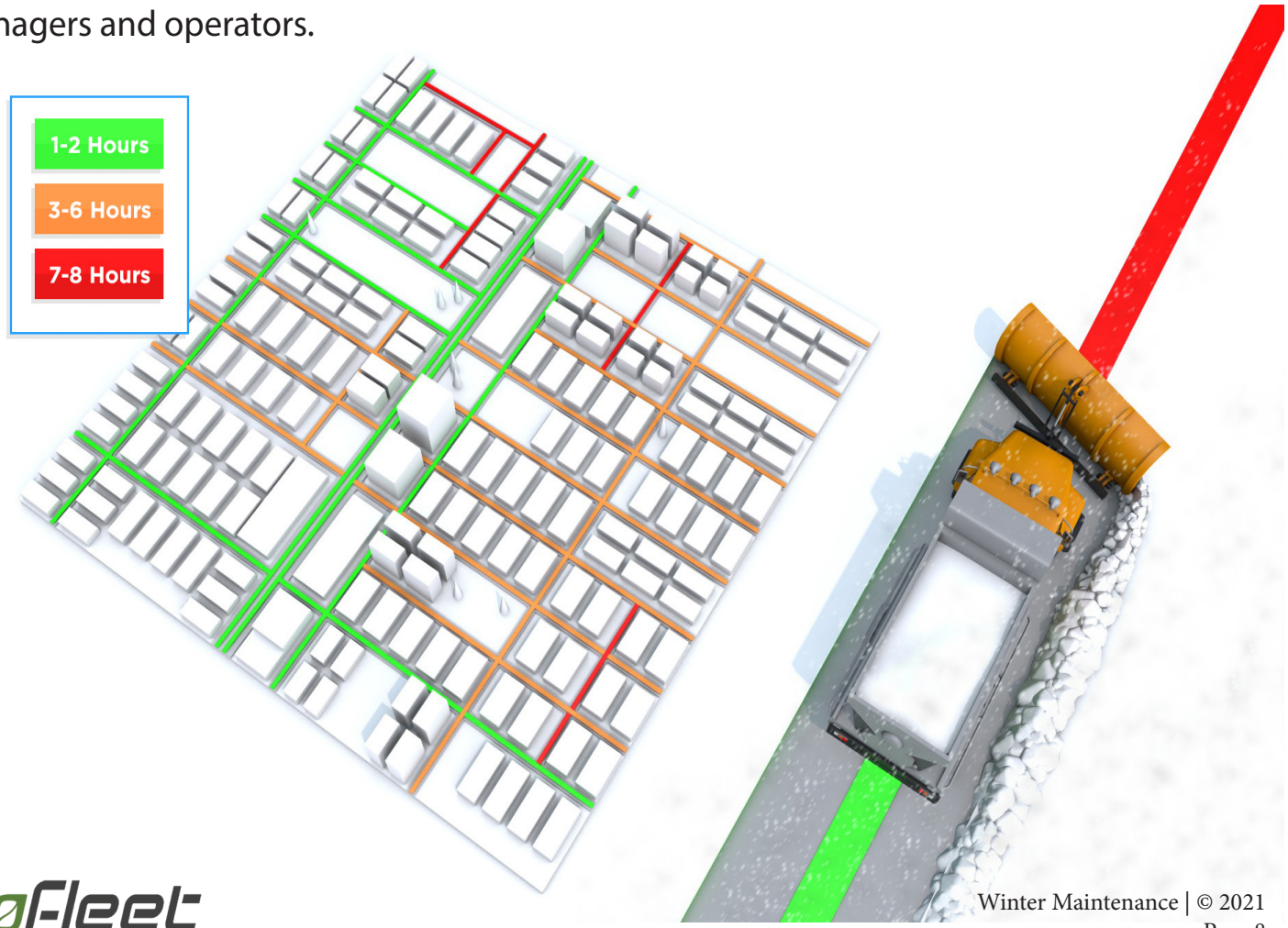
Navigation information needs to be clearly presented to operators to simplify their workflow and effectively facilitate large scale winter maintenance work. Dispatchers and fleet managers are responsible for directing assets on the fastest and most direct routes to cover all their allocated road segments. Traffic is a major unpredictable factor that fleet managers should examine when planning the work in urban areas. Traffic may cause extended delays to the operations, and it's unsafe and challenging to let winter maintenance equipment operate under heavy traffic conditions. Besides, asset operators have voiced the concerns that poor navigation software interfaces create hindrance to their workflow, and they demand a more intuitive on-road navigation user interface that provides all the crucial information in one place. Telematics is the only proven field solution that satisfies dispatchers' and asset operators' every need in the dispatching and navigation categories, and we will show you how telematics transforms the entire experience from the ground up.

Solutions

One of the unique features of the telematics platform is that it can integrate multiple enterprise solutions and display the data and results on a single map or dashboard. Custom maps are not only considered as one of the best ways to display and increase the visibility of the fleet operations but are also seen as the most suitable platform to implement a dispatching solution. Dispatchers can complete a wide range of tasks, including creating custom forms, dispatching work orders tooperators, tracking operators' progress and generating detailed operational reports allin one software. The easy-to-use interface enables fleet managers and dispatchers to create routes and assign them to any operator in seconds.

The route optimizer is a handy feature built into the system, and it helps to calculate the best route possible by taking into account the current traffic and predicted traffic volumes. This ensures operators always receive the most efficient routing, letting them skip traffic and arrive at work zones much faster.

To further streamline dispatchers' and fleet managers' workflow and simplify their planning process, geofencing is a powerful tool that allows fleet managers to specify geographic areas and develop designated rules that govern all the assets within these specific areas. Fleet managers can quickly split the urban road network into multiple work zones by setting up virtual boundaries around locations or specific areas. Fleet managers receive an instant message when a vehicle enters or leaves a predefined area or gets notified when an unexpected activity or rule violation occurs within the defined zone. All the fleet managers' commands and instructions issued on their software end will be directly transmitted and synced to operators' mobile ends. Operators gain direct mobile access to view their assigned work information and applicable rules. This level of communication transparency and simplicity is previously unimaginable and unachievable without telematics technology. But now, with customized mapping solutions and an improved on-road navigation platform for operators, we make the dispatching experience an absolute dream for fleet managers and operators.



Fleet Health & Maintenance

Most winter maintenance equipment is a sophisticated type of machinery that requires special care and proactive monitoring and maintenance to ensure that it stays in good shape. Every fleet manager knows the potential consequences of poor maintenance and its devastating impacts on the operation. It may lead to unexpected vehicle breakdowns, costing municipalities and contractors extra money and resources to rescue and recover the operations. In these cases, fleet managers have to mobilize other resources to replace vehicles that are declared out of service.

In more serious situations, poor vehicle maintenance can lead to road accidents and collisions, forcing the municipalities and contractors to pay hefty fines, insurance premium or even face lawsuits or legal claims. Frequent occurrences of accidents involving city-owned vehicles are likely to hurt municipalities' reputations. Loss of labour force can seriously affect employees' morale and hamper operations. The best way to avoid collisions and road accidents is to make sure all the fleet vehicles and equipment are in excellent shape. By establishing preventive and proactive maintenance strategies and investing in cutting-edge technology to assist the vehicle maintenance program, public agencies and contractors will be better positioned to protect employees' health and safety and to meet the vision zero targets.

Solutions

An essential part of the telematics solution focuses on providing smart fleet maintenance services to support winter operations. Though there are already many maintenance models or solution packages in the marketplace, telematics offers a far superior end-to-end experience that automates the entire fleet maintenance process, offering the most conveniences to fleet managers out of all competitors. It starts with the core concept of using smart sensors to proactively and continuously capture and record vehicle operational data and measure key health metrics. However, it's important to recognize that winter maintenance equipment is configured differently than other vehicles. Many components and systems on a snow plow, such as the blade lift, hydraulics and blade plow, require customized solutions to monitor and record their movements and status. Luckily, fleet managers can now find specialized sensors that track each of these parts and install them on the vehicles. For example, a blade plow is one of the most critical elements on the snow plow, and operators want to monitor its position during work to make sure they are fully engaged in the operation. In the telematics marketplace, there is a specific sensor designed just for that.

The positioning sensors can monitor the up and down movement of the blade plow and record the exact timing of when and how long the plow is engaged during work. The smart artificial intelligence program and algorithms built into the telematics system can perform advanced data analysis in helping fleet managers understand two things. First, when the system detects an abnormal reading captured from the sensor, it will alert the fleet managers of a possible equipment failure or malfunction. Secondly, it can assist fleet managers in knowing precisely the time of route completion by tracking when and how long the plow is engaged, which increases fleet managers' visibility to the operations and streamlines the internal reporting procedures. With advanced sensing technology combined with smart self-diagnostics capabilities powered by artificial intelligence, telematics gain a competitive edge over other forms of maintenance solutions.

A significant amount of effort has also been invested by telematics solution providers aiming to simplify maintenance technicians' workflows because they are the backbone of the entire fleet operation. Making their work easier and more efficient can shorten the vehicle maintenance downtime and increase the overall maintenance productivity. The software can play a game-changing role in digitizing and streamlining the maintenance procedures. One of the proven maintenance models widely adopted by successful fleet operators is the preventive maintenance model, using advanced data analysis and computing power to quickly identify faults to reduce the probability of vehicle failures and increase the useful life of the assets. Telematics is the foundational tool that brings preventive maintenance to life.

By linking the system with onboard vehicle sensors, the system can automatically extract the vital data related to key health metrics and scan for any abnormality or faults. If a fault or malfunction has been identified, the system can automatically generate a work order and assign it to responsible technicians for service.

From the technician's perspective, implementing a telematics system saves them time and effort from investigating the issues and root causes as the system has completed this step for them. They also gain access to a more intuitive and interactive maintenance management platform that displays their daily tasks in an organized and clear way. Additionally, having a telematics-powered maintenance platform within the corporation can drastically simplify the internal reporting and information sharing procedures. Technicians no longer have to report to the company's management or executive team about the work progress, as both parties have shared access to the maintenance management software and are able to track maintenance events anywhere they go.

With telematics in place, fleet managers and technicians can handle all types of maintenance issues and requests in a breeze.

Material Usage & Environmental Impacts

Fleet managers not only need to ensure high-quality execution of the winter operations but also look at how to do it in a sustainable and environmentally friendly way. Fleet managers hold the responsibility of ensuring all roadways, pedestrian sidewalks and bike lanes are snow-free and ice-free, yet are tasked with avoiding excessive material usage. The use of excessive de-icing materials and agents such as salt and de-icing fluid can potentially damage the environment and increase operational costs. Though salt has its public safety benefits of accelerating the melting of ice and snow, it's necessary to look at its ecological drawbacks.

One of the key concerns associated with road salt and de-icing fluid is how it may affect urban water quality. When it washes away into urban stormwater systems and eventually ends up in the streams, lakes and creeks, it quickly becomes a major contamination source that degrades the water quality and threatens the aquatic wildlife. Once it reaches there, the infiltrated salt particles and chemical particles remain in the water, and it's very difficult and expensive to remove them or clear them up. The persistent accumulation of these toxic substances may also threaten community health. Changes in the groundwater salinity resulting from the salt pollution may impact the water quality in water wells. It will be both a health concern and s taste problem for people who receive their water from these wells.

Other than potential adverse environmental impacts, excessive material usage can also drive up operational costs. Municipalities and contractors need to invest money in purchasing additional road salts and de-icing fluids, which may add up quickly over the season. We also cannot forget to calculate the social costs and environmental damage costs associated with over-salting our roadways. This is estimated at anywhere between $680 and $3,900 per tonne. Comparing this to the road salt purchase cost, which is around $50 per tonne, oversalting is just an unfeasible practice that might hurt our economic structure and government expenditures.

Solutions

You might then be wondering what we should do in this case. There is currently no alternative feasible or practical material that can replace salt in clearing up snow and ice. Other materials are considered either too expensive or ineffective to be widely adopted in the winter operation field. Luckily, the rise of telematics lights up a new path to reduce the occurrence of over-salting roadways during winter. Material usage monitoring has served as an excellent strategy in coaching operators and fleet managers in reducing excessive material usage. One of the key findings shows that many operators and fleet managers have no tools available to measure material usage; thus, they have no idea how much materials they use every day. Lack of visibility into the material usage data is the main contributing factor to the excessive material usage scenarios. Telematics addresses this problem by giving fleet managers insights into crucial material usage data, including solid and liquid application rates and solid and liquid material types used. These measurements help fleet managers to keep track of the material usage and adjust material consumption habits to safeguard the environment. The additional benefits of incorporating material usage monitoring features into the telematics platform include helping municipalities lower the cost of salting and developing smarter salt spreading strategies. These are crucial work in minimizing winter operation's negative impacts on our society and our planet.

Safety & Compliance

Safety is the top priority in any fleet. Municipalities and contractors need to adopt a layered approach to protect operators' safety and other road users' safety.

Failing to do so may put operators at significant risks and may pose adverse impacts on the winter maintenance operation.

A roadway accident and collision can lead to workers' injuries and other serious consequences, such as asset damages, legal disputes and disruptions to the entire service. Many winter maintenance equipment are specialized machinery that can only be maneuvered by trained operators. When operating these equipment, operators need to be extra cautious about the surrounding environment to ensure no pedestrians, cyclists or vehicles stay too close to the equipment. However, many operators raised the concern that the current vehicle equipped technology could not satisfy their needs. They want to gain 360-degree visibility access to their surroundings so they can operate their assets with confidence. Fleet managers sometimes also worry about operators' driving behaviours and performance as there are no tools to help them track and monitor operators' driving habits. In responding to these concerns, telematics solution providers step up and develop innovative solutions that target each of these issues.

Compliance, often driven by local or federal regulations, is an essential pillar in supporting the safe operation of the winter maintenance work. Operators not only need to follow common road traffic laws and regulations but also adhere to specified rules and guidelines set for the winter operations. Fleet managers have the duty of keeping track of fleet compliance and correct any violation promptly. However, with a relatively large fleet size, tracking and managing fleet compliance can be stressful for fleet managers. Telematics is all about lessening fleet managers' workload by creating a simplified and automated process that minimizes manual work. Few well-thought-out features have been integrated into the winter maintenance solution, making a big difference in the fleet compliance aspect.

Solutions

Telematics offers a comprehensive all-around safety enhancement solution that covers every detail of the fleet's safety aspect. In response to the concerns of lack of view of accessing the vehicles' surroundings, telematics solution providers propose a 360-degree camera monitoring system that gives operators a full view of everything around them. A telematics system can connect with up to 6 cameras, which guarantees no dead zone or blind spots for operators. A range of other safety-related telematics devices or systems such as driver distraction camera and collision avoidance system is available, where fleet managers can select one or bundles that best address their needs and concerns.

But in any combination, fleet managers need an effective software platform to view and monitor the rule violations so that they can develop and improve driver training programs to re-educate or train drivers on driving habits. Fleet managers can set up customized rules in the system and integrate them into maps.

When a vehicle violates the rules, it will automatically trigger a notification to alert fleet managers about a potential fleet compliance issue. Fleet managers can also decide if the set rules are applied to the entire fleet or only vehicles within a specific zone. Lots of customization options are available for fleet managers regarding how they want to set up rules and compliance standards. Now with the right tool in hand, fleet managers can sit back, and rest assured that they can stay on top of the entire operations and identify all the risk factors during the operations at the earliest time.

Public Supervision & Liability Claims

We believe that the public deserves a high level of transparency to the winter operations. However, in many municipalities, the winter operations department didn't offer a clear and intuitive channel for the public to access the operation's real-time information. This results in lots of confusion and guesswork among the public as they have no idea of knowing which road segment has been cleared or salted, and when is the last time a specific road segment received service. Lack of transparency often leads to poor public satisfaction and indirectly contributes to accidents and collisions in the worst scenario. If the public were to have access to winter operation information, they have the opportunity to adjust their travel plans and avoid roads that haven't been cleared or salted yet.

Another issue that arises in the winter operation field is that contractors and municipalities occasionally receive customer complaints or legal lawsuit claims due to personal injury caused by slip and fall accidents on snow and ice. In these cases, victims may blame the winter service contractors or municipalities for failure to clear up the ice and snow promptly. Though some of these claims might stand, municipalities and contractors need to be cautious about false allegations or unreasonable claims from some individuals. To fully prepare for these situations, municipalities and contractors need tools to help them capture their work history in the form of data, video and photo footage to prove they are not at fault in these incidents. Otherwise, the municipalities and contractors have to pay out a substantial amount of money to settle these false claims because they don't hold evidence to protect corporations and operators. Telematics offers an attractive solution that focuses on supporting contractors and municipalities in dealing with malicious claims and reducing the cost spent in lawsuit settlements. It can also help corporations cut down insurance premiums and avoid paying hefty fines from these malicious claims.

Solutions

In the end, winter operations are part of the municipalities' responsibility to serve the public and protect public safety. Everything we do and every improvement or decision we make to the winter operations need to put people at the forefront. One of the key ways of improving public satisfaction with winter operations is increasing information transparency and letting the public access real-time operation status. Telematics providers have long been working on making this process simpler with a completely redesigned public-facing map tool. The tool is well-integrated with the custom map builder and forms a cohesive user experience you won't find in any other platform. With the custom map builder, you control what information you want to publish to the public. Fleet managers can use colour-coded compliance tools to show when roads have been plowed or salted during the winter season. They can also decide whether the winter operation equipment's real-time locations are displayed or not, whether the public can see historical data and many more options. Additionally, tons of visualization elements and widgets are available where fleet managers can add some unique and useful touches to the public-facing map. Fleet managers can add a weather widget, for example, providing the public current weather information alongside the winter operation progress. When publishing the public-facing map to the public, fleet managers can choose from using the map as a standalone site with a unique URL and embed code or incorporate the map to an existing webpage.

The choices are unlimited, and fleet managers have all the freedom and control over how they want to customize the public map.

When dealing with incidents where there's a need to determine liability and fault, telematics offers the most well-crafted solution to protect corporations and operators against false allegations. The solution involves the utilization of a combination of critical data, such as plow position status, spreader controller status, historical vehicle trip information with timestamps and assets dashcam footage, to picture the full details of the event and what the vehicle or asset is doing at the time of the incident. One of the critical features of the winter maintenance management software is the ability to generate intelligent reports to access historical data. From assessing these historical reports, fleet managers can tell the exact location of the affected or involved vehicle and what the vehicles are doing at the time of incidents. Because all these activities listed on the report are timestamped, they can be used as an important piece of evidence to prove the operator or the fleet is not at fault. The auto-generated detailed trip report can also help the fleet managers identify factors that may impede the operations and find solutions to improve productivity and efficiency. Fleet managers can also choose what data to be displayed on the dashboard, where they can access critical operational information at a glance.

The cutting-edge camera technology and advanced sensing solutions further perfectionize the system and provide even more evidence to help corporations to defend themselves. The 360-degree high-resolution all-angle camera system can capture and record every road event. The timestamped footage will be collected and wirelessly transferred to the corporation's cloud database, where fleet managers can easily access and review the footage anywhere at anytime.

The advanced sensors that capture plow position and movements can help fleet managers understand when and where the plow is engaged in the operation and explain when and which road segment has been serviced. All of these measures can play a big part when fleet managers encounter malicious claims. Now with these tools, they can stay confident and easily determine who is liable for the incidents.

Eyeing the Future

What will the winter operations look like in the future? That might be a difficult question to answer, but the innovations and advancements in the telematics technology field can give us a glimpse into the future.

5G Wireless Communication

5G wireless communication technology is the new wireless global standard capable of connecting virtually everything together through ultrafast broadband cellular networks. The next generation of wireless communication technology enables asset to asset communications and asset to infrastructure communications, by supporting, optimizing and effectively coordinating large-scale fleet operations, just like winter operations. Increasing connectivity between fleet assets and allowing digital communication and data exchange between assets and urban infrastructures, such as signal light systems and transportation management systems, can yield more efficient and coordinated winter operations. For example, winter maintenance assets onboard sensors and cameras can serve as data collection tools to help the city's transportation department understand local traffic conditions. The ultrafast data transfer enabled by the 5G network and infrastructures allows fleet managers and transportation managers to see the real-time traffic conditions and live high-definition footage streaming. These are critical information that can help them identify congested road segments during the winter season, where they can manually adjust the signal light patterns to better direct and coordinate the traffic.

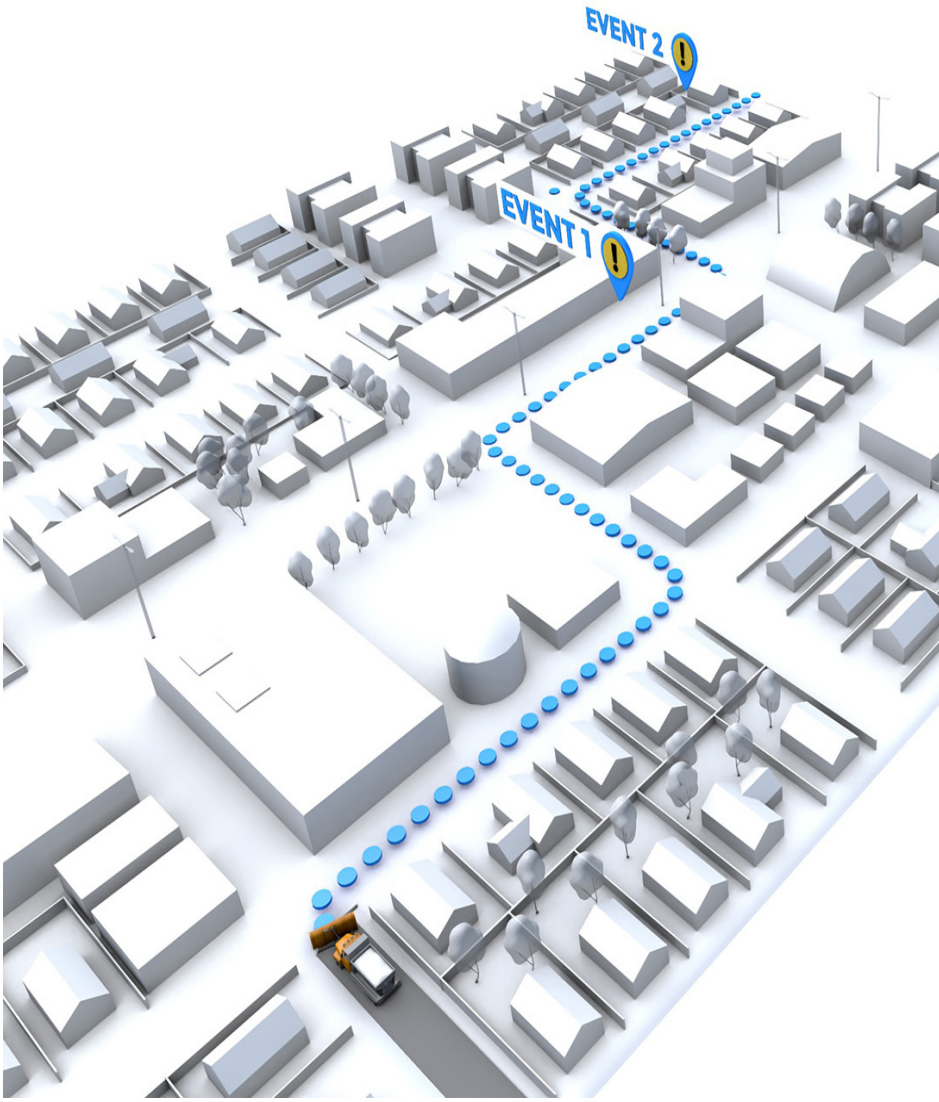
Artificial Intelligence & Machine Learning

Artificial intelligence and machine learning refer to the simulation of human minds and intelligence in machines that are programmed to think like humans. They can help to turn winter maintenance equipment into a smart asset that can detect dangerous road conditions, road potholes or any objects on the road that may obstruct driving safety.

By integrating artificial intelligence and machine learning algorithms into the assets' onboard camera system, the cameras become a smart scanning system that proactively detects and monitors road conditions. Whenever it detects road potholes, it will automatically alert the city road maintenance department and report the road pothole's exact location. From there, the city road maintenance department can send out staff and technicians to the site to fix the issues as quickly as possible. Adding smart artificial intelligence capability to the assets onboard telematics devices can help municipalities complete many tasks at once. These assets are not only just machinery to clear snow and ice but also act as an essential component of performing road inspections and identifying potential road hazards.

Automation & Autonomous Vehicles

The ultimate shape of the winter maintenance model is where everything and every stage of the operation is controlled and completed by computers, with no human intervention needed. From the driving, dispatching to plow control and equipment deployment, they are all fully automated and controlled by central and onboard computers. Automating the entire process could significantly simplify the workflow and enable a more precise and safe operation. The operation will not be restricted by labour resources anymore, and the service can run 24 hours a day with no downtime needed. It can significantly cut down the operational costs and labour costs, which transfer to huge savings every winter in the long run.



Though many people still see the autonomous vehicle as a future concept that won't happen anytime soon, significant development and progress have been made in the automobile industry to turn this dream into reality. In the telematics field, telematics solution providers have well prepared for the full transition and support of autonomous vehicle fleets, which will become a complete game-changer in the upcoming decades.

Conclusion

The winter maintenance sector hasn't changed that much in the past decades. Municipalities and winter operation contractors were still using decades-old technology, which significantly limits work productivity and slows down the operation's progress. Telematics technology can help public agencies accomplish the goal of improving public satisfaction with winter operations while also providing datasets that can offer transparency, increase productivity, control and reduce salt use and protect drivers. As a large number of local populations rely heavily on effective winter operations, fleets need to be prepared 24/7 and ready for service in the winter seasons. Telematics is the best possible tool fleet managers can own to ensure their operations go as smoothly as possible. By utilizing and adopting breakthrough technologies and innovations, winter seasons can be more festive and jollier for winter operation fleet managers going forward.

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