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Smart Mobility Analytics

Data that can save lives in traffic

There are data available that can save lives in traffic

High speeds increase the risk of serious injury and death in traffic. This was already known in 1997 when the Swedish Parliament adopted Vision Zero, with the aim that no one should be killed or badly injured on the Swedish roads. Road owners plan roads and have the ultimate responsibility for road safety. As such, it is vital to have a good basis for decision-making to be able to build safe systems.

Is it possible to increase road safety while also saving time and money?
The answer is yes! Ramboll's new Smart Mobility Analytics (SMA) service offering is a strong addition to the road operator's toolbox for planning road systems and road safety. Through analysis of GPS data, we can, among other things, detect previously hidden traffic hazards and propose safety solutions based on them. Analyses can be done in real time or based on historical data and therefore increase the possibility of removing safety hazards before they lead to accidents.

– This method provides a broad picture of the road network that has not been possible before. The client saves time and money because analysis of GPS data does not require long planning or large labour resources," says Erik Hedman, Head of Smart Mobility at Ramboll.

But let us take it from the beginning...
Smart Mobility Analytics (SMA) is an umbrella term for Ramboll's solutions for analysing traffic flows and traffic systems. Much of the analysis is produced using GPS data, which allows us to interpret vehicle speeds and routes over time and on selected routes. SMA allows us to map road sections where cars are speeding, and to compare measurements against historical data to see trends over time. In this way, the SMA provides a solid and reality-based factual basis that is useful for deciding the appropriate action.

– GPS analysis gives us a better understanding of driving behaviour; where cars are speeding and how speeds vary on a stretch of road," says Erik Hedman.

Who is responsible for road safety?

Road operators are ultimately responsible for road safety on Sweden's road network. On national roads, the Swedish Transport Administration (Trafikverket) is the road operator. In urban areas, the municipality is responsible for maintaining roads and streets that are not public or private. In addition, different stakeholders may request, pay, or cooperate to improve road safety. For example, regions may pay for better road safety on sections that are less prioritised by the road operator. Individual roads are managed by road associations or individual property owners.*

On road safety and speeds

When Vision Zero was adopted in 1997, the starting point for road safety was people's physical ability to withstand collisions.*

Research has shown that pedestrians have an 80% risk of dying if they are hit by a car at **50 km/h**. At **30 km/h**, the risk of death is reduced to 10%.

Recent research has shown that the risk of being killed in so-called violent collisions varies between different age groups, with older people being at greatest risk. As the traffic environment is meant for everyone, **30 km/h** is recommended in urban areas where streets are shared by pedestrians, cyclists, and car traffic in so-called mixed traffic.*

Road safety as part of sustainability – Agenda 2030

Road safety, its consequences and possible solutions are part of the global sustainable development goals, Agenda 2030, and are closely linked to other sustainability challenges, such as climate change, health, equity, poverty, and human rights. The broad sustainability agenda contributes to reducing road deaths and injuries.

The 2030 Agenda also includes specific targets on road safety: **sub-goal 3.6 Reduce road traffic deaths and injuries** and **sub-goal 11.2 Make sustainable transport systems accessible to all**.

** Source: Swedish Transport Administration*

Difference from traditional measurement methods
Traditionally, car speeds have been measured by stationary equipment, with all passing traffic captured at the same measuring point. Variations over distance and time are not captured by this method, which means that braking, acceleration, and other variations are also lost. While stationary equipment focus on collecting flows and speeds at a specific location, analysis of GPS data can describe travel patterns and longer travel sequences.

Since it is possible to look at long periods of time with Smart Mobility Analytics and GPS analysis, it is possible to identify dangerous locations - for example by tracking rapid braking - and take safety measures before accidents occur at the location," says Erik Hedman.

Invisible measurements describe reality
Another difference is how the measurements are perceived by road users. With speed cameras and other stationary equipment, the measurement point is visible, which can tempt drivers to change their driving style right at the measurement point. As GPS data is captured anonymously, driving behaviour is not affected and the measurement provides accurate information on driving styles and speeds. Erik continues,

”In addition, it is possible to both see and ignore weather conditions, which are otherwise an uncertain variable in traditional speed measurement. Now we can assess the impact of weather on traffic without risking damage to the measurement technology due to heavy snow or strong winds”.

Overall, SMA as an analysis method provides a deeper understanding of the transport system - its movements and needs for change - than has been possible in the past. The accuracy and wide range of measurement data helps road operators develop solutions that are cost-effective and deliver the desired results.

A comparison between traditional and GPS measurement methods

Different situations require different measurement methods and, in our comparison, below, we refer to data from pneumatic road tube sensors and traffic counting cameras as fixed measurement methods.

Data from fixed measurement methods

- Requires preparatory work such as planning measurement locations, time periods, measurement method, possible procurement of contractor and post-processing of data
- Requires field work
- Provides data in the form of site-specific measurements on selected points
- Requires installation of fixed equipment in the road area
- Often the data is limited to a few days of collection
- Provides information on flows, vehicle classes and speed

GPS measurements

- Contributes to automatic and continuous data collection
- Data is processed immediately
- Based on millions of connected vehicles and devices in real time
- Access to years of continuously collected data
- Continuous measurement periods that can be broken down into detailed time intervals
- Provides speed and flow information broken down into multiple segments on each road stretch
- Displays travel time data between target points
- Information on flows, vehicle classes and speed
- Displays route selection between destination points, allowing analysis of start and end points
- To see variations over time, GPS data can be compared against historical data going back several years. Yearly and seasonal variations can then be captured, and temporary traffic movements can be put into context.

A collision at **80 km/h** instead of **90 km/h** reduces the risk of death by 40 percent.

A crash at **90 km/h** is as hard on the human body as a fall from the tenth floor.*

** Source: Swedish Transport Administration*

Working with Smart Mobility Analytics - how does it work?
Our partners collect GPS data from motor vehicles. The information can then be aggregated to a level where we can see the times the vehicles have been in different locations, the speeds they have been travelling and the routes they have been taking. Data on speeds, traffic volumes and flow distributions on selected road segments is updated in real time. Another possibility is to measure movements before and after a certain date and time, which is useful to see new driving patterns when something changes in the system.

– Speed limit changes, new bus routes or redesigned intersections may be such changes that are worth analysing, says Erik. He sees that municipalities and other road authorities have reached a point where it is more difficult to detect risks on the roads. In that situation, GPS measurements are an asset.
Erik gives an example:

”Many road operators have removed their most dangerous road locations and now accidents occur more randomly. So perceived safety risks need to be interpreted with facts. GPS data can be used to detect or confirm such risks before accidents occur and thus actually save lives.”

Opportunities with Smart Mobility Analytics
By measuring position, speed, vehicle type, traffic volume, destinations, travel time and time periods, road operators can get quick analysis of:

- Speed profiles: profiles of routes, road segments and road networks over different time periods.
- Route selection: compare routes and travel times for different starting points and final destinations.
- Speed comparisons: compare speed variations before and after a speed limit change and identify road segments where vehicles are travelling at excessive speeds.
- Study start and end points of routes and turning movements at road junctions.
- Studying data segments in detail to find the peak speeds of a road network.
- Confirming traffic flows, speeds, and route choices in traffic simulation models. Analyse traffic volume and distribution of different vehicle types on selected road segments and routes.

The GPS data used by Ramboll in SMA is anonymised and shows speeds and routes travelled by motor vehicles. The values are captured in real time but can also be retrieved from records with historical data, going back ten years. For historical comparisons and in real-time measurements, it is possible to look at either a specific point in time or a longer sequence.

Data from regular bus services and all other vehicles are sorted out and filtering functions ensure that only one traveller per vehicle is followed. In the case of very sparse traffic, data is sorted out to prevent the measurement from being traced back to individuals, in breach of data protection law. The data used in Smart Mobility Analytics is collected by Ramboll’s partners TomTom and Inrix.

Landskrona Municipality - New speed limits based on facts and analysis

Mission
When rural residents of Landskrona Municipality experienced speeding cars, the municipality wanted to find out if the experiences could be traced back to actual events. At the same time, the municipality wanted to get tips on how to improve traffic safety on vulnerable roads.

Solution
Landskrona Municipality hired Ramboll, which started by conducting GPS analyses in the villages. We looked at historical data on average speed on different road sections and analysed time, traffic density, weather conditions and between which destinations the vehicles had travelled. Ramboll matched routes with high average speeds with reported accidents, to see the relationship between speeds and accident rates.

In the next step, the villages were surveyed on site. Now the focus was on the infrastructure - how cycle and pedestrian lanes, stops and crossing points were located. Finally, Ramboll was able to suggest speed reduction measures for each location.

Result
The project in Landskrona was implemented in 2020 and led to speed reduction measures in the villages. In cases where the speed was perceived as high but proved to be reasonable, the municipality was able to have an upright dialogue with the residents based on the analyses produced by Ramboll.

Average speed in Härslöv.

”The SMA and GPS analysis became a sound basis for our transport policy decisions. The SMA allows road authorities to implement measures based on the situation on different road sections, which often differ. Therefore, the tool is very useful from a road safety point of view.”

Jacob Pinotti, Head of Department
Traffic and Permits, Landskrona Municipality

Swedish Transport Administration – GPS data for impact assessment for speed limit changes

Mission
The Swedish Transport Administration (Trafikverket) hired Ramboll to carry out a detailed study and analysis of how the actual speed changed in relation to the posted speed in connection with speed limit changes.

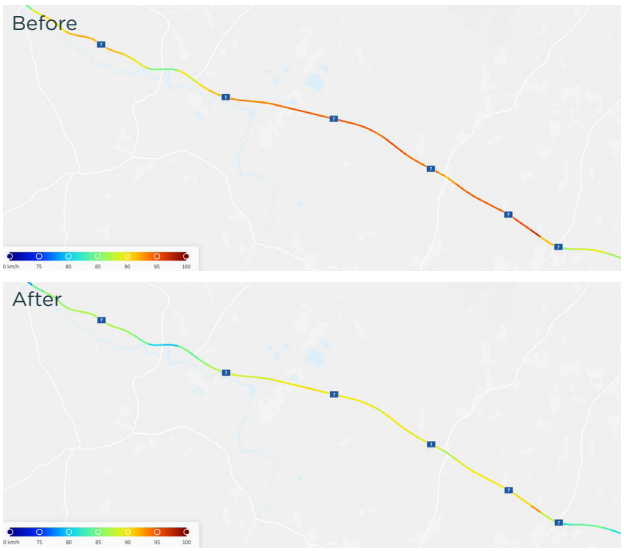
Since 2014, Trafikverket has been working on adapting the speed on the national road network. Around 1200 kilometers of road are to receive a speed increase while the speed is reduced on around 4250 kilometers of road. In previous studies, Trafikverket has used different kinds of stationary equipment. These methods only measure a limited number of locations.

Solution
The aim of the study was to obtain clearer effect relationships for future speed adjustments.

Concurrently, Trafikverket queried to what extent speed limit changes affects the actual speed of cars.

In the comparison, Ramboll analysed GPS data from motor vehicles at different times and on different routes. Trafikverket wanted to see a broad comparison, so it used data from three time periods before the speed changes and three periods after.

Result
The study provided a greater statistically reliable basis compared to previous measurements, especially for speeds that had been reduced from 90 to 80 km/h. The large sample of GPS data used in the study meant that the cause-and-effect relationships could be compared more reliably. Therefore, it was concluded that cause-and-effect relationships can be better studied in the future using GPS data.



”Through the applied methodology with GPS data, the study has produced good results that can be implemented in our tools. Through continuous development of cause-and-effect relationships, we can improve analysis and decision support for long-term planning of the transport system. I see room to continue to improve the cause-and-effect relationships using SMA and GPS data to help us all get around smoothly, greenly and safely.”
Fredrik Gullberg, Social Economist
VO Planning/Expert Centre/Social Economics, Trafikverket

Road 47 before/after speed limit changes from 90 to 80 km/h. Measurement period: March-April 2019.

Seven tips for road operators to improve their work with road safety

1. Facts as a basis
With real data, road managers can establish their road safety decisions on facts instead of assumptions. One should use the right type of data at the right time.

2. See the entire route
Smart Mobility Analytics can be used to analyse speeds along entire stretches of road, rather than just at a particular position. This provides a deeper understanding of the transport system - its movements and needs for change - than has been possible in the past.

3. Find the safety risks
Smart Mobility Analytics provides analysis from the entire road network over long periods of time and can quickly identify stretches that may be dangerous for traffic. We can see this correlation in our data in cases where speeds drop sharply over a short period of time. In this way, the road operator can get information about a safety risk that can be addressed before accidents occur.

4. Adapt the speed analysis
Speed analyses with Smart Mobility Analytics can be customised as needed. There is no need to install measuring equipment, which means that data can be collected immediately without any lead time to get the measuring equipment out. At the same time, this makes the method more cost-effective than traditional measurement methods.

5. See how measures affect traffic, both now and then.
Because the data analysed in Smart Mobility Analytics is available for several years back in time, it is possible to compare traffic flows and speeds both before and after the measure, even if the measures have already been carried out. For example, you can compare traffic flows before and after speed limit changes on a road. Historical comparisons also capture temporary breaks in trends or changes in traffic over time.

6. Seeing the effects of traffic shifts
Smart Mobility Analytics allows you to monitor the effects of traffic shifts. For example, roadworks and other temporary diversions where traffic is shifted from roads suitable for high flows and speeds to less suitable local roads with a mix of vulnerable road users such as pedestrians and cyclists.

7. Weather impact
Smart Mobility Analytics data can be used to both see and ignore weather conditions, which are an uncertain variable in traditional speed measurements. Now, the impact of weather on traffic can be read without risking damage to measurement equipment from heavy snow, strong winds or plow trucks.

Rambolls service in Smart Mobility Analytics

is a powerful addition to the road operator's toolbox to work systematically with traffic safety and system planning in a data-driven way. It can be used dynamically through simulations, real-time comparisons and with historical measurements.

For questions, demonstrations, or price quotes, please contact:

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