



SMART

Moving beyond traditional traffic control

The ITEA project SMART (Spatial Modelling Analytics and Real-time Tracking) Mobility developed various technologies for dynamic traffic control and geospatial visualisation, helping to mitigate traffic congestion, reduce emissions and boost quality of life in cities.

Urban congestion affects citizens and the environment, causing pollution and accidents and reducing a city's general liveability. Given that EU urbanisation will reach 75% by 2050, municipalities need tools to juggle issues with fiscal and societal constraints on new infrastructure. However, real-time traffic awareness, adaptive traffic management and efficient algorithms and actuators for real-time traffic control had been hard to achieve.

SMART Mobility aimed to give city planners and managers a solution to facilitate data-driven decisions to improve urban mobility and traffic throughput for all modes. Targeted innovations include improved dynamic traffic control, 4D geo-referenced city model reconstruction and dense traffic prediction. Using sophisticated road-side sensors and V2X communication from vehicles, standardised Cooperative Awareness Messages (CAMs) are continuously sent to a cloud-based traffic management application. The road-side sensors make sure that all traffic participants and their movements are represented and the CAMs provide information about the type of vehicle, its speed, heading, etc. Hence, it provides an accurate situational overview enabling full traffic control and the execution of the policies of Public Authorities, such as prioritising public transit or stimulating sustainable transportation modes to reduce CO₂ emissions - a form of dynamic control that traditional methods lack.

Technology applied

Making sure that CAMs are sent for all traffic participants, including pedestrians and bicycles, was a key motivation for the project. For geospatial visualisation and analysis, the Transportation GeoXchange (TGX) platform of Esri Canada is a central intelligent tier in which data from most partners is ingested and combined with digital twin data. This provides a comprehensive real-time and historical view of traffic data for studies and decision-making, eliminating the need

creating digital twin data using highly accurate information from LiDAR, satellite and aerial imagery, forming realistic 3D supermeshes. This serves as the foundation for incorporating intersection topology and surface type mapping.

Royal HaskoningDHV's Flowtack application is the Intelligent Traffic Light Control System (ITLC), which is fed real-time CAMs from the ViNotion intelligent sensors, allowing for quick changes to dynamic control. For instance, the system may extend a green light to prevent unnecessary stops by groups of vehicles or modify signals to prioritise cycling. This is further supplemented by Eindhoven University of Technology's AI-based algorithms for anomaly detection and



for multiple point solutions. Accurate, real-time intersection traffic data is contributed by the AI optical sensor of ViNotion's ViSense product that connects directly to the dynamic traffic control light system of Royal HaskoningDHV. International Road Dynamics offers a side view of arterial roads and classifies vehicles into 13 categories with speed detection. Geotab ITS data enables insights from millions of anonymised traffic behaviour records collected from fleet tracking. Cyclomedia specialises in

traffic analysis. The successful integration of multiple real-time feeds results in a vendor-agnostic analytical platform that supports an array of use-cases and decision support capabilities.

Making the difference

When companies within the private sector come together to create innovative solutions, as in the ITEA programme, the group that benefits most is buyers – in this case, the public sector. Crucially, the transformation from traditional to

real-time traffic control is expected to reduce congestion by 10-20%, making cities more liveable. For citizens, improved traffic flow saves time, reduces stress and increases road safety, particularly for cyclists. For municipalities, the system facilitates swift traffic policy implementation, aligning with the global push for sustainable transportation and emission reduction. Through factors such as less idling and travel time, a 10% reduction in CO₂ pollution has been field lab-validated, positioning SMART well in the transition to a net-zero carbon society.

For the consortium, participation in SMART led to deeper experience, improved solutions and an expanded market between Europe and North America. Esri Canada, for instance, used the opportunity to access real-time transportation data from multiple vendors to develop repeatable methodologies that can be scaled with many more vendors and data types, potentially opening up new business cases. Royal HaskoningDHV has improved Flowtack from exploiting 100% coverage of traffic awareness receiving the CAMs; they ultimately expect to reduce delays and

stops by 10% through application uptake. They also anticipate greater sales in tangent with ViSense, which ViNotion has developed into both a product and solution through the partnerships established in SMART. Additionally, ViNotion will explore new use-cases in traffic control, further advancing the algorithms and AI functionality.

Although the project addresses immediate traffic control challenges, it will also be a springboard for future innovations, collaborations and technological advancements across the consortium. A key element of this is ViNotion's certification by the Dutch Ministry of Infrastructure and Water Management, approving the deployment of their prototype system anywhere in the Netherlands. They are currently engaged with several field labs that have delivered promising results. For instance, the percentage of correctly detected far-distance vehicles approaching an intersection has been validated at 97% versus a starting point of zero. While SMART has concluded, this certification and the strong bonds formed between the partners will enable its impact to grow over the foreseeable future.

Major project outcomes

Dissemination

- > 9 scientific publications and 6 publications in industrial press
- > Presentations at 12+ industrial seminars and trade fairs, e.g.: National Bike Congress 2023, Electronics & Applications congress 2023, SATC 2022, NaTMEC 2022

Exploitation (so far)

- > Ministry certified i-TLC smart camera for detecting and measuring traffic with integration to Flowtack for dynamic traffic control
- > Real-time traffic anomaly detection component
- > Transportation GeoXchange (TGX) - 4D real-time visualisation of mobility data for planning within an intelligent GIS platform
- > Surface Type data product that provides highly accurate detailed surface classifications with extensive coverage throughout the Netherlands
- > Cloud RIS within Royal HaskoningDHV's Flowtack iTLC
- > Optimised algorithms within Flowtack for 100% CAM functionality
- > AI FHWA13 class counter and identifier – MVP1
- > Course module in anomaly detection for TU/e MSc course 5LSH0 "Computer Vision"

Standardisation

- > Contribution to development of CSA EXP150.1 and CSA EXP150.2 standards
 - > Digital Infrastructure Guidelines for Connected and Autonomous Vehicles
 - > Physical Infrastructure Guidelines for Connected and Autonomous Vehicles
- > Proof of concept for the coming Intelligent Traffic Light Controller (iTLC) standard
- > Early adoption of the Weigh-In-Motion (WIM) standards
- > Adoption of new ITF, SLPK, GeoTiff standards

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Partners

Canada

- > Esri Canada Limited
- > Geotab ITS
- > International Road Dynamics Inc.

Netherlands

- > Cyclomedia Technology
- > Eindhoven University of Technology
- > HaskoningDHV Nederland B.V.
- > ViNotion BV

Project start

January 2020

Project end

October 2023

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