DITM WHITE PAPER

From mobility to system

Why digital infrastructure is the real breakthrough

Digital Infrastructure for
Future-proof Mobility

Project information

Project period
1 October 2022 – 1 October 2026

Project partners
ElaadNL · ELEO · Geomaat · Infiniot · InQuisitive · Monotch · NKL · NXP · Siemens · Sioux · TNO · TomTom · TU/e · VDL ETS · V-tron

Project coordination
Brainport Development, RAI Automotive Industries NL, TNO

Funding
The DITM project is enabled by the Dutch Ministry of Infrastructure and Water Management (I&W), the European Union – NextGenerationEU and the DITM partners.

Contact & more information
Brainport Development (Project Lead)

Ana Alanis
Programme Manager Smart Mobility
Brainport Development N.V.
a.alanis@brainportdevelopment.nl

Funded by the European Union
NextGenerationEU

Ministerie van Infrastructuur en Waterstaat

Digital Infrastucture for Future-proof Mobility

About this publication

The Digital Infrastructure for Future-proof Mobility (DITM) project brings together industry, knowledge institutes and public authorities to develop and validate the digital infrastructure needed for the next generation of mobility.

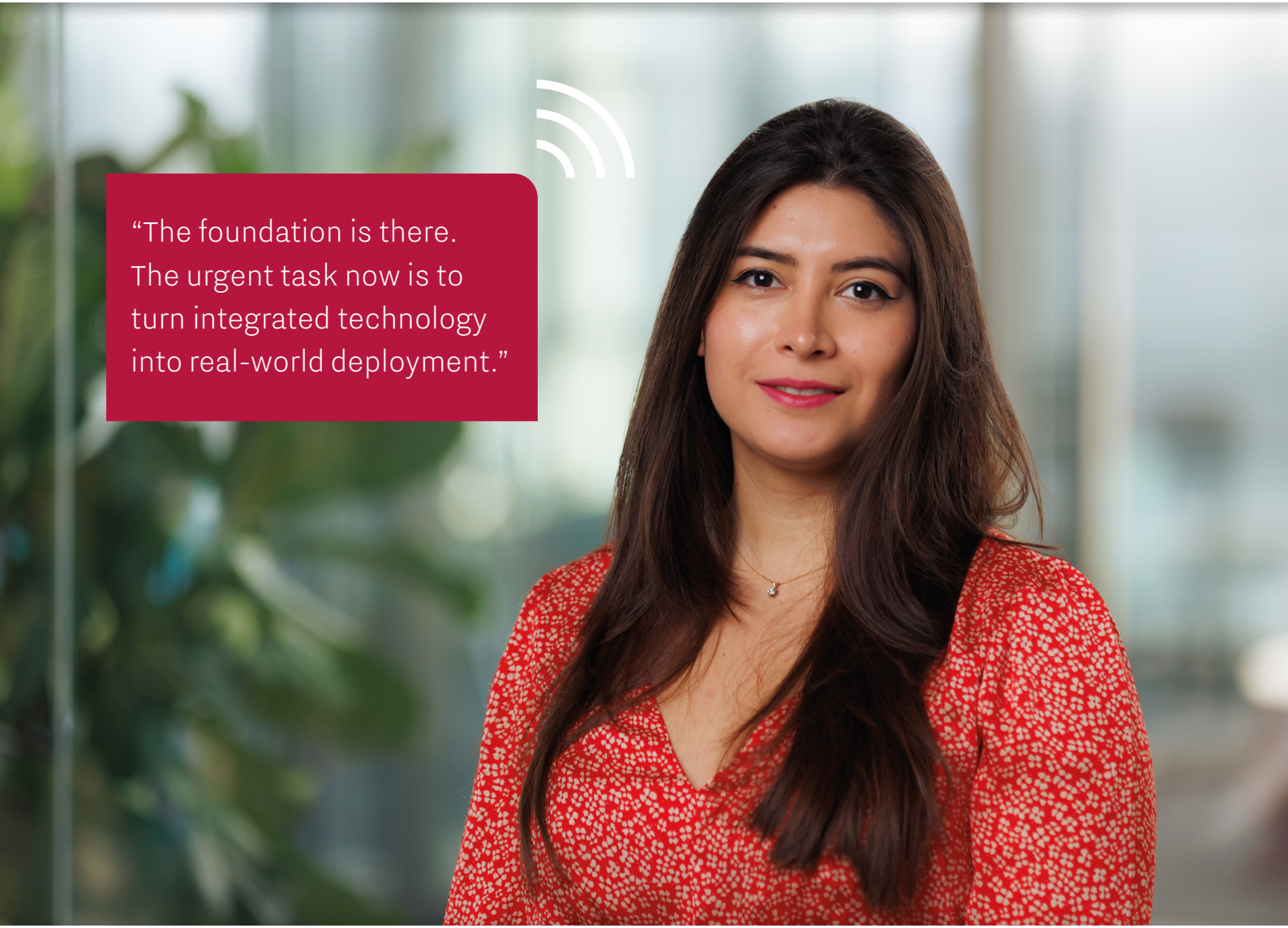
This publication presents the project's vision, results and lessons learned through two complementary whitepapers.

Whitepaper 1

Digital Infrastructure for Future-proof CCAM
Towards connected, cooperative and automated mobility through Key Enabling Technologies, shared data and validated use cases.

Whitepaper 2

Digital Infrastructure for Future-proof Energy in Mobility
Grid-aware charging infrastructure for reliable, secure and scalable electrification.


“The foundation is there. The urgent task now is to turn integrated technology into real-world deployment.”

Foreword

Europe is entering a decisive phase in the transition towards clean and connected mobility. The technologies are advancing rapidly, but the challenge is no longer technology alone. The challenge is to integrate mobility, energy and digital infrastructure into systems that are reliable, scalable and ready for deployment.

That ambition has driven the Digital Infrastructure for Future-proof Mobility (DITM) project from the very beginning.

Over the past four years, DITM has brought together companies, knowledge institutes and public authorities to develop, connect and validate the Key Enabling Technologies that will shape tomorrow's mobility system. Together, we have demonstrated how digital infrastructure can enable vehicles, infrastructure, energy systems and operational platforms to work together in concrete use cases.

The real breakthrough is not the development of individual technologies. It is the integration of technologies, data, infrastructure and organisations into a system that works reliably in practice.

That is also why DITM matters beyond this project. The Brainport region continues to grow, bringing new challenges for accessibility, sustainability and quality of life. Initiatives such as the Brainportlijn illustrate the ambition to create smarter mobility solutions for the region, while DITM provides part of the technological foundation needed to make that future possible. At the same time, the project strengthens the innovative capacity and competitiveness of Dutch and European industry.

The two whitepapers that follow capture the knowledge, experience and lessons generated throughout DITM. Together they show what has been achieved, what has been validated and where further work is needed to move from successful demonstrations to large-scale deployment.

I hope these publications will not only document the results of DITM, but also inspire the next generation of collaboration, innovation and implementation.

Ana Alanís
Programme Manager Smart Mobility, Brainport Development
Project Lead, Digital Infrastructure for Future-proof Mobility (DITM).

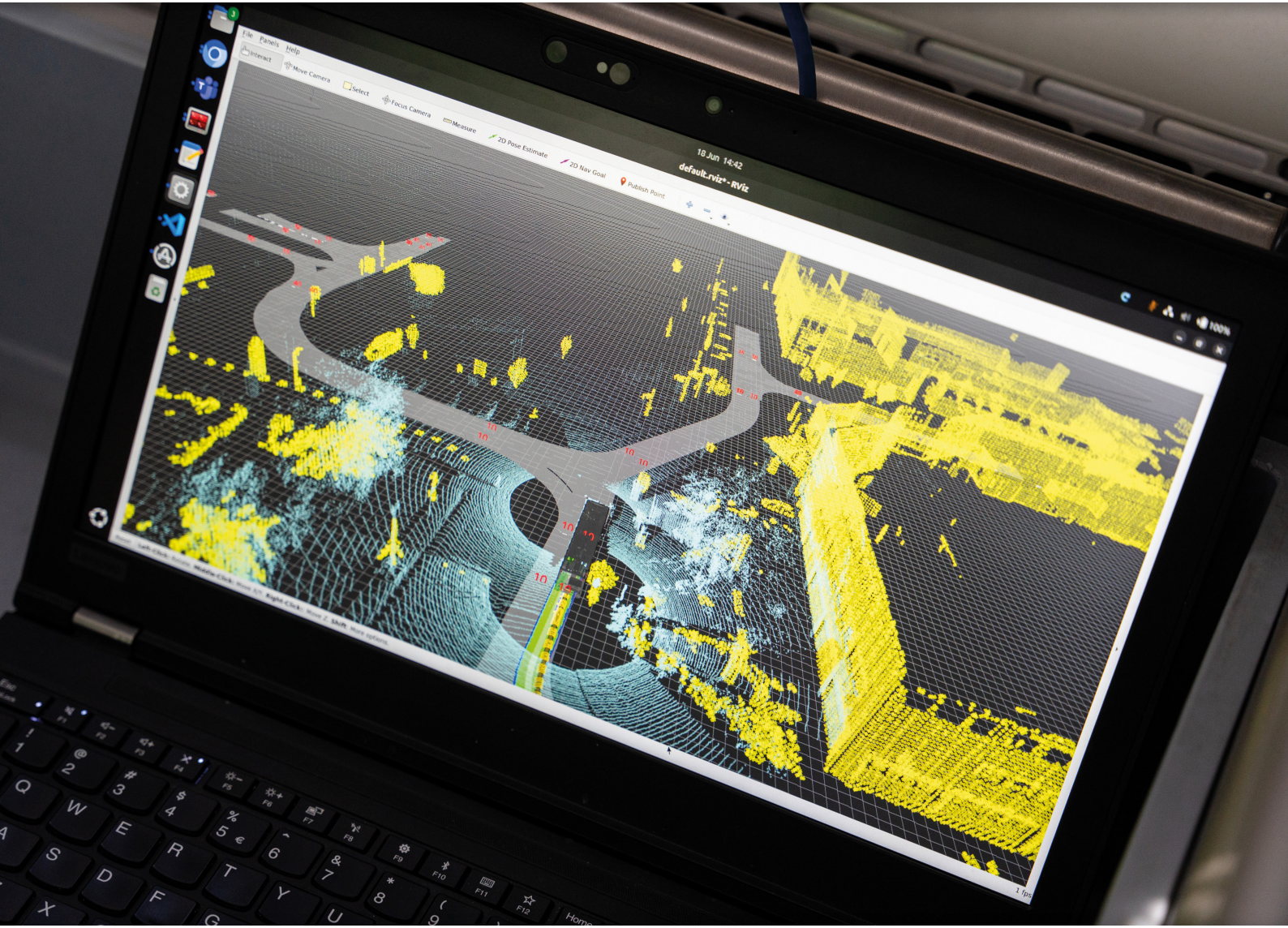
Core message
The DITM project does not present digital infrastructure as another isolated infrastructure project. Its distinctive contribution is the creation of an open, public-private ecosystem in which mobility, energy and data can be connected through Key Enabling Technologies, shared standards, secure data exchange and validated use cases. The result is not a completely finished system ready for immediate large-scale rollout, but a tested pathway from promising components to coordinated deployment.

Europe is investing heavily in the future of mobility and energy. Electric vehicles, automated driving, smart charging, data spaces, digital twins and intelligent infrastructure are all moving forward. Yet progress remains slower and more fragmented than the underlying technologies suggest it could be.

One reason is that mobility and energy transitions are often still treated as separate. Vehicles become smarter, but depend on physical and digital infrastructure that is not always ready to interact with them. Charging infrastructure expands, but must operate within an electricity grid that is increasingly constrained. Data is generated everywhere, but is not always shared in ways that are reliable, trusted, timely or usable for automated decisions.

DITM - Digital Infrastructure for Future-proof Mobility - starts from a different premise. The future of mobility will not be defined by the vehicle alone, nor by the grid alone. It will be shaped by the system that connects vehicles, infrastructure, energy assets, service providers and public authorities in a coordinated, secure and scalable way.

That is why the DITM approach is not simply about building more infrastructure. It is about defining and testing the digital layer that allows existing and newly developed technologies to work together. This includes high-definition maps, lane-level localization, secure communication channels, standardized data-sharing environments, remote operations, simulation and validation tooling, smart charging concepts and governance arrangements for data ownership and system responsibility.



High definition sensing


SIEMENS
Digital Infrastructure for Future-proof Mobility
SDNU 1242068
12GB
FRONT END ACCESS
FOR PERSON ONLY
NOT FORKTRUCK
OR VEHICLE

EnergyPod

An ecosystem approach with a sharper edge

Many mobility programmes rightly emphasize the importance of ecosystems. DITM's added value is that it makes this ecosystem operational. It brings together private and public partners, industry and knowledge institutes, mobility and energy stakeholders, and connects them through a shared technical architecture rather than through ambition alone.

The project has advanced Key Enabling Technologies and tested their dependence on digital infrastructure. In the mobility domain, this includes data-sharing environments, localization technologies, HD maps, map production and delivery pipelines, trusted 5G communication, software-defined vehicle concepts, remote operations, and SIL/HIL/digital-twin validation. In the energy domain, the same system logic applies to the coordination between charging operators, fleet operations, battery storage, grid constraints and prioritization mechanisms.

This matters because the challenge is neither just organizational nor just technological. The core technologies are available in many areas, but integrating them into a reliable system remains complex. DITM shows that coordination is possible, while also making clear that deployment requires further validation, standardization, governance and investment.

The role of digital infrastructure

In the context of these whitepapers, Digital Infrastructure for Future-proof CCAM and Energy refers to the integration of advanced digital technologies within mobility and energy networks to create an interconnected ecosystem. This ecosystem uses securely shared data, trusted communication, digital representations of physical assets and intelligent control mechanisms to improve connectivity, optimize performance, strengthen resilience and enable sustainable operation.

In practice, digital infrastructure consists of elements such as high-definition maps, real-time traffic and infrastructure data, secure communication networks, data-sharing environments, digital twins, validation tools and interfaces between mobility and energy systems. Within DITM, these elements were implemented and tested in concrete use cases rather than described only as concepts.

The point is not that every element of the system needs to be connected to every other element. The point is that the relevant actors and assets in a specific use case can exchange trustworthy information at the right time, under the right conditions, and in a form that allows automated or semi-automated decisions. For example, an automated vehicle on a depot can use a digital map, localization methods and a yard-management backend to decide whether to go to a charger, a wash bay, a maintenance area or a waiting position. An intelligent speed assistance system can combine camera recognition, HD maps and authoritative road-operator data to determine the correct speed at lane level. A smart-charging system can coordinate charging demand with grid capacity and operational priorities.

Two whitepapers, one transformation

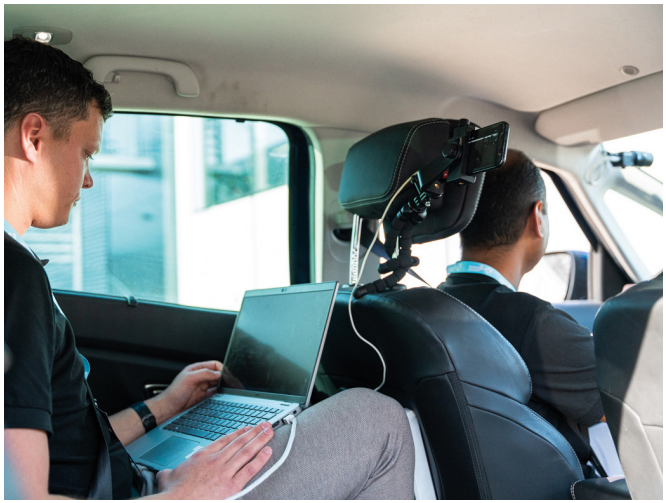
The two whitepapers that follow should be read as complementary parts of the same transformation.

The CCAM paper

Explains how Cooperative, Connected and Automated Mobility (CCAM) can move from isolated vehicle functions to coordinated system behaviour. It shows how use cases such as yard automation, Green Light Optimized Speed Advisory, Intelligent Speed Assistance and lane-level navigation rely on Key Enabling Technologies and digital infrastructure.

The energy paper

Explains why electrification cannot be solved only by adding chargers or reinforcing the grid. It shows how concepts such as smart charging, energy buffering, energy hubs and prioritization can turn mobility-related electricity demand into a more flexible, manageable and economically relevant part of the energy system.



The connection between the two is important, but it should not obscure the focus of each paper. The CCAM paper concentrates on vehicle technologies, data exchange, maps, localization and validation. The energy paper concentrates on the interaction between charging demand, grid capacity, energy assets and operational control. This introduction provides the bridge between them.

From components to coordinated use cases

The DITM logic can be summarized as a chain of traceability. Societal challenges create the need for new mobility and energy capabilities. These capabilities require concrete use cases. The use cases depend on Key Enabling Technologies. Those technologies need a digital infrastructure to exchange data, validate decisions and operate across organizational boundaries. Only then can system-level impact become credible.

SYSTEM CHALLENGE	USE-CASE DIRECTION	KEY ENABLING TECHNOLOGIES	WHAT DIGITAL INFRASTRUCTURE ADDS
Safer and more reliable automated mobility	Yard automation and assisted public-road operation	Localization, HD maps, robotization interfaces, remote operation, SIL/HIL validation	A shared operational environment in which vehicle, depot systems and mission planning can exchange trusted data
Better use of existing road capacity	GLOSA, lane navigation and infrastructure-to-vehicle services	Traffic-light data, variable-message-sign data, secure 5G, NDS.Live, data spaces	Timely information flows between physical infrastructure, cloud services and in-vehicle functions
More robust speed and lane decisions	Intelligent Speed Assistance with lane-level context	Traffic-sign recognition, lane-level HD maps, authoritative road-operator data, sensor fusion	A way to combine multiple sources and assess confidence instead of relying on a single input
Grid constraints and rising electricity and power demand	Smart charging, buffering and energy hubs	Charging control, prediction and prioritization modules, fleet scheduling, grid-capacity data	Coordination between mobility operations and energy availability instead of uncoordinated charging demand

What DITM has shown - and what it has not yet shown

DITM has shown that connected, cooperative and automated functions can be implemented in controlled demonstrations and that the underlying digital infrastructure can connect vehicles, data platforms, infrastructure and operational systems. It has also shown that hybrid architectures are needed: sensor-based, backend-based and direct-communication approaches each have different strengths, costs, security profiles and deployment timelines. Robust deployment will often require combinations of these approaches rather than a single preferred paradigm.

At the same time, these results should not be overclaimed. Controlled demonstrations are not the same as large-scale deployment. Moving from pilot environments to real-world implementation requires further work on validation, reliability, safety, cybersecurity, standardization, governance, investment models and organizational responsibilities. DITM's contribution is therefore best understood as a tested foundation for deployment, not as a finished deployment programme.

The strategic opportunity

The strategic question is no longer whether mobility and energy will become more digital, connected and automated. They already are. The question is whether Europe can shape this transformation through open standards, public-private collaboration and trusted infrastructures, or whether it will fragment into local solutions and proprietary platforms that are difficult to scale.

The Netherlands, and Brainport in particular, has strong ingredients for a leading role: automotive and mobility expertise, high-tech systems knowledge, public-private collaboration, energy-transition urgency and a dense innovation ecosystem. DITM adds a practical route: develop Key Enabling Technologies, integrate them through an open digital architecture, validate them in use cases, and translate the results into deployment roadmaps for mobility, energy and adjacent markets such as logistics and defense.

The next step is not to choose between technology and governance. It is to develop both together. Technology must keep advancing, especially where reliability, safety, security and scalability are concerned. Governance must mature at the same time, especially around data ownership, standards, responsibilities and investment. Only their combination can turn promising innovations into a future-proof system.

DITM Vehicles


MARIN
TNO
innovation for life
VDL ETS DITM


Project note
The DITM project is enabled by the Dutch Ministry of Infrastructure and Water Management (I&W). DITM is funded by the European Union - NextGenerationEU and DITM partners. Project period: 1 October 2022 - 1 October 2026. More information on the DITM project and its partners: info@brainportdevelopment.nl