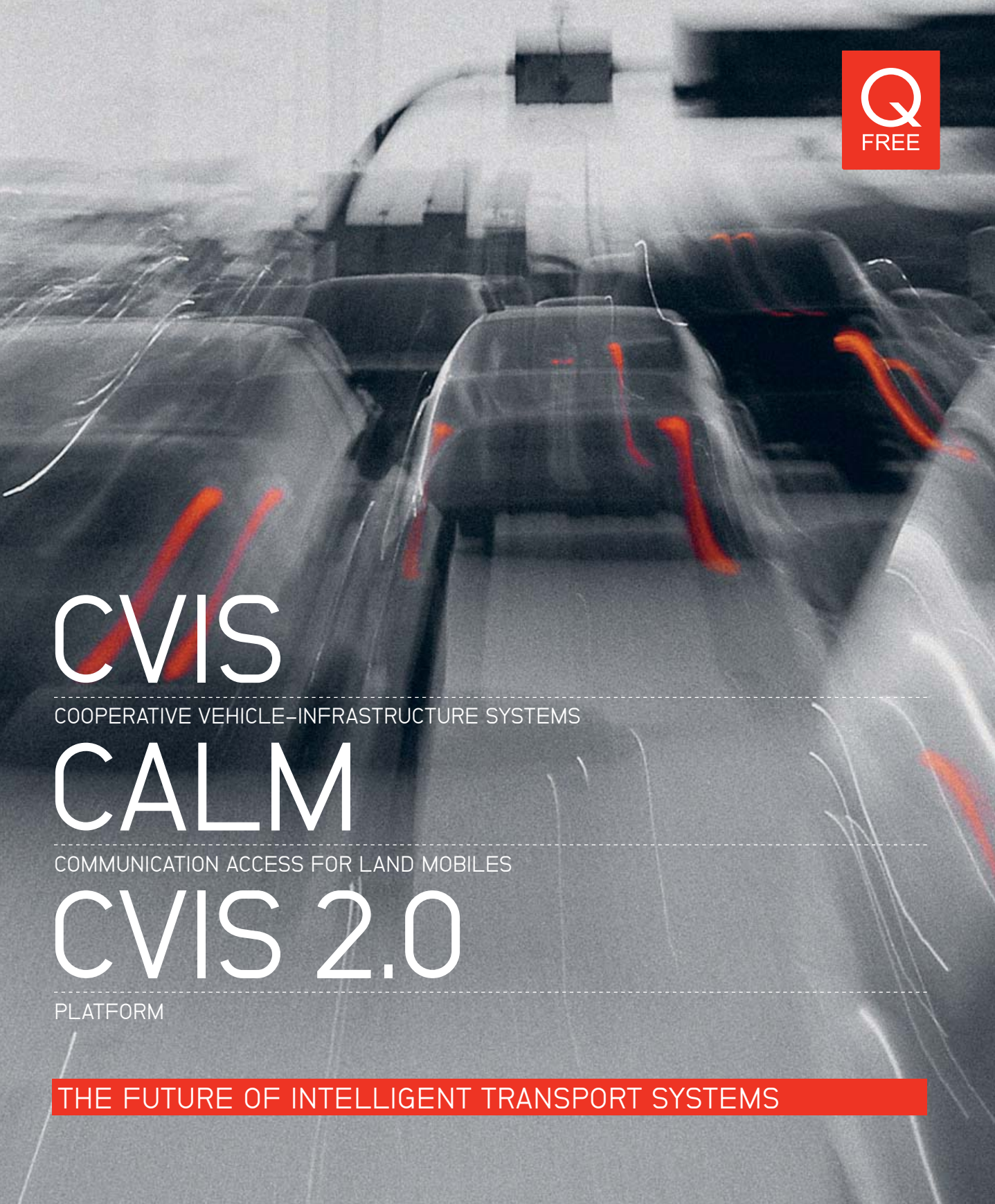

Q
FREE
CVIS
COOPERATIVE VEHICLE–INFRASTRUCTURE SYSTEMS
CALM
COMMUNICATION ACCESS FOR LAND MOBILES
CVIS 2.0
PLATFORM
THE FUTURE OF INTELLIGENT TRANSPORT SYSTEMS

INTRODUCTION.

THE FUTURE OF INTELLIGENT TRANSPORT SYSTEMS.

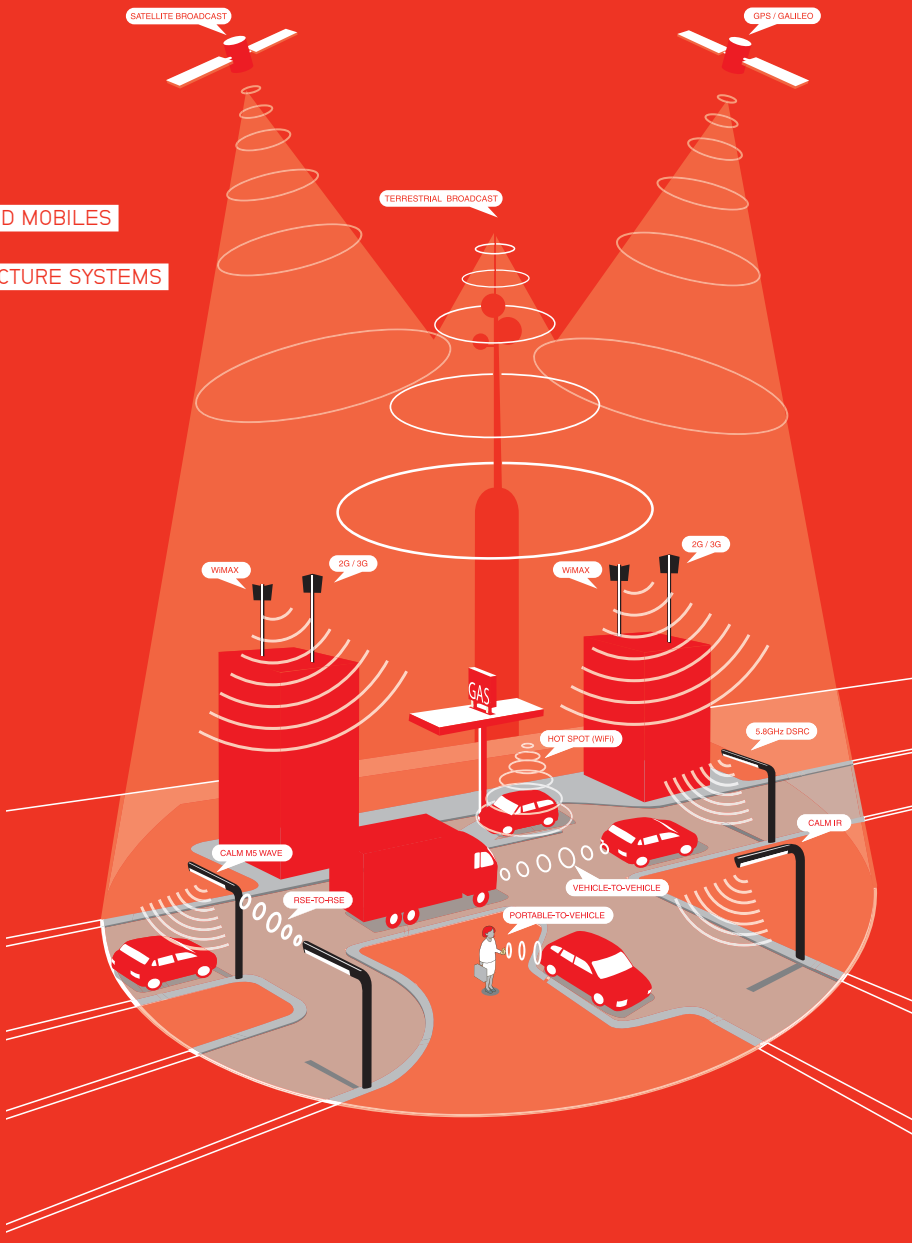
CALM – COMMUNICATION ACCESS FOR LAND MOBILES

CVIS – COOPERATIVE VEHICLE–INFRASTRUCTURE SYSTEMS

CVIS 2.0 PLATFORM

Imagine driving your car, always having up–to–date information about everything from local driving conditions to congestions and alternative routes. Q–Free has a leading role in the Cooperative vehicle–infrastructure systems (CVIS) project, where 60 European companies have now joined forces in order to create new Intelligent Transport Systems opportunities.

Cooperative Systems create new opportunities within the Intelligent Transport Systems (ITS) sphere. These systems utilize both vehicle-to-vehicle and vehicle-to-infrastructure communication, enabling a diversity of new applications for safety, efficiency and infotainment. Q-Free has a leading role in the CVIS project, which is taking cooperative systems to the next level. In the CVIS project a universal communication platform has been developed, supporting continuous Internet connectivity and vehicle-to-infrastructure (V2I) communication, for a number of traffic efficiency and infotainment applications.



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THE CALM CONCEPT.

WHAT IS COMMUNICATION ACCESS FOR LAND MOBILES (CALM)?

CALM is a standardized draft series of air interface protocols for Intelligent transport systems (ITS) services and applications, under the acronym CALM (Communication Access for Land Mobiles).

An ideal Intelligent transport system (ITS) needs a communication sub system that:

- Is available wherever and whenever a vehicle is present in a traffic situation
- Can communicate vehicle-vehicle and vehicle-roadside in a transparent way
- Relieves the applications from the need to know about communications setup and management
- Uses modern Internet techniques and standards for global usability (IPv6)
- Provides a range of different possibilities related to data speeds, communication distance, cost and many other parameters

CALM meets the requirements mentioned above. CALM uses one or more media in parallel, including existing communication technologies as well as CALM specific communication technologies.

CALM provides a layered solution that enables continuous communications between vehicles or between vehicles and the infrastructure. The principles of CALM architecture and standards are predicated on the principle of making best use of the resources available: CALM uses the optimal wireless telecommunications media that are available in any particular location, and have the ability to switch to a different media when necessary. Multiple available media can increase capacity or add redundancy depending on the requirements.

CALM COMMUNICATION MODES

CALM communication modes are defined as:

- Vehicle to Infrastructure: Communication may be initiated by either roadside or vehicle
- Vehicle to Vehicle: A low latency peer to peer network with the capability to carry safety related data such as collision avoidance, and other services
- Infrastructure to Infrastructure: The communication system may also be used to link fixed points where traditional cabling is unavailable

CALM MEDIA

CALM Media has multiple interface choices. The following list give some of the possible physical interfaces:

- 5GHz wireless LAN systems, based on IEEE 802.11 normal WiFi as well as the new CALM M5/802.11p mode
- Cellular systems, GSM/HSDSC/GPRS and 3G UMTS
- 60GHz systems
- Infrared communication
- Satellite communication
- Metropolitan access communication (e.g. WiMAX)

- A Convergence Layer, supporting DSRC, broadcast, GPS/Galileo/Glonass positioning

CALM BENEFITS

- Stability: A formal body that is responsible for the development
- Openness: the standards are available to everybody
- Visibility and credibility of the specifications
- Extensibility:
- Compatibility: CALM is based on IPv6: thus fully compatible with Internet services

The CALM specifications and standards are not implementing a physical piece of equipment - CALM is actually an architecture, a set of protocols, procedures and management processes. Implementation of physical equipment is a function of a commercial process.

CALM will support multiple types of application and multiple types of media simultaneously. It is however no requirement for implemented equipment to support all the possible media: the choice of what media to support will be a decision of the equipment or vehicle manufacturer, also depending on the media options that are available, varying from country to country and from location to location.

Adopting CALM does not mean implementing all of its possibilities - it just means that the components implemented will operate seamlessly - anywhere - where the available media are supported.

The CALM standards are being developed by ISO TC204 Working Group 16.

All main Standards are either published or in voting at the time of writing.

CALM AND Q–FREE

Q-Free is one of the initiators of CALM, and is committed to the concept since it will lift the current DSRC technology seamlessly into the future. CALM means that users of DSRC are already prepared for the next big leap in ITS technology, and that all applications in the ITS environment can migrate easily to this new platform.

TO FIND OUT MORE:

OFFICIAL WEB PAGE OF ISO TC 204 WORKING GROUP 16:
www.CALM.hu

ISO TC204 WG16 PORTAL OF ESF GMBH:
www.tc204wg16.de

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THE CVIS CONCEPT.

WHAT IS CVIS – COOPERATIVE VEHICLE/INFRASTRUCTURE SYSTEMS.

CVIS – Cooperative vehicle–infrastructure systems– give major functional improvements to road users as well as road operators, by allowing vehicles to communicate and cooperate directly with other nearby vehicles and with the roadside infrastructure. CVIS has developed and made available a platform providing a wide range of journey support, information and security services offered to road operators and drivers.

CVIS was launched in February 2006 and ends mid-2010. Approximately 60 partners are participating. The total four-year project budget is approx. € 41 million, roughly 50% funded by the EU. CVIS is coordinated by ERTICO – ITS Europe.

CVIS TECHNOLOGY

CVIS is developing a harmonized technology for vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication, based on a multi-channel terminal capable of connecting to a wide range of potential carriers, including:

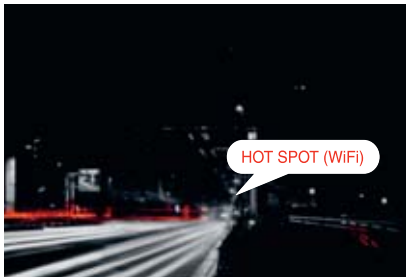
- Mobile wireless Local Area Networks (802.11p/Wi-Fi)
- Cellular networks (GPRS, UMTS)
- Short-range microwave beacons (DSRC)
- Infrared (IR)

This scheme is based on the international CALM standards that provides full interoperability between different car producers and different roadside and infrastructure systems.

CVIS INFRASTRUCTURE

CVIS equipped vehicles will be able to connect and communicate via local ad-hoc networks of vehicles and roadside equipment in the vicinity, and also via an internet connection.

CVIS develops hardware and software that are based upon open standards, and thus easily can be updated. Unlike many of today's information systems, the architecture implemented in CVIS will not become outdated when new technologies arrive.



CVIS APPLICATIONS

CVIS implements a number of sample applications for various types of road users and road operators. These applications are related to:

- Destination route guidance
- Congestion control and avoidance
- Traffic lights control and coordinating
- Area-wide Traffic Information Provisioning (traffic speeds, congestion “hot spots”, road conditions etc.)
- Truck and vehicle monitoring and management and micro management
- Parking and loading space management
- Electronic Fee Collection
- Safety information and hazards warnings (ghost driver, collision avoidance etc.)
- Weather information, collected from sensors on vehicles as well as road infrastructure

CVIS TEST SITES

The specifications developed by the CVIS core technology and application sub projects are trialled at test sites in seven European countries (France, Germany, Italy, Netherlands-Belgium, Sweden, Trondheim and United Kingdom) - in urban, inter-urban and commercial transport environments.

The trials involve users and operators, and will give real evidence to such things as impact, benefits, user affinity and privacy, and will also include deployment costs examination and roadmap definition.

In addition more than 10 other projects are using the open CVIS platform bringing the total number of test sites around 20.

CVIS AND Q–FREE

Q-Free is a member of the Core Architecture Group. Knut Evensen from Q-Free is the Chief Architect. Furthermore, Q-Free is managing the Communication and Networking sub project and is responsible for development and supply of the CALM antenna, communications and sensor board.

TO FIND OUT MORE:

CVIS PROJECT WEBSITE:
www.CVISproject.org

IMPLEMENTATION OF CVIS.

PLATFORM OBJECTIVES

The primary aim was to provide an open reference design to meet the requirements defined in CVIS project.

The CVIS prototypes and designs are mostly based on existing techniques and components since the CVIS innovation is largely in the architecture combining the different media with IPv6 and adding advanced network management.

Cooperative systems are systems that can interact real-time and that can organize behavior at decentralized levels. One of the key enablers for cooperative services is therefore a system that allows communication at every location, at any time and also to everybody (ubiquitous communications).

The industry is working on adapting existing communication technologies to provide support in a mobile environment. Among the most important for the CVIS project are the M5 and IR technologies. M5 supports omni-directional communication between moving objects with a minimum data rate of 6 Mbps up to 300-500 meters radius. It's particularly useful for vehicle-to-vehicle and low-directive vehicle-roadside communication. IR complements this by providing highly directive beams with a typical performance of 1-2 Mbps up to 100 m range. Directional communication is useful since the communication range can be confined to a specific object of set of mobile objects, while omnidirectional links is useful in the general case with continuous communication to the surroundings.

DESIGN PHILOSOPHY

- Make the communication system available as prototype devices to various test beds and field trial sites during the project, and later as open reference designs through open source IPR agreements.
- Provide liaisons to the relevant ISO, ETSI, IEEE and IETF standardization groups so that by the end of the CVIS project, the European as well as the global standards is matched as close as possible to the CVIS open reference designs.

Open platform air interfaces (media)

- CALM M5 radio communication at 5.9 GHz frequency bands.
- CALM 2G/3G Cellular radio technology
- CEN Dedicated Short-Range Communication at 5,8 GHz
- Wireless LAN according to IEEE802.11abg
- CALM Infra Red communication (Not part of open platform)

CVIS HARDWARE PROTOTYPES.

CVIS Protocol functionalities

- Mobile IPv6 routing functionality
- Geographically mapped IPv6 addressing
- Real-time data exchange
- CALM management

CVIS 1.0 PLATFORM

- One communication router that will handle all the communication and routing functionalities
- One host computer that will run the applications that will be demonstrated in CVIS.

The host computer and communication router provides the backbone of the CVIS vehicle, roadside and central systems that are connected via internet technology.

The CVIS platform is available for other R&D projects in an open fashion. Several FP6 and FP7 projects as well as national projects have already entered agreements to use the platform for their purposes, and CVIS will grant the use to other projects in a very flexible way.

CVIS 2.0 PLATFORM

The experience with CVIS 1.0 showed that installation, power consumption, cost and long-term stability was a problem. Installation is difficult because of two relatively big car PCs needs to be fitted. The connections between the computers and sensors are also complex, while the 4 m antenna cable bundle is very difficult to fit. The two PC used up to 100 Watt which is a real power drain for a vehicle when the engine is not running. The cost for the complete set was quite high, and was not reducible with higher unit volume. The platform complexity meant that mechanical/electrical faults happened too often, and the platform would stop operation.

CVIS 2.0 is a hardware optimisation to fix this experience with the CVIS 1.0 platform:

- The Host PC is replaced with a tiny PC with integrated touch screen fitted on the dashboard. The only connection is an Ethernet cable and power supply. All host functions are run unchanged in this PC.
- The Router PC functions including positioning sensors are integrated in the antenna module that has only one cable – Ethernet with Power-over-Ethernet.
  - For vehicles this is a shark-fin roof mounted device with processing and radios embedded in the antenna base
  - For roadside units the router is integrated in a weatherproof unit including the needed antenna elements.
  - Software is the same as the current CVIS Router, except driver changes as required by the new generation chip sets.
- The only extra hardware is a small switch with a PoE injector.

TERMS USED IN CVIS:

2G	Second generation cellular phone technology e.g. GSM
3G	Third Generation mobile phone technology e.g. UMTS
CALM	Communications Access for Land Mobiles.
CALM M5	The ISO 21215 standard that incorporates WAVE (WAVE PHY/MAC is IEEE 802.11p standard)
CI	Communications Interface
CVIS	Cooperative Vehicle Infrastructure Systems
GNSS	Global Navigation Satellite Systems
GPRS	General Packet Radio Service. A GSM data transmission technique that transmits and receives data in packets.
GPS	Global Positioning System
GSM	Global System for Mobile communication. A European digital standard for mobile or cellular telephony.
IEEE 802.11p	A standard in the IEEE 802.11 family, defining enhancements to 802.11 required to support ITS applications.
IP	Integrated Project (e.g. CVIS, SAFESPOT) or Internet Protocol
IPv6	Internet Protocol version 6
POMA	Positioning and Mapping sub-project
WiFi	An industry coalition that manages interoperability and type approval of equipment based on IEEE 802.11
WiMAX	WiMAX is a wireless industry coalition for advanced IEEE 802.16 standards (broadband wireless access networks).

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THE COMPANY.

STATE OF THE ART TECHNOLOGY SINCE 1984.

Q–Free is a Norwegian based company established in 1984. Our state–of–the–art technology is used worldwide to combat urban congestion and pollution and help finance transportation infrastructure.

It is also increasingly being used for traffic surveillance and vehicle identification. Q-Free is a preferred partner in Intelligent Transport Systems (ITS) and a world-leader in Road User Charging (RUC) and Traffic Surveillance solutions.

Q-Free is listed on the Oslo Stock Exchange.

Q–FREE

LEADING THE WAY

IN ROAD USER CHARGING AND TRAFFIC SURVEILLANCE

Q–FREE SOLUTIONS

ROAD USER CHARGING
CONGESTION CHARGING
TRAFFIC SURVEILLANCE
TRUCK TOLLING
PARK & ACCESS CONTROL

Q–Free's innovative solutions are used worldwide to combat urban congestion and pollution, for traffic surveillance and to finance transportation infrastructure

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