ICT in Transport

Introduction to information and communication flow system

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Defining ICT

- A family of electronic technologies and services used to process, store and disseminate information, facilitating the performance of information-related human activities, provided by, and serving the institutional and business sectors as well as the public-at-large.

Types of ICTs

What are not ICTs devices?

Barriers to ICT implementation

Functioning of ICTs

Appearance and use of information and communication technologies

Table 1. ICT and transport dimensions.

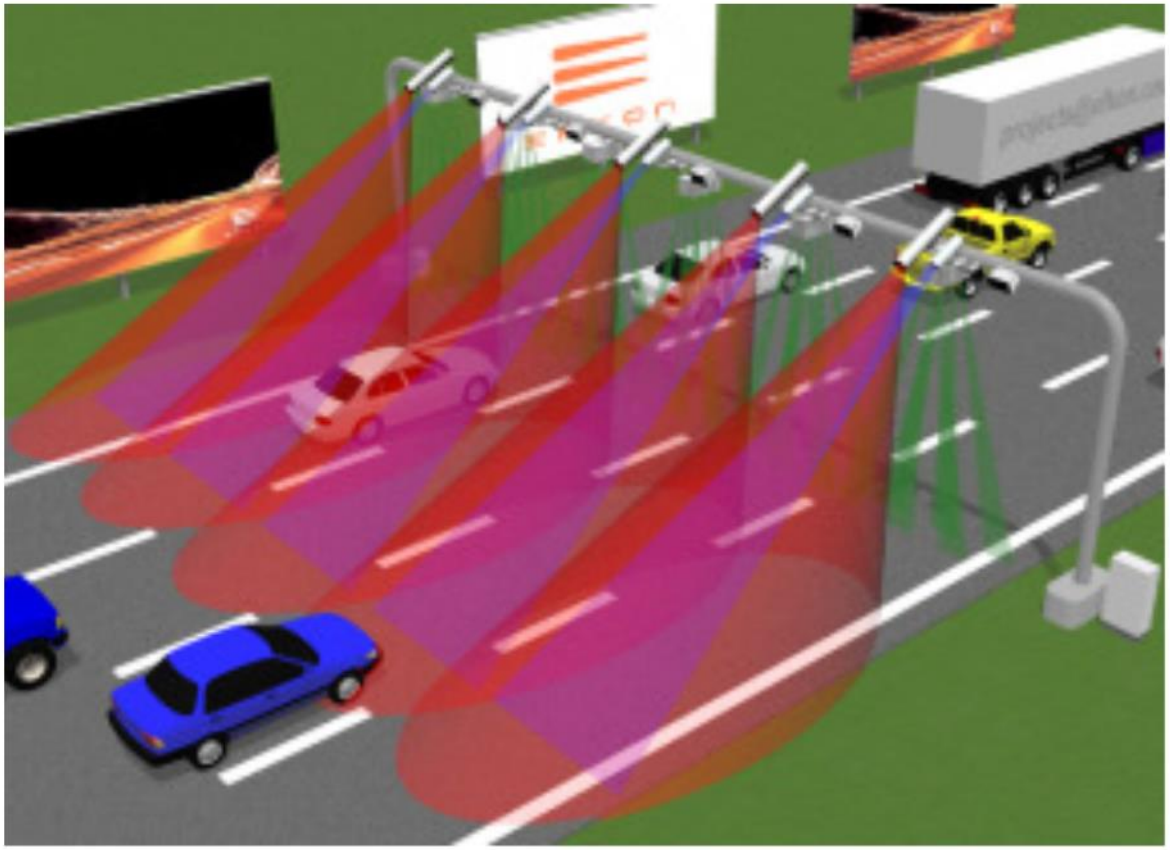
Dimension	Example
Travel information, planning, routing	
– Public transport	Moovit, Moovel, Citymapper
– Alternative transport	Uber, Mytaxi, car2go, Hailo
– Integrated transport	Frei.Mobil, Qixxit
– Car	Google maps, Waze
– Bicycle	BeeLine, GraphHopper, BikeCitizens
– Information services (e.g. weather)	AccuWeather
– Trip suggestions	Outdooractive, Myscenicdrives
– Modal shift	ViaggiaRovereto, Bike Rider
Sharing	
– Bicycle sharing	Spinlister, Bicimad, Youbike, Ofo
– Car sharing (rental)	Europcar
– Car sharing (own)	Car next door
– Ride pooling, shared commuting	Go2gether, Chariot, Facebook
– Park sharing	Ez-Park
– Park sharing/renting	Lyft
– Ride shares	ParkFlyRent
– Taxi services	Hailo
– Boat sharing	Boathound
Distance work	
– Content sharing	Buffer, Weekdone
– Chat services	Hipchat
– Video chat rooms	Sqwiggle
– Videoconferencing	GoToMeeting
Payment & price comparison	
– Integrated payments	Moovel
– Comparison of cost (transport modes, fuel)	Skyscanner, LTM, mehr-tanken
– Last minute deals	Trainline, Lastminute
Safety	
– Traffic safety improvement	Velodossier
– Participatory transport systems	Givetpraj, Stadtradeln
– Safety perceptions	Metrocosm
– Traffic learning	The Traffic Agent
Convenience	
– Parking space reservation	Justpark
– Private parking space renting	Park2Gether
– Parking space payment	Parku
– Park time reminders	Parker
– Park location reminders	Findmycar
– Illegal parking	Wegeheld
– Crowdedness indicator	Xtra
– Shopping	Bringbee
Space & distribution	
– Efficient use of existing capacities	Transit app, UberPOOL, Waze
– Car sales	Autoscout24, Autotrader, Cars
Health	
– Physical activity	Pedometer, Fitbit
– Energy "burnt" (calories)	Move app
– Kilometers cycled	Radeltzurarbeit
– Air quality	Moovel
– Pathogen exposure	PathoMap
Mobilities	
– Virtual travel	TripAdvisor, YouTube
– Travel visualization	Amcharts, Maploco, Instagram
– Competitive travel	MostTraveledPeople, Listchallenge
– Co-presence	Whatsapp
– Social status	Facebook
– Car cultures	TopGear, auto-motor-sport

ICT and sustainable transportation

- Information and communication technology plays a vital role in the sector of transportation. The ICT market continually launches new applications that support traffic congestion control, transport logistics and transport infrastructure management. In addition to all these ICT has also invaded the new era of transporting information rather than people. The ICT applications have the potential to increase the efficiency of transport networks and decrease the negative externalities, e.g. decrease the congestion and increase the quality of transport networks. However their actual impacts on transport sector and the sustainable development are still unknown. In the transport sector, the deployment of ICT in the developed cities like Stockholm has been the era of developing sensing capabilities both of vehicles and traffic monitoring systems to perceive anomalies, and hazards in the environment, and to improve the fluency of traffic for less costs and cleaner environment. The widespread adoption and development of ICT that promote sustainable transport behaviour are perquisite in terms of sustainability to be realized (Weisers, 2008). Therefore it is essential to recognize the dynamics of ICT in the field of transportation.

Working of RFID

- How can we reduce traffic congestion?



DSRC system detects vehicle entering the congested area (Bayliss, 2000)

Automatic license plate recognition (ALPR) Technology

- ALPR technology is used in most of the electronic congestion pricing systems; this system has been so much in favour of controlling the congestion in a documented way. This technology of ICT is very often used as a backup for either the DSRC systems or the VPS for enforcement. The ALPR system is based on taking the images of the number plates of the vehicle crossing the area, and then processing the image with the character recognition software to identify the vehicle and its owner. In most of the case in the recent days, the electronic pricing system has a front and a rear camera to take pictures of both sides of the car, so that the identification rate can be improved.
- The components that the ALPR system merely requires are the pole or gantry mounted cameras, and an illumination device, provided the entire setup is road side or street based. Depending on the system design there might be a need for the two cameras (Front and the Rear), and classification devices.

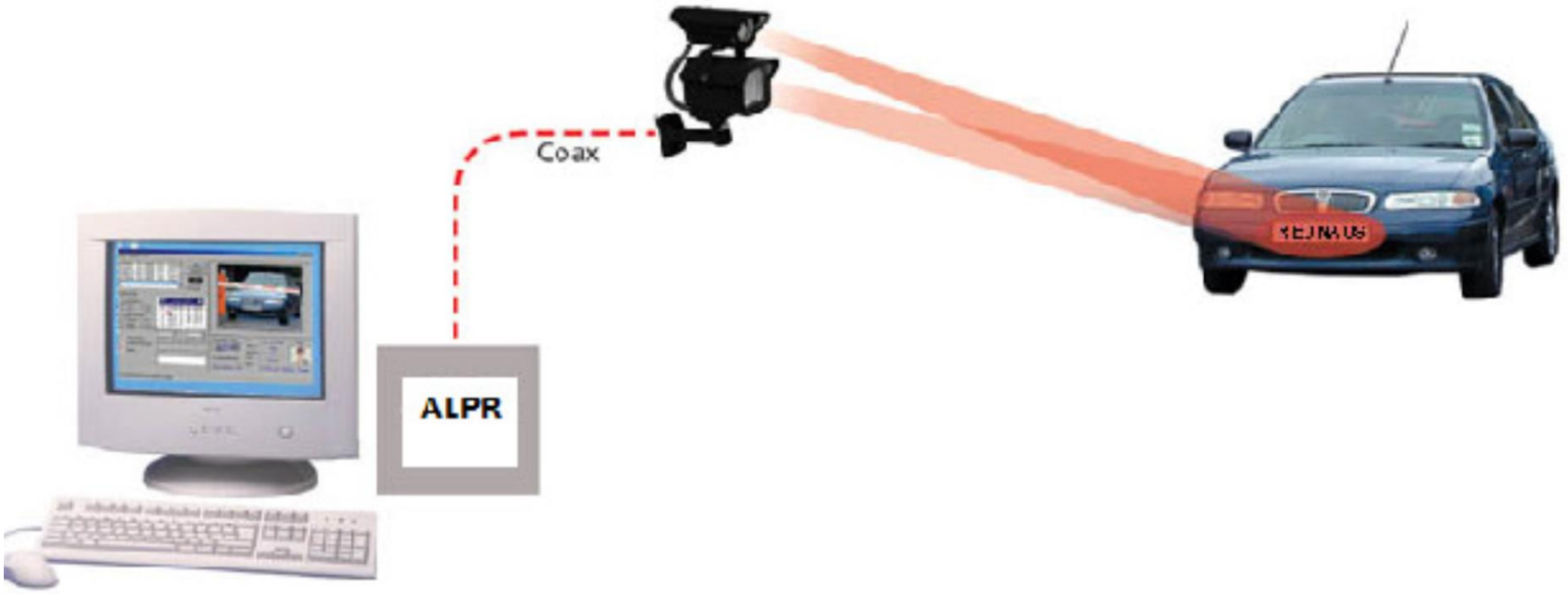


Figure 7: A simplified form of ALPR system (Bayliss, 2000)

- In addition to these basic components of ALPR, there should also be some necessary form of system controller that requires a constant power supply and communication connections through a purpose designed control unit for each camera locations. The communication connection should have a promising network set up with a dedicated fibre-optic connection, and the power supply should be uninterruptable. This system is not only used for enforcement backup, but some cities like Stockholm are using only the ALPR systems for charging. When there is a complete absence of the in vehicle unit with the tags or transponders, it simply takes the picture of the number plate and the picture is matched with a highly reliable character recognition software to identify the owner of the vehicle, and a monthly invoice is sent (Stockholm Traffic Administration, 2009). The picture below gives a clear idea, on how the matching is done to identify the owner.

Figure 8: Matching the license plate in case of enforcements and charging (Bayliss, 2000)

- What do you perceive is the main problem with the ALPR technology?

- In what ways the real time information sharing solutions help in reducing the traffic congestion?

Figure 13: Conversion of traffic data to real time information- A three step process (Yanagita, 1930)

Real time information sharing process

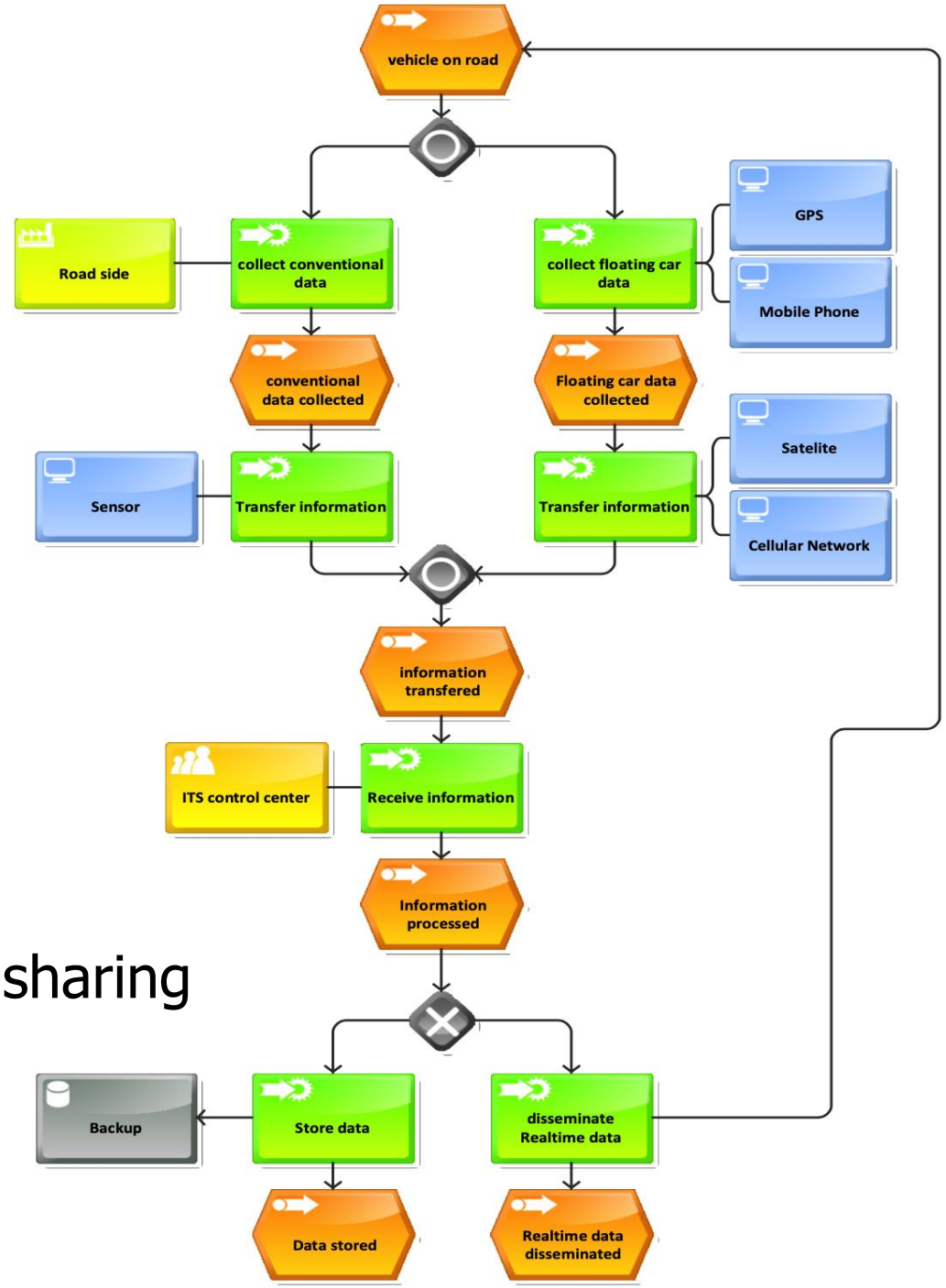


Table 2. ICT use by persons and transport demand

Type of ICT use	Impact on transport demand (persons)
Use of E-services: shopping, banking, education, entertainment, government services	Reduces travel needs for routine transactions, but may cause increase of travel demand to central places with high-level services (e.g. to enjoy "shopping experience"). May add extra mode.
On-line, last minute, booking (flights, hotels, holidays, theatre)	Causes new travel demand due to lower consumer prices.
Use of E-networking in social relations: personal communication, chat rooms, network games	Reduces travel needs for routine networking, but may cause new travel demand due to successful social networking.
E-working (at home or tele-center)	Reduces travel needs for individuals concerned but is nation wide very modest (0.8% reduction in annual vehicle miles, in US). May cause secondary impacts that counteract first impacts (substitution of work travel by not-for-work travel, and moving further to work).
E-office (internet, e-mail, portable computers, tele-servicing)	Possibly reduces travel during work. May cause increase of long distance travel because of more on-the-move working options.
E-meeting (tele- and videoconferencing)	Reduces travel needs to a limited extent, cannot substitute key-meetings (evaluation, preparation of major decisions, kick-off meetings, etc); maybe just adds an extra mode.

Table 3. ICT use by businesses and transport demand

Type of ICT use	Impact on transport demand (freight)
E-business (b2c), including e-marketing and customer services	Reduces transport for ordering and delivery of non-material goods (e.g. music, software); may add an extra mode. Delivery may be reorganized to decrease transport demand; but if time pressure, more frequent delivery with smaller loads. If more customers around the globe, distance may increase (more air transport) with smaller loads.
E-business (b2b)	Electronic ordering (sourcing) around the globe increases delivery distance (more air transport) probably with smaller loads. Whether reorganization of value chains influences transport, depends on underlying models, e.g. short assembly times may cause supplier villages around assembly plants and reduce transport.
In/outbound logistics, and real-time guidance in freight distribution	Better performance on time aspects, but may increase transport distance. Decrease in number of trips (through chaining and load matching).
Configuration of value webs	Influence on transport demand depends on underlying optimization, e.g. transport costs, production and delivery time, best available product quality.
	Impact on transport demand (persons)
Remote (simultaneous) development and design	Reduces travel demand of R&D personnel to some extent, but cannot substitute for informal creative meetings.
Remote diagnostics (monitoring)	Reduces travel demand of servicing engineers, but is still limited due to legal issues concerning responsibility and liability of partners, and due to network shortages (bandwidth).

Table 3. Information and communication technology and production: implications for transport

Application	Role of information and communications technology	Impacts on transport
e-Commerce and e-everything	Internet, sms, e-mail, etc.	May reduce the need for the movement of goods in certain cases, e.g. music is downloaded from the web, and orders are transmitted electronically
Just-in-time production	Technology for stock control, ordering and tailored production	More frequent deliveries. Smaller loads, faster delivery, more air movements
Logistics and freight distribution	Real-time route guidance, track and trace technology–optimizing delivery vehicles and routes	Savings in reliability and travel time, but may add to journey distance. Possibilities for trip chaining and load matching. Also, savings in terms of vehicles and route choice
e-Marketing and publicity	Internet, sms, e-mail, etc.	Could potentially reduce the amount of other sorts of marketing/publicity material produced. More likely that e-marketing will be an additional source of information rather than a substitute

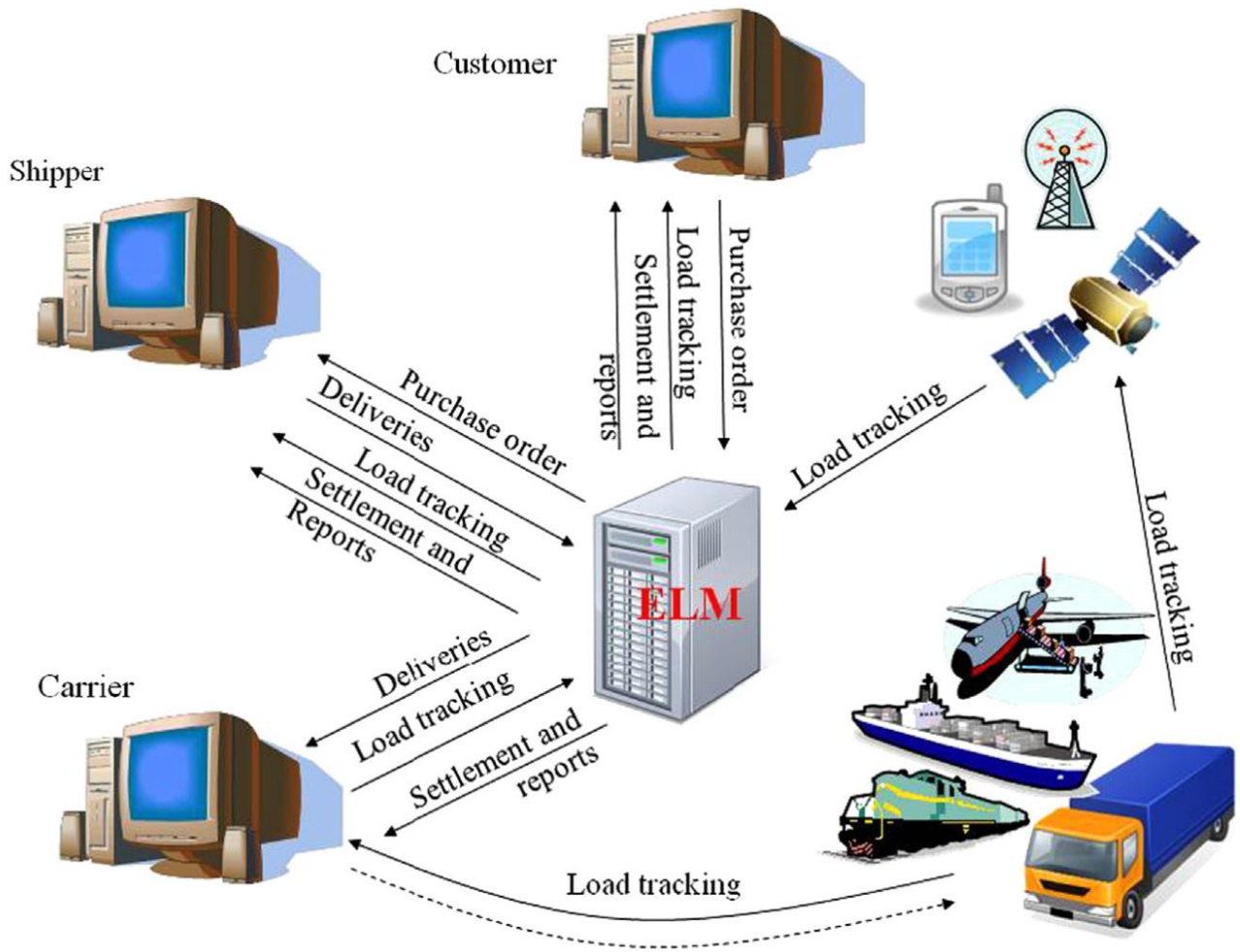

Customer
Shipper
Carrier
ELM
Purchase order
Load tracking
Settlement and reports
Purchase order
Deliveries
Load tracking
Settlement and Reports
Load tracking
Load tracking
Deliveries
Load tracking
Settlement and reports
Load tracking

Table 3. Technologies available for ITS [12].

Mode	Description
Air	The most important technological elements in the air transport mode are the maneuvers support systems for aircraft landings and takeoffs (ILS - International Landing System and MLS - Microwave Landing System), navigation aid systems (VOR - VHF Omnidirectional Range, GNSS) and radars.
Maritime	In maritime transport, the most representative elements are the Automatic Identification System –AIS-, and the positioning and communication systems GNSS (Global Navigation Satellite Systems). In this mode of transport, the radio-electric systems to aid navigation are widely used. Terrestrial or satellite radio-navigation systems such as LORAN-C type (Long Range Aid for Navigation), GPS - Global Positioning System and radar, (Radio Detection And Ranging) have been key technological elements to avoid collisions and to allow the development of this mode of transport.
Rail	In rail transport, the highest technological development is clearly seen in the railway traffic management systems, such as the European Rail Traffic Management System - ERTMS, which is composed by: ETCS (European Train Control System) and GSM-R (Global System for Mobile communication - Railways). For railway traffic management in cities, systems such as the Automatic Train Protection - ATP, or the Automatic Train Operation – ATO are used, which enable an integral management of the rail network, producing a safe and high quality service, and reducing the system's energy consumption.
Road	In road transport, the most important technological elements are related with positioning systems like GPS and traffic monitoring through cameras. These systems can be used for automatic incident detection (AID), toll management, urban transportation control, congestion detection, in-tunnel control, speed control and calculation, dangerous goods transport control, infractions detection, among others. Other relevant technological elements for road transport are the Advanced Driver Assistance Systems – ADAS- and the In-Vehicle Information Systems IVIS -, which provide users with information about secondary tasks related to transport, such as navigation.