Intelligent Transport Systems

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# Market Analysis of the Intelligent Transport Systems and Services (ITSS) Sector

November 2008

**Report on a study of the global Intelligent Transport Systems and Services (ITSS) market sector by innovITS, the UK centre for excellence in transport telematics and technology for sustainable mobility**

# ITSS Market Study

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# Foreword

## Market Analysis of the Intelligent Transport Systems and Services (ITSS) Sector

Prepared for Technology Strategy Board

This document brings together, I believe for the first time, information about the development of the market for a variety of products and services that help society meet one of its most difficult challenges- the movement of people and goods. The information has been researched from a variety of sources, commercial forecasters, operators and other public bodies and we are grateful for their permission in publishing this information to a wider audience. We are also grateful to Alan Carter of Transpomatica Consultants Limited who collated the analysis and to my colleagues on the Board and staff of innovITS who all contributed their own valuable insights.

innovITS limited is funded by the Department of Business, Enterprise and Regulatory Reform to be a centre for excellence in transport telematics and technologies for sustainable mobility. It was established in 2005 in response to recommendations from AIGT (Automotive Innovation and Growth Team). Its mission is to accelerate the deployment of ITSS to solve UK transport problems, in particular to improve road safety and security; to optimise transport productivity via congestion reduction, traffic diversion and gaining extra capacity from existing infrastructure; to encourage integrated transport; and to enhance environmental, economic and social benefits.

It is hoped that the publication of this study will assist in this mission in helping participants to understand the wider context in which they are working and the opportunities that their efforts can exploit. I commend it to your attention

David Pearson, Chairman, innovITS Limited

Some of the data used in this report was obtained from commercial market research and information companies. The main suppliers of this data and their contact details for further information are:

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# Summary

## Introduction

This report has been prepared by innovITS in response to the request from the Technology Strategy Board, an executive non-departmental public body established by the UK Government in 2007. The main purposes of this report are to provide a better understanding of the commercial, technological and political dynamics of the global, European and domestic ITSS markets.

Using data provided by professional market research organisations and other bodies, the study examines information on the market structure, drivers and constraints, market trends and growth predictions, major projects, leading vendors and regulatory impacts in key ITSS sectors. As a reference framework, the seven ITS policy sectors identified by the Department for Transport (DfT) in their November 2005 policy framework together with automotive telematics and communications services were used for analysis of the ITSS market.

It became clear during the course of the study that no reports were available comprehensively covering the full spectrum of ITSS in the global, European and domestic markets of interest. This is mainly due to the diversity of definitions of ITSS and to the wide variety of narrow interests. Much of this report is therefore a synthesis of the data available from several sources, with conflicts of information resolved on a rational basis.

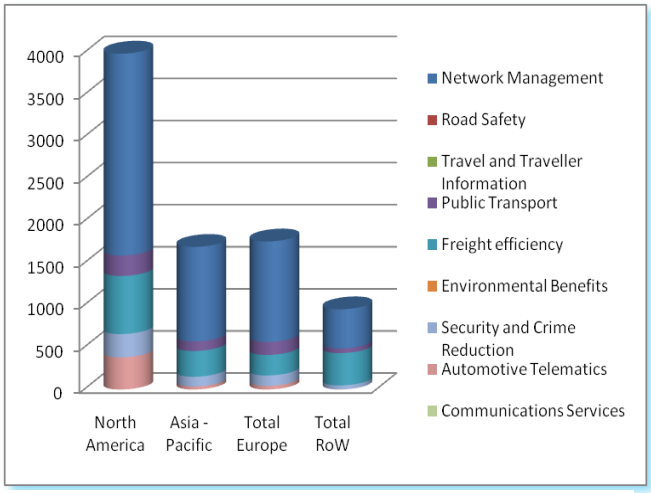



*Figure 1-1 2000 Product-market matrix data: revenues in US$million*

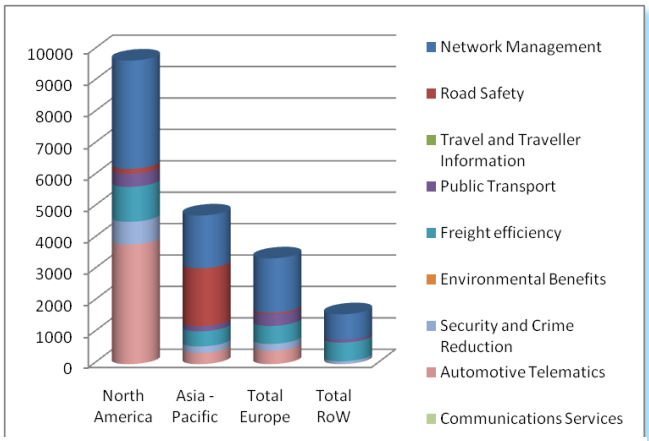



*Figure 1-2 2005 Product-market matrix data: revenues in US$million*

## Key findings

The global market for ITSS in 2005 was of the order of US$19bn and is expected to grow to $44bn by 2010 and then to $65bn by 2020.

The largest ITSS market is North America with about half of the market in 2005, with the share declining to about 40% in 2020. The Asia-Pacific region is next largest, with about one quarter of the market in 2005, with the share expected to decline slightly by 2020. The third largest market is Europe with 16% of the market in 2005, expected to increase 22% by 2020. The Rest of World, including key emerging markets, had 8% of the global market in 2005 and is expected to grow to 17% by 2020.

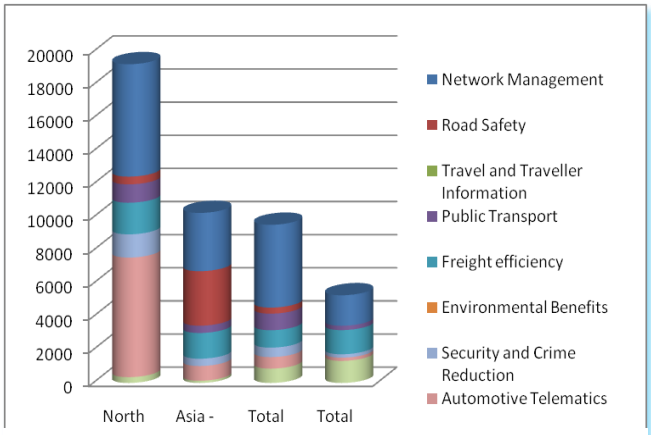



*Figure 1-3 2010 Product-market matrix data: revenues in US$million*

Globally, the key current ITSS products and services are Network Management, including Road User charging, with 39% of the global market, Automotive Telematics with 24% and Freight Efficiency, including commercial telematics, with 14%. By 2010 the percentages are expected to show little change, with Network Management at 38%, Automotive Telematics at 20% and Freight Efficiency at 14%. By 2020 significant impact from mobile communications is expected, though Network Management will remain in the lead at 35%, and Communications Services and Automotive Telematics at 15% each.

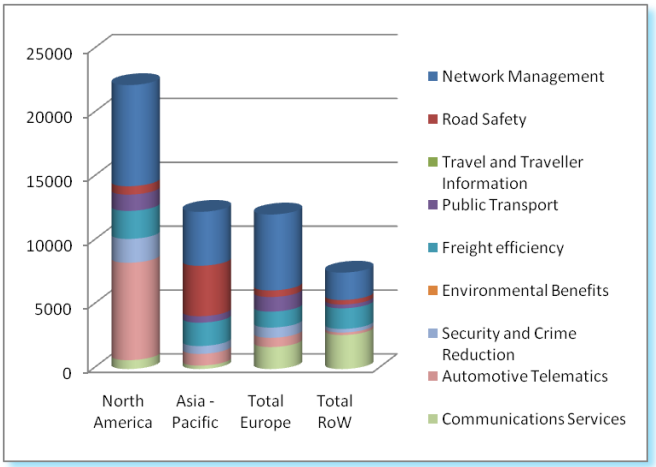



*Figure 1-4 2015 Product-market matrix data: revenues in US$million*

Within Europe, the key ITSS products and services are currently Network Management with about half of the market, Freight Efficiency with 18% and Automotive Telematics with 14%. By 2010 the percentages are expected to change to Network Management with 51%, Public Transport and Freight Efficiency with 11% each and closely followed by Communications Services at 9%. By 2020 Network Management is expected to reduce to 45%, Freight Efficiency to 10% and Communications Services to increase to 20%.

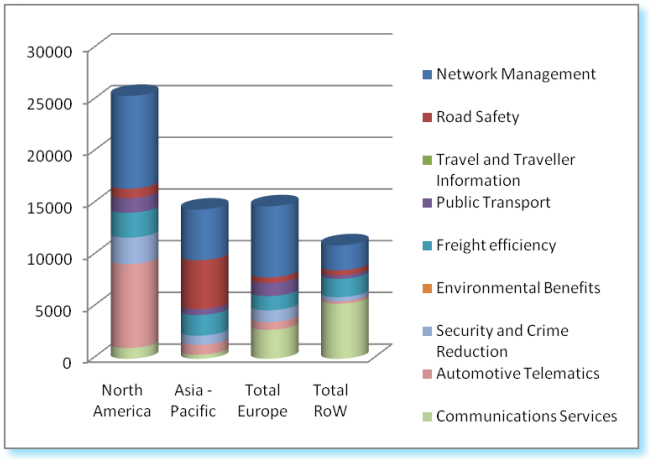



*Figure 1-5 2020 Product-market matrix data: revenues in US$million*

## Conclusions

The global ITSS market is large and growing, particularly in established regions, and in the infrastructure and communications product areas where UK has significant strengths. Many of the markets will not be accessible to UK business for reasons of regulations, standards and national preferences. UK companies are interested to ascertain the scale of the ITSS market available to them and it is hoped that this study report will assist the Technology Strategy Board in understanding the global market and determining policies that support UK business.

This report also includes a brief assessment of the UK's strengths, weaknesses, threats and opportunities in the global market for ITSS based on a series of telephone interviews with key players in the UK market. The views expressed provide useful insights on the perception of the UK as strong at academic research, R&D, systems integration, enforcement, traffic management and road user charging, but weak in the automotive sector, at implementation and at turning ideas into production, underlying the very reason for the existence of innovITS.

At this stage it is hard to assess the impact of the "credit crunch" and the economic downturn. At present it seems that public sector procurement is unlikely to be affected in the short term. The commercial telematics sector also seems robust, with companies seeking to improve operational efficiencies in adverse trading conditions. The areas most under threat are those concerned with the private consumer and ITSS facilities directly associated with property developments.

# 1 Introduction

## Purpose

1.1 This study report has been prepared by innovITS with the aim of providing a better understanding of the commercial, technological and political dynamics of the global, European and UK ITSS sectors. The report is intended to provide information on market structure, drivers and constraints, market trends and growth predictions, major projects, emerging global markets and on the impacts of regulations and standards in key ITSS sectors.

## Definition of the ITSS sector

It is recognised that there are many different definitions of the ITSS (Intelligent Transport Systems and Services) sector, depending on the perspective of the multiple players active in the sector. For this study we have taken a wide view and defined ITSS as ***"a range of technology based solutions for improving the quality, safety and information aspects of traffic and transport. ITSS technologies, also known as 'transport telematics', usually have three core characteristics: communications, information and integration. ITSS solutions enable individual travellers, drivers, transport operators and public authorities to make better-informed, more 'intelligent' decisions."***

ERTICO – ITS Europe, the multi-sector, public/private partnership pursuing the development and deployment of Intelligent Transport Systems and Services (ITS), defines ITSS in these terms: ***"ITS – Intelligent Transport Systems and Services – is the integration of information and communications technology with transport infrastructure, vehicles and users. By sharing vital information, ITS allows people to get more from transport networks, in greater safety and with less impact on the environment. Only once travellers, vehicles and infrastructure can freely exchange information will the capacity of the transport network be fully utilised."***

The EU Transport Research Knowledge Centre defines the Intelligent Transport Systems theme in the following terms ***"Intelligent Transport Systems (ITS - sometimes known as transport telematics) comprise several combinations of communication, computer and control technology developed and applied in the domain of transport to improve system performance, transport safety, efficiency, productivity, service, environment, energy, and mobility. ITS can be applied to the transport infrastructure of highways, streets, and bridges, as well as to a growing number of vehicles, including cars, buses, trucks, and trains. These systems can be used both for passenger and for freight transport. These technologies provide a new means of improving the service quality and management of the transport system"***

The Department for Transport, in its ITS policy framework document published in November 2005, defines ITS as "combinations of information processing, maps, databases, communications and real-time data from a range of sensors, to produce solutions that enable:

- ***infrastructure owners and operators to improve the quality, safety and management of transport networks;***
- ***individual travellers, drivers, hauliers, transport operators and authorities to make better informed, more 'intelligent' journey decisions;***
- ***network operators and 'third party' service providers to supply advanced information services, increasingly on a multi-modal basis, to all types of traveller; and***
- ***road users to drive safer, 'smarter' vehicles."***

More detailed definitions of the various products within each aspect of ITS are given in later chapters. As in any industry, there are many abbreviations and acronyms in the ITSS sector; the main ones for ITSS are listed in Appendix C

## Assumptions/Interpretations

1.2 In conducting the study and preparing this report the following assumptions and interpretations are made:

- Data is to be derived from commercially available sources, primarily professional information service providers
- All numerical data values are expressed in $US, with a nominal exchange rate based on £1=$1.80=€1.3
- The emphasis of the report is on road transport, with other modes (rail, trams, air and sea) restricted to information systems

## Information sources - commercial

1.3 Several commercial information service providers were investigated as possible sources for the study. None of these covered the complete range of information required. Based on analysis of their offerings it was decided to procure a combination of reports and services from two suppliers, namely ABI Research and Frost & Sullivan. We are grateful to both for their permission to use their data in this report. Further information can be obtained from both organisations and their contact details are at the front of the report.

## Information sources – other

1.4 Other sources researched included government, association, press and company websites. We also obtained information from organisations, in both public and private sectors, and we are also grateful for their material and input.

## Information quality and limitations

1.5 The information provided by commercial organisations usually comes with heavy disclaimers about the reliability of the information. Whilst there are statements to the effect that their reports are intended to be as reliable as possible, the information providers do not accept any responsibility for the content of their reports or liability for any resulting losses. Having said that, the reports often indicate an error tolerance on market data, with the figures typically in the range 5% - 10% - 15%. Consequently the figures used in this innovITS report will have similar error tolerances.

1.6 Whilst some parts of the market data related to “travel and traveller information” and “public transport ITSS” can be separately identified, e.g. Transport Direct and real time information, it is sometimes aggregated within the data for systems such as network management and automotive telematics. The report includes such data in the relevant chapters.

1.7 There is little market data on the product areas relating specifically to “enforcement systems”, although this is a field in which UK has some strengths.

1.8 Although some additional qualitative data is included in the chapter on environmental benefits, there is little quantitative market data. This lack of data results from the fact that this theme is only just emerging in ITSS policy and thus not yet attracting focussed industry response. There are also difficulties in defining distinct products and services as many environmental benefits arise from the use of other product and service areas.

1.9 Estimates of market values relating to “communications services” reflect significant uncertainties as to how the mobile market may impact on more traditional ITSS services, giving rise to the likelihood of a large margin of error.

1.10 Most of the forecasts from the service providers go to 2010 or 2012 and only exceptionally to 2020. Data for 2015 and 2020 included in this report is therefore highly speculative.

1.11 Inevitably, forecasting of market revenues has to take account of many variables and uncertainties, including economic, technological, commercial, political, social, environmental, institutional and legal. Any or all of these could significantly impact on forecast revenues.

Significant economic uncertainty arises from the "credit crunch". This is impacting sales of private vehicles and also infrastructure ITSS projects that are tied to construction and commercial developments.

## Structure of Report

1.12 After this introductory chapter the report is set out as follows:

Chapter 2: ITSS Market Segments, indicates how the ITSS market is broken down into the key geographical sectors as well as the division into products and services.

Chapter 3: ITSS Market Analysis – Global Overview, looks at the ITSS market primarily from the view point of the key market territories of North America, Asia-Pacific, Europe and Rest of World including emerging markets.

Chapters 4 – 10: cover the various product and service sectors that relate directly to the seven Department for Transport themes in their Framework Policy.

Chapter 11: Automotive Telematics, brings together the specific elements of in-vehicle ITSS.

Chapter 12: Communications Services, covers fixed line and mobile services for travel and traffic applications.

Chapter 13: Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis of the UK's position in the global ITSS market.

Chapter 14: Conclusions.

1.13 Four Appendices then provide additional supporting data, namely:

Appendix A: Base product-market matrices, showing revenues in US$million, with a separate matrix for each year 2000, 2005, 2010, 2015 and 2020.

Appendix B: Abbreviations used in the report.

Appendix C: Highways Agency Technology Programme as at August 2008.

Appendix D: Transport for London Investment Programme in ITSS

The two Appendices C and D are included as prime examples of the two largest public sector ITSS purchasers.

# 2 ITSS Market Segments

## ITSS Market segments

2.1 For the purpose of the study and report, we have divided the ITSS Market Segments into:

- Geographical sectors
- Policy themes and product sectors
- Product and service types
- Market classifications

## ITSS Geographical sectors

2.2 ITSS geographical sectors are divided into:

- **North America** – this established ITSS market comprises mostly the USA, with Canada and Mexico added where appropriate
- **Asia-Pacific** - this established ITSS market comprises mostly Japan together with Korea and Australia added where appropriate
- **Total Europe** – comprises the established ITSS market in the UK and the rest of Western Europe, together with the emerging markets of Eastern Europe
- **Rest of World** – comprises the emerging ITSS markets in South Africa, South America, China, India and other Asian countries

## ITSS Policy themes and product sectors

2.3 Products and services in the ITSS market are grouped into nine sectors. Seven of these sectors are in line with the Department for Transport's ITS policy framework theme (published in November 2005):

- Theme 1: **Network Management** - improving road network management, including road pricing.
- Theme 2: **Road Safety** - **i**mproving road safety, by reducing collisions, casualties and deaths.
- Theme 3: **Travel and Traveller Information** - better travel and traveller information, helping to match supply and demand by providing better information so that travellers can make informed choices on when and how to travel.
- Theme 4: **Public Transport** - better public transport on the roads, supporting more reliable, more accessible, safer and more efficient services.
- Theme 5: **Freight Efficiency** - supporting the efficiency of the road freight industry.
- Theme 6: **Environmental Benefits** - reducing negative environmental impacts.
- Theme 7: **Security and Crime Reduction** - supporting security, crime reduction and emergency planning measures.

2.4 The eighth sector is **Automotive Telematics**, which brings together several key technologies and spans several of the DfT themes.

2.5 The ninth sector is **Communications Services,** comprising fixed and mobile communications which are at the heart of nearly all ITSS.

## Product sectors

2.6 For the purposes of this report the product sectors are based on seven DfT ITS themes, together with automotive telematics and communications services. The products and services are grouped into each of the product sectors as given in the table:

| Product and service sector | ITSS theme | Products and services included | Ref Chapter |
|---|---|---|---|
| ***Network Management*** | Improving road network management, including road use charging | Advanced traffic management systems, including urban and interurban hardware and systems<br>Road user charging, congestion charging and electronic toll systems, including urban and interurban | 4 |
| ***Road Safety*** | Improving road safety, by reducing collisions, casualties and deaths | Infrastructure for road safety including vulnerable road users.<br>Advanced driver assistance systems, including night vision systems, lane departure warning, blind spot detection, intelligent parking assist, adaptive cruise control | 5 |
| ***Travel and Traveller Information*** | Better travel and traveller information, helping travellers to make informed choices on travel | Infrastructure systems, including traffic information systems and variable message signs<br>In-vehicle systems, including RDS-TMC and TPEG | 6 |
| ***Public Transport*** | Better public transport on the roads, supporting more reliable, more accessible, safer and more efficient services | Public Transport information systems, including ticketing, journey planning and real-time information systems for bus/rail passengers and management | 7 |
| ***Freight efficiency*** | Supporting the efficiency of the road freight industry | Commercial Vehicle telematics systems including freight and fleet management systems | 8 |
| ***Environmental Benefits*** | Reducing negative environmental impacts | Environmental benefits of ITSS including usage based insurance and benefits arising from ITSS listed above and below | 9 |
| ***Security and Crime Reduction*** | Supporting security, crime reduction and emergency planning measures. | CCTV, ANPR, access control, enforcement, vehicle identification, eCall and incident management | 10 |
| ***Automotive Telematics*** | Automotive telematics | Telematics and infotainment - original equipment and aftermarket – hardware, systems and services | 11 |
| ***Communi-cations Services*** | Communications Services | Use of mobile telephones (cell phones) for travel and transport applications. Infrastructure telecommunications including fixed line, Wi-Fi and Wi-Max | 12 |

## Product and service types

2.7 Where appropriate and where data exists the product and service types are further subdivided into:

- **Systems and products**, including hardware and equipment
- **Professional services**, including consultancy, software development, systems integration, training and management
- **Other services**, including installation, commissioning, maintenance and operation

## Market classification

2.8 The ITSS market can be further classified into three types:

- **Public sector** – in this market type the purchaser is usually a public authority, e.g. municipality, government department, police authority or similar body. Infrastructure ITSS is usually purchased by the public sector.
- **Consumer** – this covers individual "black boxes" and systems purchased by consumers, usually backed by an extensive distribution and service network. The consumer may purchase these either as Original Equipment or as an Aftermarket product.
- **Business to Business** – this covers purchase by one business from another and frequently relates to the commercial telematics market.

# 3 ITSS Market Analysis: Global Overview

## Global overview of the ITSS market

3.1 This chapter provides a global overview of the ITSS market sector. It accumulates for each geographical sector the sales volumes for each of the Intelligent Transport Systems and Services detailed in the following chapters.

## Base model and data set

3.2 The core matrices of the geographical and ITSS data are presented as the base model and data set for the study. These matrices are shown in Appendix A, one page for each of the base years: 2000, 2005, 2010, 2015 and 2020.

## Total world by ITSS theme

3.3 The graph shows the forecast total world market revenues in US$m for each of the key ITSS themes for 2000-2020.

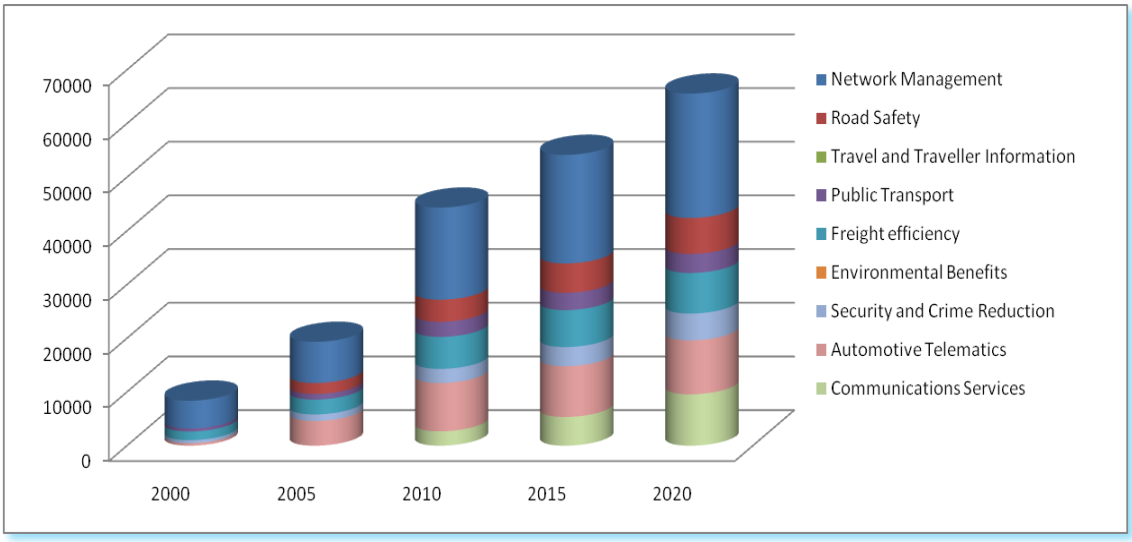



*Figure 3-1 2000-2020 Total World by ITSS theme: revenues in US$million*

## Geographical sector summaries

3.4 The geographical data is summarised for North America, Asia-Pacific, Europe, and Rest of World.

3.5 Summary for North America - the graph shows the forecast North America market revenues in US$m for each of the key ITSS themes for 2000-2020.

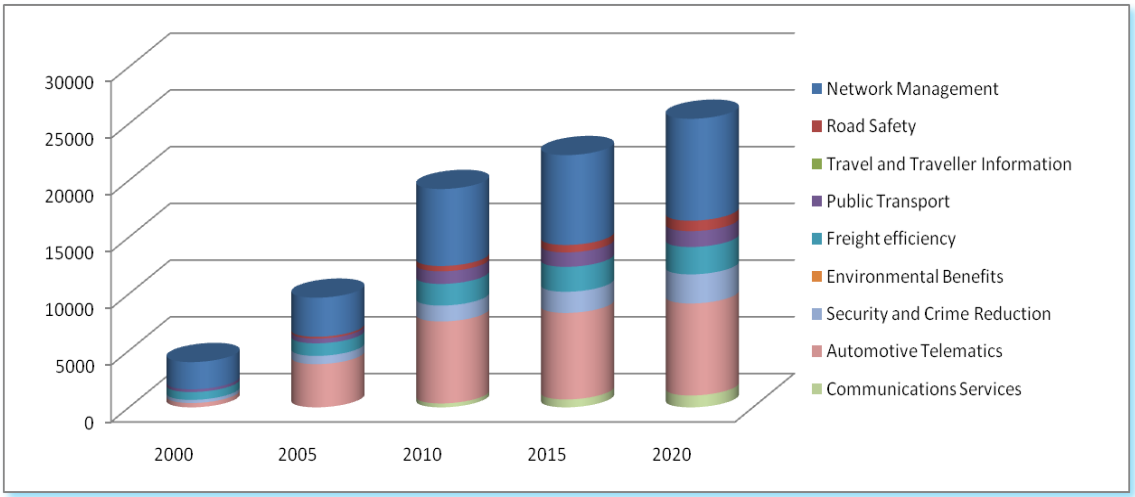



*Figure 3-2 2000-2020 North America by ITSS theme: revenues in US$million*

3.6 Summary for Asia-Pacific - the graph shows the forecast Asia-Pacific market revenues in US$m for each of the key ITSS themes for 2000-2020.

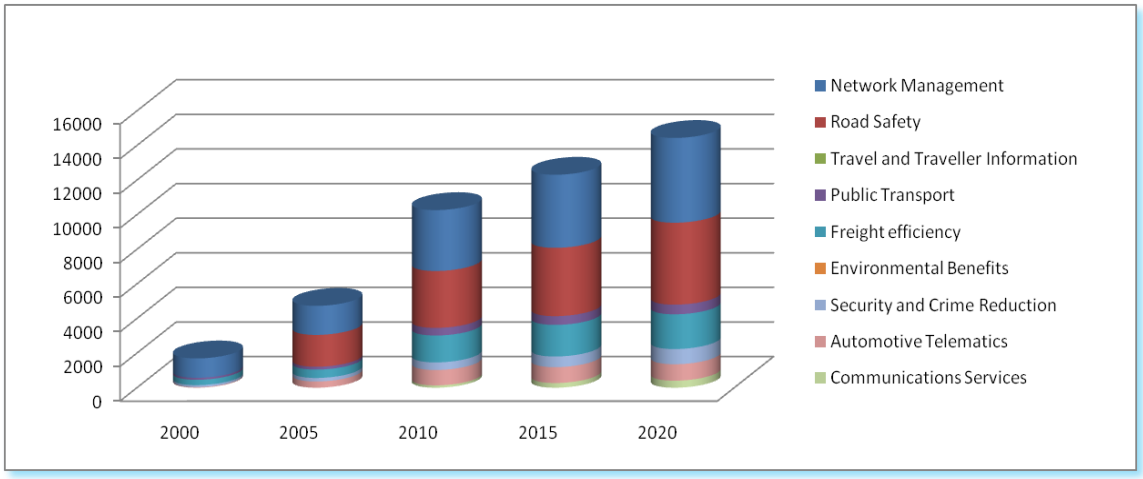



*Figure 3-3 2000-2020 Asia-Pacific by ITSS theme: revenues in US$million*

3.7 Summary for Europe - the graph shows the forecast Europe market revenues in US$m for each of the key ITSS themes for 2000-2020.

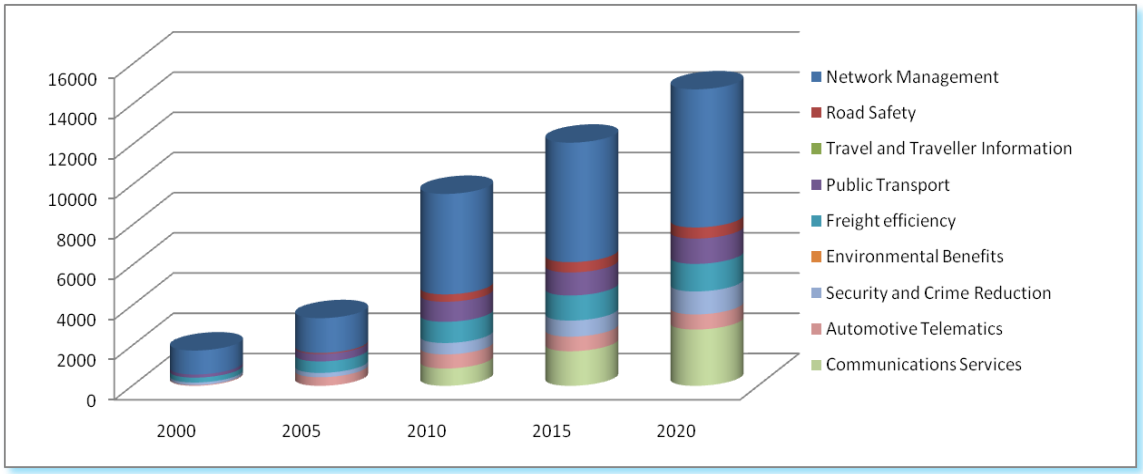



*Figure 3-4 2000-2020 Total Europe by ITSS theme: revenues in US$million*

3.8 Summary for Rest of World - the graph shows the forecast Rest of World market revenues in US$m for each of the key ITSS themes for 2000-2020.

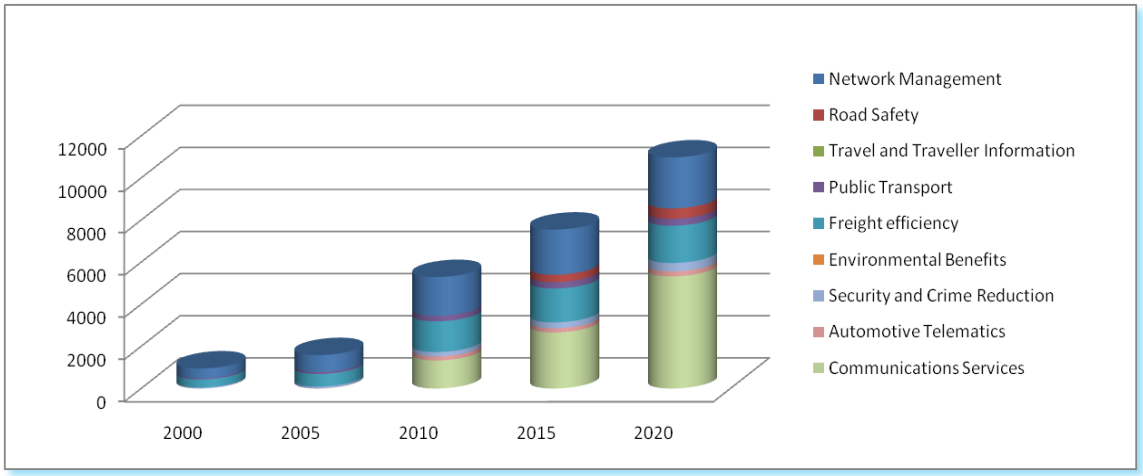



*Figure 3-5 2000-2020 Total Rest of World by ITSS theme: revenues in US$million*

## Market shares by product

3.9 The graph shows the market % shares by product for the Total World Market and how these are expected to change in the period 2000-2020.

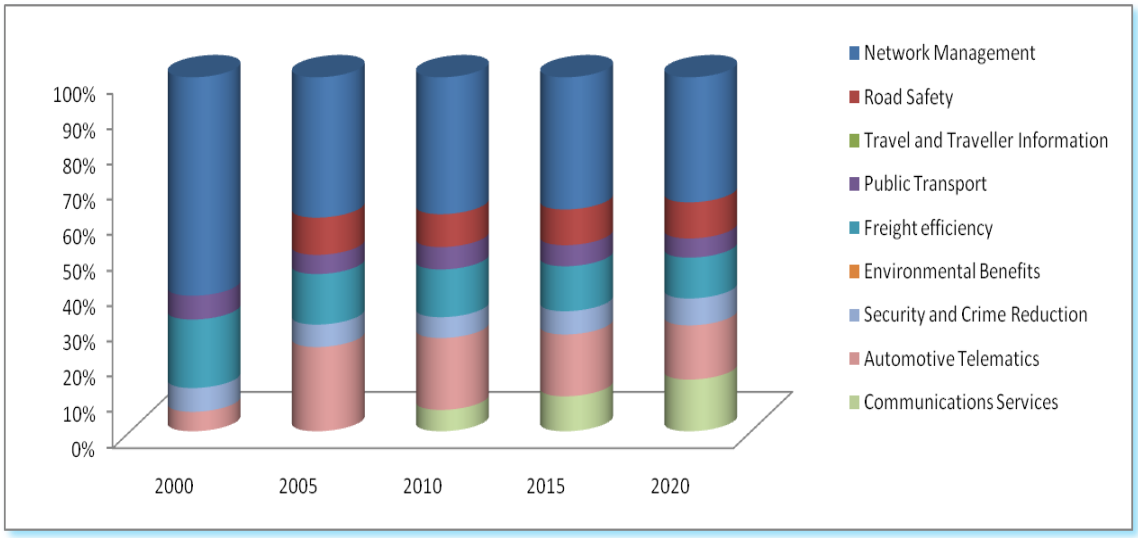



*Figure 3-6 2000-2020 Total World Market % shares by product*

3.10 The graph shows the market % shares by product for the Total Europe Market and how these are expected to change in the period 2000-2020.

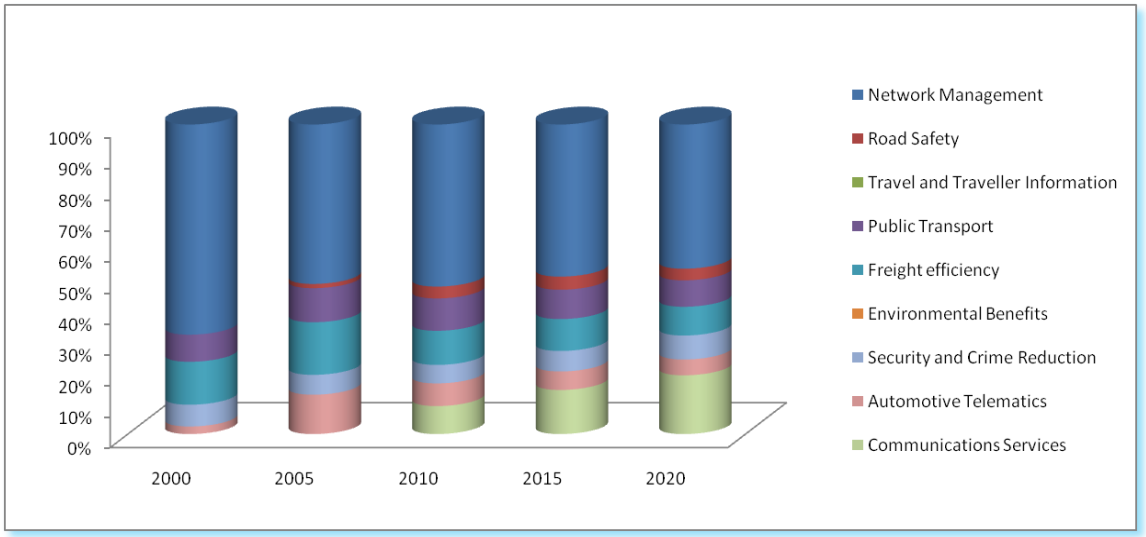



*Figure 3-7 2000-2020 Total Europe % shares by product*

# 4 Network Management

## Market structure and drivers

4.1 The ITSS market related to improving road network management is generally a public sector market in which systems and services are purchased by public authorities, e.g. municipalities, government departments, government agencies, regional and state government organisations, police authorities and similar bodies. Some systems, particularly electronic toll collection systems may be purchased by private sector operators such as road, bridge and tunnel concessionaires.

4.2 Currently the global ITSS market for improving road network management is undergoing several changes, mainly caused by the increasing economic cost of road management and traffic congestion, the emergence of new technologies and the rising interest in congestion charging/road user charging. The key market drivers are:

- Growing levels of congestion, creating the need to improve traffic flow, reduce delays and improve journey time reliability.
- Rising public and government concerns, backed by current and anticipated legislation, to significantly reduce emission levels, improve air quality and reduce noise pollution.
- Rising public and government concerns to improve road safety and reduce accidents, particularly vulnerable road users such as pedestrians and cyclists.
- The high cost associated with transport congestion, estimated at 1.5% of GDP in Western European countries; and the high cost of delays at border crossings, estimated to increase the cost of goods transported by 0.8% for each day of waiting at border crossings.
- Increased public acceptance of congestion charging schemes – the high level of frustration which is caused by time delays due to static traffic on the roads has led users to accept Congestion Charging as a means to combat congestion. In London, the new mayor has put Congestion Charging out to public consultation, which will test public acceptance.
- Increasing recognition by public authorities of the benefits of Private and Public Partnerships (PPP) in risk sharing and tackling budget limitations.
- Increasing need for project funds, such as London's congestion charging, that can be used to fund transport improvements.
- Greater flexibility of payment systems through the introduction of in-car on-board-units, e.g. by using direct debit accounts, resulting in quicker, more flexible transactions.

4.3 For the supply side of the market, the industry structure comprises:

- Hardware/equipment manufacturers, including both roadside equipment and control centre equipment suppliers
- Technology and field service providers
- Information service providers
- Back office system providers, including process outsourcers
- System integrators
- User services companies, e.g. for billing and customer support
- Traffic planners/consultants

## Market demands: the ITSS role

4.4 In response to the market drivers, ITSS provide a variety of methodologies and technology applications. In particular ITSS:

- provide the tools and techniques to measure and reduce congestion;
- provide systems to manage the existing road network better through in-vehicle systems and the infrastructure;
- support delivery of real-time traffic and traveller information;

- provide the means to implement road pricing; and
- increase capacity of the existing road network.

### Market constraints

4.5 Several factors constrain the growth and development of ITSS for improving road network management. The key factors are:

- Restrictions on public sector budgets where ITSS will compete with other calls for transport investment such as public transport, and non-transport investment such as community facilities
- Generally a reluctance by public authorities to take risks and adopt new technologies and new solutions
- Restrictions and political objectives that may impact on public procurement, though the impact is likely to vary from country to country
- Variety of political pressures, and opinions from local authorities on the sources of investment and the allocation of revenues, causing delays in the introduction of schemes
- High operation and maintenance costs of ITSS systems including telecommunications and other revenue costs
- Technical and administrative problems and human errors in enforcement processes such as misreading of number plates when registration numbers are input into the database, increasing costs for redressing errors
- Restrictions arising from the lack of interoperability and inadequate standardisation of specifications
- Concerns over privacy and data protection issues

### Purchaser profiles

4.6 Most ITSS for improving road network management are funded through public authorities such as the following typical organisations:

- *Local highway authorities* such as municipalities, local authorities, cities, counties, unitary authorities. Such authorities purchase urban and local traffic management systems and are typically funded by a mix of local taxes and central and regional government grants.
- *Government departments*, such as national ministries of transport or construction or public works. Where complex technology or significant new development is involved, other ministries such as communications or science and technology could be the purchasing authority.
- *Government agencies* (e.g. UK Highways Agency), regional government and state government organisations (e.g. Bavaria). Typically such authorities purchase ITSS for interurban highways; they also let concessions for the construction of toll roads, bridges and tunnels, and procurement of tolling systems.
- *International government bodies* such as the European Commission, with its funding of R&D programmes and of regional developments. Funding bodies such as EBRD and the World Bank also have a role in developing countries.
- *Police authorities* at national, regional or local levels. In some countries (e.g. India) the police have responsibility for ITSS procurement; in others police responsibility is limited to procurement of enforcement systems (e.g. red light cameras).

### Products and Services - Advanced Traffic Management Systems

4.7 Generally Advanced Traffic Management Systems, both Urban and Interurban, have evolved over several years, and many are legacy systems that predate the term “ITSS”. Such systems cover the management of cycles, motorcycles and pedestrians, as well as vehicles and include:

- *Urban Traffic Management and Control Systems*. These comprise systems such as adaptive traffic control systems for urban network management and traffic control, and include vehicle detectors, centralised hardware and software, data communications, CCTV cameras, intersection control equipment, signals and signs. Their purpose is to reduce vehicle delays and the number of stops on the road network.
- *Vehicle detection*. These include a variety of technologies for real time detection of vehicle speeds, flows, presence, occupancy, length and other parameters. The commonest form of detection is based on inductive loop detectors. Newer vehicle detection technologies, avoiding the need to cut the road surface for loop insertion, include microwave, acoustic, infra red and video image processing.
- *Ramp Metering Systems*. These are designed to control traffic movements from ramps onto an expressway using traffic signals to limit access to the expressway at busy times. These systems work with several detectors upstream, downstream and at the merge points of the ramp together with predictive algorithms to control congestion.
- *Interurban Traffic Management Systems.* These operate on expressways and include vehicle detection and variable message signs (VMS) displaying information to drivers. The information can be tactical and strategic in content and be responsive to incidents as well as regular events. Interurban Traffic Management Systems are also used for the control of lane signalling where provided.
- *Tunnel Traffic Management Systems.* These are special systems for control of tunnel signals, CCTV cameras and incident detection, with video surveillance, fire detection and ventilation control.
- *Bridge Traffic Management Systems.* These are used for bridge security monitoring as well as control of traffic.

## Products and Services - Road User Charging

4.8 Road User Charging (RUC), Congestion Charging (CC) and Electronic Toll Collection (ETC) Systems are inter-related systems, connected through their classification as different types of payment systems.

4.9 The objectives of a road user charging scheme can include any or a combination of congestion management, revenue raising, local or global environmental considerations - and potentially other objectives. The schemes are characterised by key parameters including:

- The basis of the charge, i.e. event-based or rate-based, where event-based includes crossing a particular point or driving in an area and rate-based includes various forms of rate including time, distance and place (TDP)
- Responsibility for who detects the charge liability, i.e. the scheme or the user?
- The geographic structure, which generally falls into three types, i.e.
    - area, charging for driving within a given area, e.g. London Congestion Charging
    - cordon, charging for crossing a closed cordon, e.g. some of the Norwegian cities
    - point, charging for driving past a specific point on the road network, perhaps as a supplement to cordon charges, e.g. in the Singapore ERP scheme
- Event observation technologies

4.10 For event-based road pricing it is necessary to “observe” chargeable events associated with individual vehicles for charging and / or compliance purposes. For TDP road pricing it is necessary to capture “spot observations” of an individual vehicle associated with a particular location and time. Such observation activities use various combinations of in-vehicle, roadside and remote communication technologies based on:

- ANPR (Automatic Number Plate Recognition) in which the vehicle number plate is read from roadside camera images to identify a vehicle and associate it with a chargeable event, or for compliance comparison with data on a distance-based charged journey.
- Charging tag in which the vehicle carries a tag that can be read electronically to identify it and then be associated with a chargeable event and linked to a charge payer account. The tag may also provide the ability to confirm the transaction associated with the chargeable event to the driver e.g. by bleeping or flashing.
- GNSS **(**global navigation satellite system) in which an onboard unit (OBU) calculates the location of the vehicle at a particular time using a set of signals from GPS or potentially Galileo satellites. This data may be used to determine the charges due either by calculation within the OBU or by uploading the data to an off-board facility.
- Other possible technologies include GSM mobile phone positioning. The key requirement in Europe is that technologies must be compatible with the European interoperability directives.

4.11 Toll Collection schemes are based on three types:

- Manual Toll Collection Systems – e.g. Vignette Stickers
- Automatic Toll Collection System
- Electronic Toll Collection System – DSRC systems

These three types and their characteristics are described in the following table:

| Manual Toll Collection Systems | Automatic Toll Collection Systems | Electronic Toll Collection Systems |
|---|---|---|
| Oldest, most used method of collecting tolls in Europe<br><br>Tolls collected at toll plazas installed in various highway or motorway locations<br><br>Vehicles pass through tolling zone, stop and pay operator, by cash, cheque, credit cards<br><br>Increases congestion as vehicles queue at toll plazas waiting for toll to be collected<br><br>Improvement of this system – e.g. prepaid “Vignette” toll stickers | Improvement over manual systems<br><br>Aim - to reduce manpower in toll plazas<br><br>Automated machines for insertion of payment – cash / credit cards / prepaid smart cards - receipt of toll tickets<br><br>Shorter vehicle queues but still congestion present<br><br>Used in several European countries | Toll payment without stopping vehicles, reduces need for toll plazas<br><br>‘Transceivers’ on overhead gantries / pavements to register vehicles passing through tolling zone<br><br>Gantries define entry and exit boundaries – investment in gantry construction necessary<br><br>On board units (OBUs) installed in the vehicle to communicate with transceivers<br><br>Information sent to central computer to calculate toll rate to be paid<br><br>Payment by pre-paid smart cards/ credit basis |

4.12 Electronic Toll Collection (ETC) Systems. ETC systems have evolved from earlier manual toll collection and automatic toll collection systems and are characterised as:

- ETC systems use technologies allowing drivers to pay for use of the road without stopping the vehicle. ETC systems enable features such as cashless transactions and free flow of vehicles.
- ETC allows the possibility of reducing or eliminating a physical toll plaza. Transceivers can be mounted on overhead gantries, roadside or pavements, allowing vehicles to pass through the toll without having to stop. The transceivers establish the tolling zone by defining the entry and exit boundaries, and on board units (OBUs) installed in the vehicles communicate with the transceivers to register that the vehicle has entered or exited the tolling zone. Vehicle information is then sent to a central system for billing.

- Payment for road usage is by several methods including: *prepaid* systems using smart cards, *real-time* systems which are effected by the OBU or smart card linked to driver's account or *retrospective* systems where the billing centre invoices the driver.
- Many ETC systems are based on a dedicated short range communication (DSRC) frequency—usually 5.8 GHz for the vehicle to roadside infrastructure communication. The transmission can either be microwave or infrared-based, though microwave is the most preferred mode in most countries. A key exception is Germany, which uses vehicle positioning systems (VPS) technology and uses infrared frequencies for their OBUs.
- OBUs in ETC systems are mainly transponders or electronic tags that interact with the signal transmitted by the roadside beacon. Identification data is exchanged with a roadside processing computer with details on the type of vehicles using the road and the appropriate fee to be charged. The identification data also enables the roadside equipment to identify the appropriate driver account and to deduct the toll.

4.13 Congestion Charge (CC). Prime examples are the schemes based in the UK (London and Manchester), Sweden (Stockholm) and Norway (Bergen and Oslo):

| Region | Product/Services | Companies | Revenues |
|---|---|---|---|
| UK (London / Manchester) | Area Based: Fixed Charge ANPR Scheme | CAPITA / IBM | Net revenues from the London scheme amounted to €181m in 2006/2007 |
| Sweden (Stockholm) | Congestion Tax entry based fee charge ANPR Scheme | IBM | Annual revenues from the scheme approx €100m.<br>€25m contribution towards implementation costs per year. |
| Norway (Bergen / Oslo) | ANPR for non tag users and ETC for tagged users | IBM | Revenues: Bergen scheme €8.8m, Oslo scheme €126.4m |

## Technology trends

4.14 For ATMS, both Urban and Interurban, the key technology trends are:

- Adoption of IP protocols and architectures for data transmission and systems integration
- Greater sophistication of modelling techniques and integration with real-time adaptive systems
- Increasing use of wireless for connecting field units, e.g. MESH systems. The potential release by the MoD of additional frequencies in 2008 opens new opportunities in the UK.
- Increasing use of video analysis techniques, e.g. for vehicle detection, classification and number plate reading

4.15 For road user charging, congestion charging and electronic toll collection the key trends are:

- Increasing sophistication and cost reduction of competing microwave-based/DSRC systems and satellite-based vehicle positioning systems. The DSRC systems introduced by Austria and Switzerland and the satellite-based vehicle positioning system (VPS) introduced and operated in Germany have put down a marker for more sophisticated tolling systems. The launch of Galileo is likely to influence decisions on the market moving from DSRC towards VPS.
- Integration of other telematics facilities and features, e.g. diagnostics and mobile communications
- Drive towards technical interoperability across countries worldwide, particularly in Europe
- In spite of the general move towards more sophisticated systems, it is interesting to note that Stockholm's congestion charging project used gantry mounted DSRC and smart card/OBU

technology in the 2006 trial, but the permanent scheme will use ANPR technology. This decision was based on the specific geography of Stockholm, the anticipated running costs and avoidance of the need to create a second national database.

- Increasing accuracy levels with satellite technology, essential for a distance based charging. Galileo technology coupled with GPS is expected to provide increased coverage and accuracy.
- There is some move towards hybrid technology, using both GPS and DSRC where the GPS tracks the vehicle and the DSRC enables direct debits from the user's account

## Market data trends and growth predictions

4.16 The following charts show the revenues and growth forecasts in US$million for Advanced Traffic Management Systems and Road User Charging, Congestion Charging and Electronic Toll Collection System, separately and aggregated for both Total World and Total Europe. The values include part of the travel and traveller information systems (e.g. roadside Variable Message Signs) and part of the communications services (e.g. infrastructure communications).

4.17 Advanced Traffic Management Systems (ATMS) – Total World

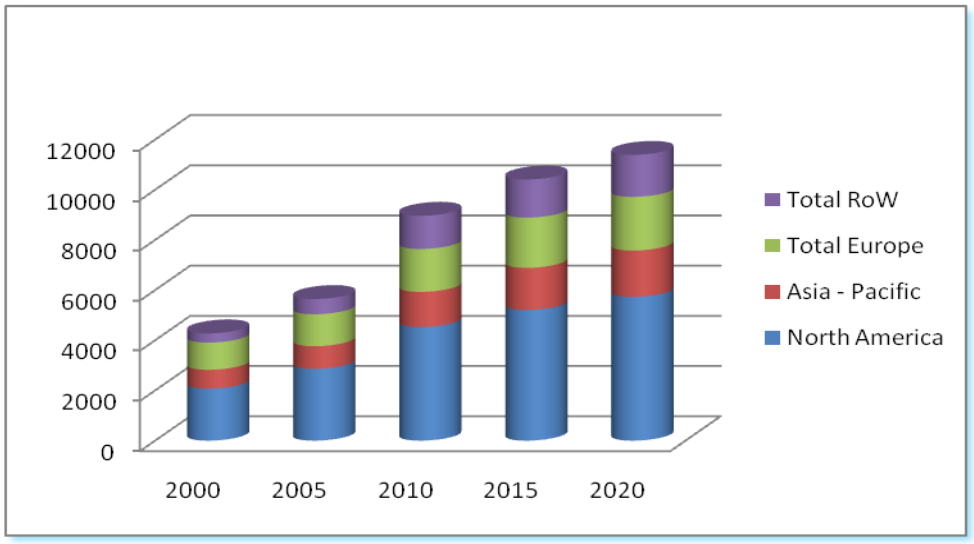



*Figure 4-1 2000-2020 ATMS by World Region: revenues in US$million*

4.18 Road User Charging, Congestion Charging, Electronic Toll Collection – Total World

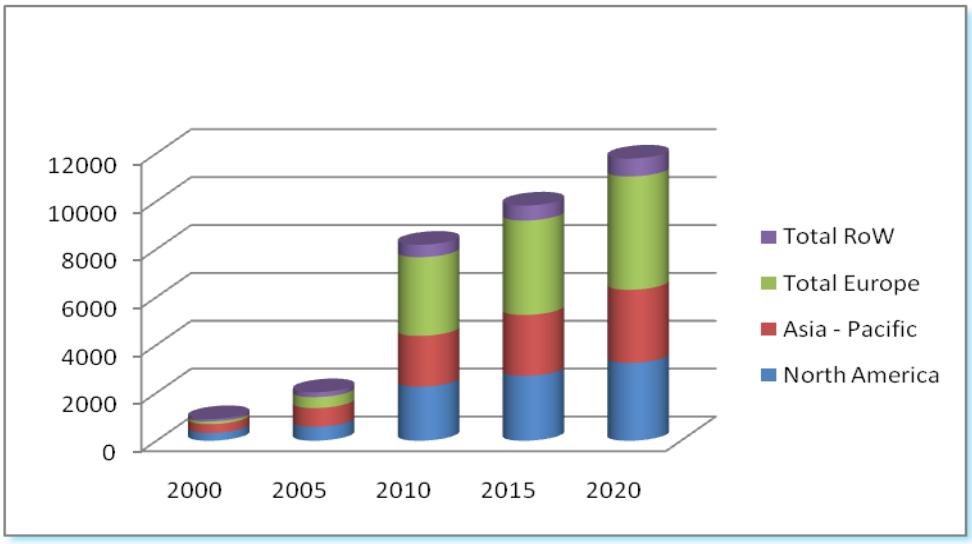



*Figure 4-2 2000-2020 RUC-ETC by World Region: revenues in US$million*

4.19 Aggregate Advanced Traffic Management Systems (ATMS) with Road User Charging, Congestion Charging, Electronic Toll Collection – Total World

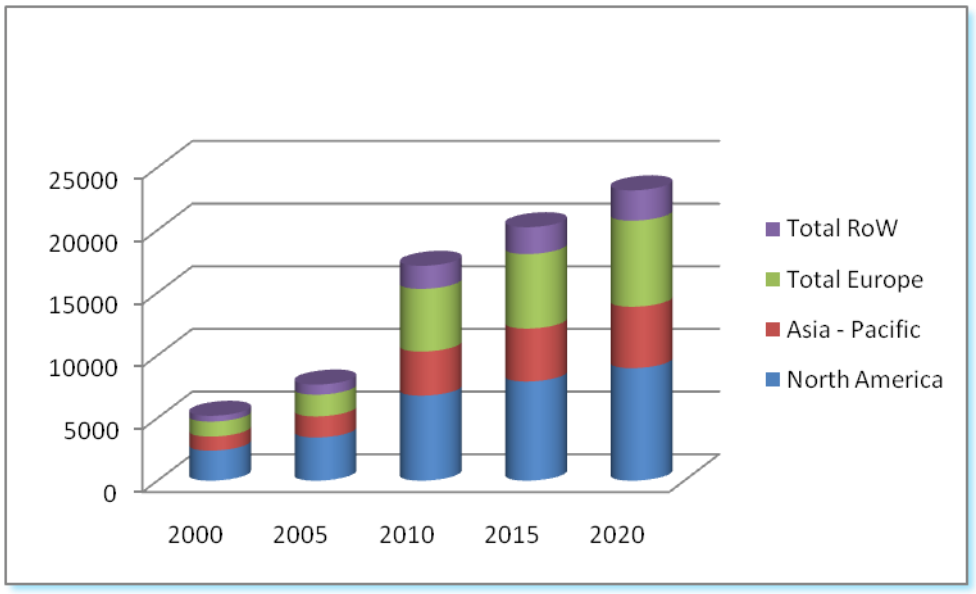



*Figure 4-3 2000-2020 Network Management by World Region: revenues in US$million*

4.20 Advanced Traffic Management Systems (ATMS) – Total Europe

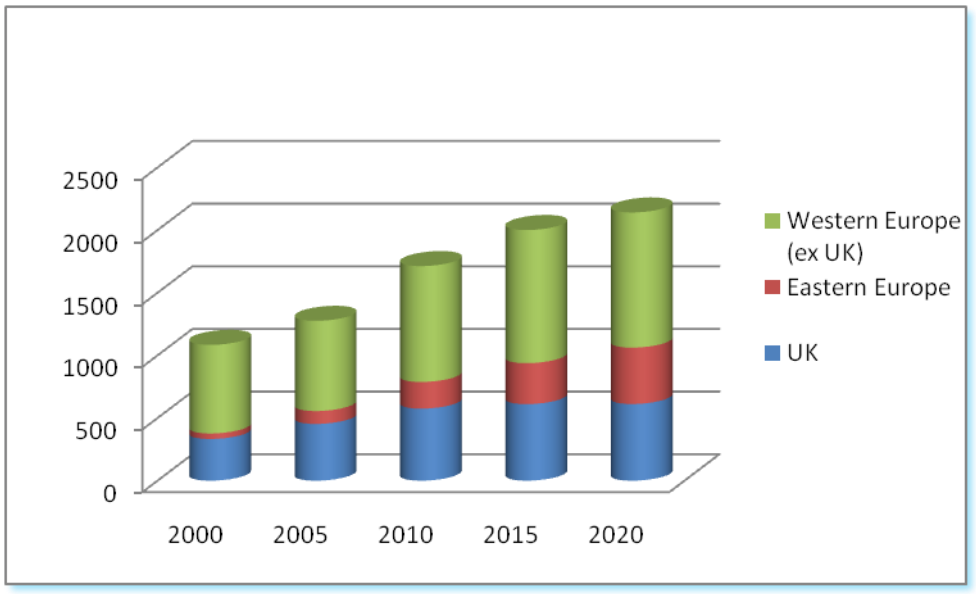



*Figure 4-4 2000-2020 ATMS by Europe Region: revenues in US$million*

4.21 Road User Charging, Congestion Charging, Electronic Toll Collection – Total Europe

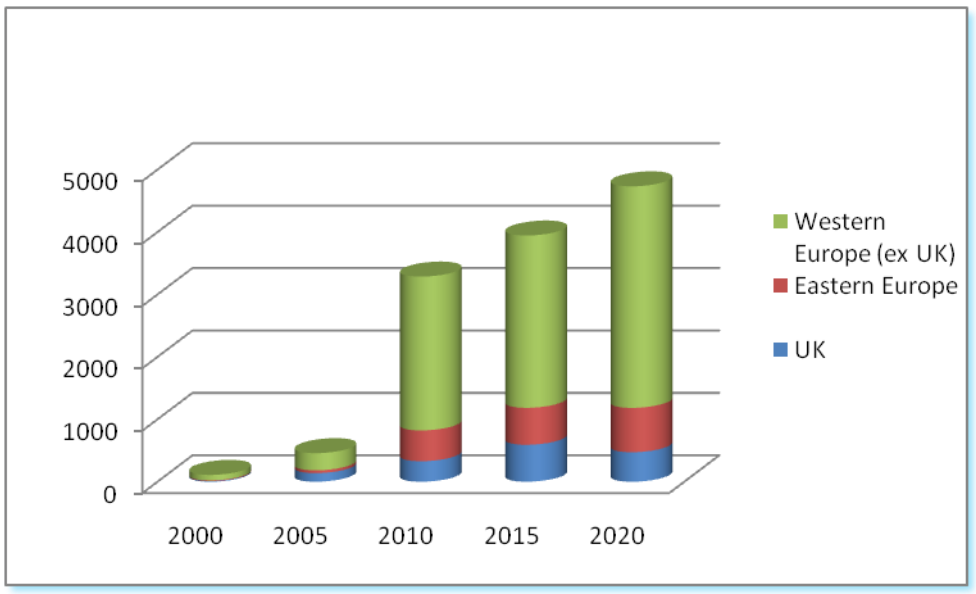



*Figure 4-5 2000-2020 ATMS by Europe Region: revenues in US$million*

4.22 Aggregate Advanced Traffic Management Systems (ATMS) with Road User Charging, Congestion Charging, Electronic Toll Collection – Total Europe

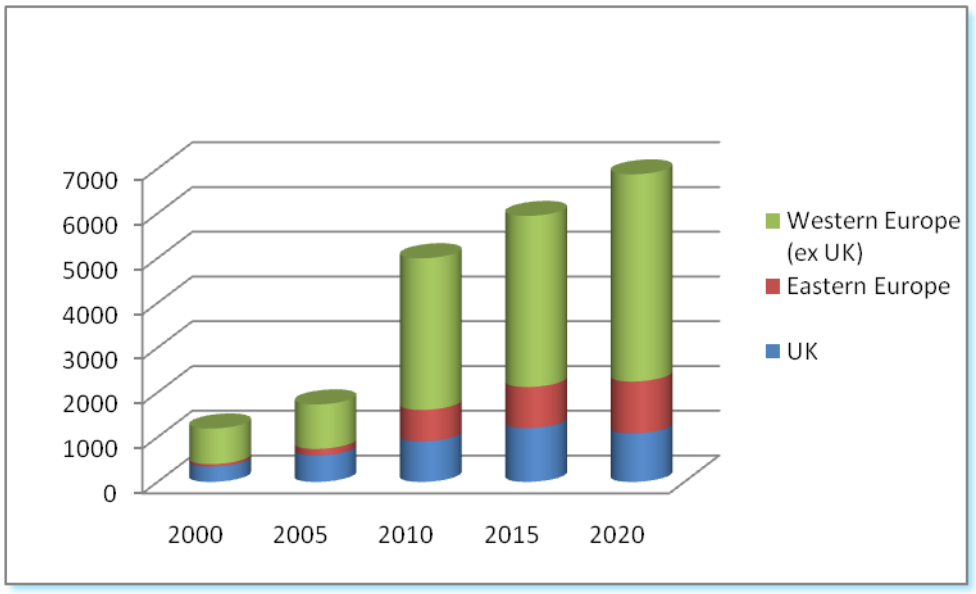



*Figure 4-6 2000-2020 Network Management by Europe Region: revenues in US$million*

4.23 Regional differences in Europe - Congestion Charging

- Frost & Sullivan estimate that the total revenues for Europe are expected to reach €2.05 bn by 2015 with a Compound Annual Growth Rate (CAGR) of 32% over a two year period (2008-2010). Given the political uncertainties over congestion charging, this is perhaps optimistic. Their analysis is based on the following schemes.
- ***Netherlands****:* Future congestion charge scheme is expected to make revenues up to €1.8 bn by 2015 with OBU sales of 10.2 Million units by 2011 with a CAGR of 5%
- ***Copenhagen:*****TxT**ag and beacon system is expected in Copenhagen by 2012, based on more than 400 cars already operating with tags for toll roads

- ***Italy:*** The Italian market for congestion charging scheme is expected to be running by 2008 with around 600,000 units in demand for 2009
- ***Spain:*** In Spain, the expected revenues range from €47m - €49m in one year with a 5% growth rate by 2014 with further interest in congestion charge schemes
- ***UK:*** Trial projects for a national scheme in the UK are expected to be announced. The scheme is expected to be implemented by 2011 using interoperable tag and beacon technology.

4.24 Global Initiatives - Congestion Charging

- Several global initiatives and potential growth opportunities are expected to arise – the key projects include:
- Toronto, Canada: existing 407 Express Toll Route (ETR)
- Singapore: existing pay-as-you-use principle
- Melbourne: existing 22Km City Link Toll Road is a privately operated toll road
- Sao Paulo (Brazil): future city authorities have limited access to the centre by only allowing vehicles with certain number plates on different days and now the city authorities are considering a congestion charge as an alternative
- New York: future new bridge tolls congestion charge advocacy project being developed

4.25 The key *emerging* global markets for Network Management are:

- *Advanced Traffic Management Systems (Urban and Interurban)*: China, India, South Africa (with short term opportunities related to the 2010 Football World Cup), South America (especially Brazil and Chile)
- *Electronic Toll Collection*: China, India, South America
- *Road User Charging and Congestion Charging*: Europe (Western and Eastern), North America

## Leading Vendors

4.26 ATMS (Urban and Interurban). Globally there are many vendors of ATMS systems. By way of example, the Leading Vendors in Western Europe and their market shares are shown in the charts below. The first shows shares as hardware/equipment suppliers and the second as systems integrators.

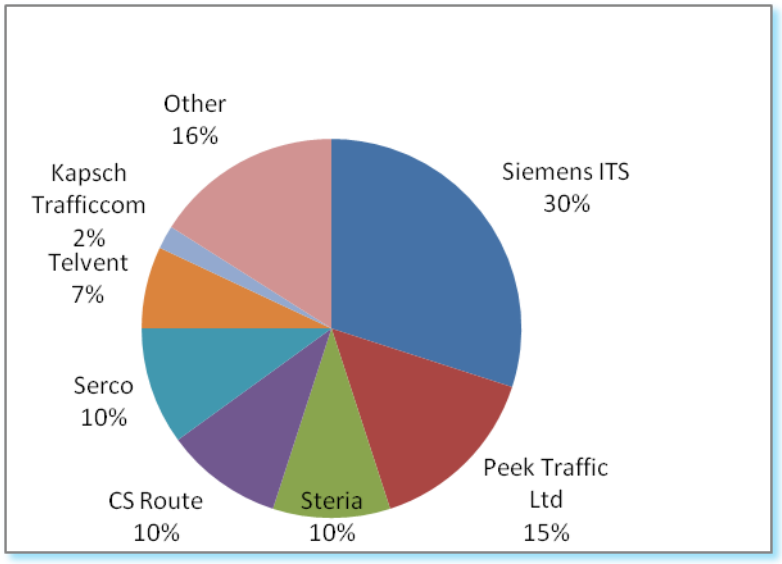



*Figure 4-7 ATMS (Western Europe) - Market Share - System Integrators*

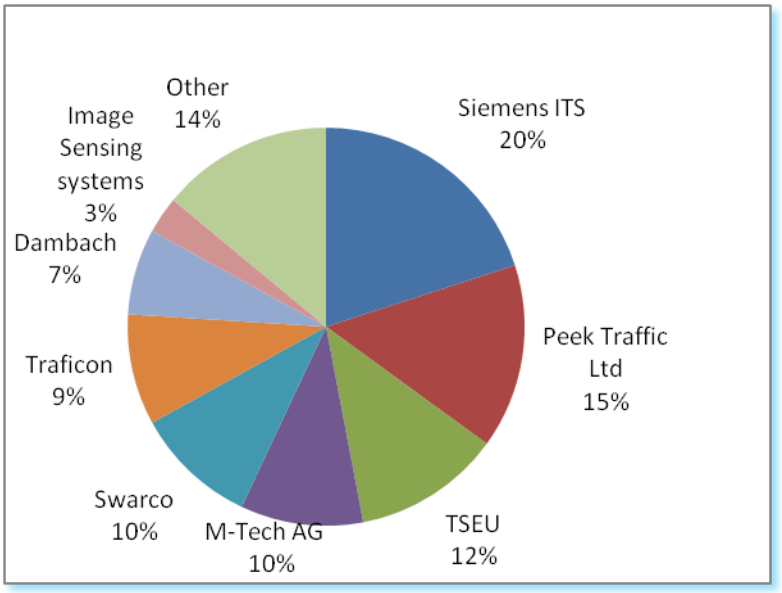



*Figure 4-8 ATMS (Western Europe) - Market Share - Equipment Manufacturers*

4.27 The key suppliers in the UK congestion charging market are:

- Key Market Participants are:
- PIPS Technology
- Siemens
- Mastek
- Efkon
- Autostrade
- IBM
- Q-Free
- Initial Electronic Security Systems

4.28 The key suppliers in the London Congestion Charge Scheme and their roles are given in the table below:

| Market Participants | Expertise | Contracts |
|---|---|---|
| CAPITA | IT Service Provider | London Congestion Charge Scheme |
| IBM | Systems Integrator / IT Service Provider | London, Stockholm and Norway Congestion Charge Schemes |
| SIEMENS | Systems Integrator / ANPR Supplier | TFL for Western Extension of London Congestion Charge Scheme |
| MASTEK | IT Service Provider | Partnership with Capita for software delivery of London Congestion Charge Scheme |
| PIPS TECHNOLOGY | ANPR Supplier | Supply ANPR cameras to Siemens and TFL for Western extension of London Congestion Charge Scheme |

## Network Management: Summary and Conclusions

4.29 Most ITSS markets for Advanced Traffic Management Systems, both Urban and Interurban, in the established markets in North America, Asia-Pacific and Europe are growing steadily in the drive to minimise congestion and make best use of the road space. There are pressures from the public sector to reduce costs particularly revenue costs. New wireless communication technologies and new modelling techniques together with competitive pressures will limit growth in market value. Many new opportunities arise in developing and emerging markets and these will boost overall market size.

4.30 ITSS markets for Road User Charging, Congestion Charging and Electronic Toll Collection are faced with more complex constraints and greater opportunities for growth. The Road User Charging market is undergoing several changes with significant growth opportunity, largely driven by the economic cost of road management and traffic congestion. Technological advances have brought change in Western Europe, providing a basis for similar developments elsewhere, including Eastern Europe.

4.31 A key issue for Road User Charging is the problem of interoperability and standardisation of systems, with attempts to solve this being made by legislation. The problem of funding is being addressed through private financing initiatives, particularly for infrastructure development. The higher growth rates for Road User Charging reflect the market for On Board Units (OBUs) installed in vehicles, which is expected to grow significantly over the next few years.

# 5 Road Safety

## Market structure and drivers

5.1 The ITSS market related to improving road safety recognises both public and government concerns to reduce casualties across all sectors of transport, including private vehicles and public transport, and especially vulnerable road users. The ITSS markets are currently separated into the automotive and infrastructure aspects, though these will converge through developments such as the Vehicle Infrastructure Integration (VII) project.

5.2 Generally the automotive part of the ITSS market for safety systems is driven by legislative requirements as well as motorists' growing concerns and consumer demands over safety issues, and is defined by accident reduction targets. The infrastructure part of the ITSS market for safety systems is driven by public authority needs to design, operate and maintain safer roads.

## Market demands: the ITSS role

5.3 ITSS technologies provide an opportunity to increase the safety of vehicle drivers, vehicle occupants, and other road users including the more physically vulnerable sectors of society. ITSS in particular supports the improving road safety agenda in four main ways:

- network management techniques that help to tackle congestion and improve traffic flow, as described in Section 4, also provide safety benefits;
- camera technology linked to back-office systems support the enforcement of road traffic legislation, including the use of safety cameras and CCTV, and also help enable prompt remedial action in the event of an accident;
- in-vehicle ITSS developments offer additional safety features to drivers, and there is potential for greater co-operation between vehicles and the road infrastructure to support safety and other objectives; and
- systems that recognise the specific needs of groups such as vulnerable road users and the silver generation who have different safety and information needs.

## Market constraints

5.4 Several factors constrain the growth and development of ITSS for improving road safety. The key automotive factors are:

- Customer perceptions of the benefits of safety systems. Some are perceived as expensive options for high-end niche vehicles. There is a perceived ability to handle a variety of active safety features.
- Lack of standardisation between active safety products from different suppliers and VMs.
- Complexity of systems, particularly those requiring a significant level of interaction with powertrain systems.
- The lack of clear accountability on the VM in the event of system failure causes VMs to be cautious when marketing safety features.

5.5 The infrastructure ITSS market for safety systems is largely constrained by the same considerations as for network management systems, with which they are closely coupled. These are the limitations on public sector budgets, a general reluctance to take risks and adopt new technologies, issues with interoperability and standardisation, and perceived high costs of operation and maintenance.

## Purchaser profiles

5.6 The purchaser profiles for the automotive ITSS safety market are closely aligned with the general profile for automotive purchases. Generally the end purchaser will be well informed about the benefits of active safety systems, although concerned about their complexity and the need to buy an option which should perhaps be a standard fit.

5.7 The purchaser profiles for the infrastructure safety aspects are as for the public authorities outlined in para. 4.4.

## Products and Services

5.8 There is an extensive range of safety systems in the automotive sector, categorised into active safety systems and passive safety systems. For the purpose of the study we consider a number of systems under the collective title of "Advanced Driver Assistance Systems" (ADAS), comprising Night Vision Systems, Lane Departure Warning, Blind Spot Detection, Intelligent Parking Assist and Adaptive Cruise Control. We omit Tyre Pressure Monitoring Systems (TPMS) from the study. The systems considered are defined as:

- *Night Vision Systems (NVS)*: Also known as near infra-red (IR) night vision, in active night vision, an infra-red laser or light emitting diode (LED) illuminates the front of the car and the reflected light is captured in a CMOS camera with a special filter that filters out the visible light. Passive night vision utilises an FIR camera, and captures the heat emitted by a body at the FIR wavelength.
- *Lane Departure Warning (LDW):* The function of an LDW system is to monitor the risk of an inadvertent deviation from the lane by the driver due to lack of attention. Current systems either use an audible beep or a rumble strip noise, which sounds similar to when the tyre runs on a lane divider. The system typically uses a forward looking camera that compares lane markings with the vehicle's direction and assesses a possible deviation.
- *Advanced Emergency Braking (AEB):* This is a system which can automatically detect an emergency situation and activate the vehicle braking system, with or without driver intervention, to decelerate the vehicle with the purpose of avoiding or mitigating a collision.
- *Blind Spot Warning and Detection (BSD):* A BSD system warns the driver in case a vehicle is positioned in the driver's blind spot areas on the rear sides of the car and is initiated if the driver switches on the indicator or attempts to change lanes in that direction. The system uses short range radar to detect objects in the scanned region.
- *Intelligent Park Assist (IPA):* The IPA system is utilised to automatically manoeuvre the car into a parking slot. This is accomplished with a camera fixed to the back of the vehicle, and the signals, which control the steering of the vehicle.
- *Adaptive Cruise Control (ACC):* This feature enables the vehicle to maintain a driver-defined distance from the preceding vehicle, and while driving within a maximum speed limit also set by the driver. The system is designed for use only on motorways and functions at speeds between 30 kph and 200 kph. However, if there is a rapid reduction in the vehicle's speed, the system will warn the driver and switch off, letting the driver take over control. "*ACC with Stop and Go*" will be the next-generation ACC system, capable of bringing the vehicle to a complete halt by itself if necessary, and also start moving once the vehicle or traffic ahead begins to move again.

## Technology trends

5.9 The technology trends associated with vehicle active safety systems are outside the scope of the study as these are best dealt with by automotive engineering specialist organisations.

5.10 However, it is worth noting that several ADAS applications are emerging based on the use of digital map data as a key component for enhanced accuracy and results. These include Lane Departure Warning and Adaptive Cruise Control. Several other active safety systems, though not considered by the study, will also be impacted by the use of digital map data, including: Electronic Stability Control, Hybrid Energy Management, Curve Warning and Adaptive Lighting. Overall there is a progressive trend towards autonomously controlled vehicles with the potential for platooning before this. Lateral and longitudinal controls are both required for this with a very distinct link to accurate and reliable location information.

5.11 The US-led Vehicle Infrastructure Integration (VII) initiative is a key technology trend, with a clear focus on improving Road safety. Key points are:

- VII aims to reduce accidents and traffic congestion through coordinated development of a US-wide wireless communication infrastructure allowing communication between vehicles and between the vehicle and the roadside. The VII vision is that every car manufactured would be equipped with a communications device and a GPS unit so that data could be exchanged with a nationwide, instrumented roadway system.
- The VII initiative builds on the availability of advanced vehicle safety systems developed under the Intelligent Vehicle Initiative (IVI) and on the results of related research and operational tests. The fundamental building blocks of the VII concept are coordinated deployments of communication technologies in all vehicles by the automotive industry and on major U.S. roadways by the public sector.
- Secure data transmitted from the roadside to the vehicle could warn a driver that it is not safe to enter an intersection or that the vehicle is dangerously close to running off the road. Vehicles serving as data collectors could anonymously transmit traffic and road condition information from every major road within the road network, giving highway authorities the information needed to take action to relieve traffic congestion.
- Protection of privacy is paramount. The intent is that general data collected by the public sector would be anonymous and used only for safety purposes and for efficient management of transportation operations. It is expected that this technology will facilitate a number of uses that drivers may choose such as electronic toll collection or telematics services for which some private information might be required. For those services, the intent is that the owner or driver would have to “opt in” and give permission for that information to be shared.
- A VII consortium has been established to determine the feasibility of widespread deployment and to establish an implementation strategy. Current membership includes USDOT, AASHTO, ten State DOTs and several light vehicle manufacturers.

5.12 In Europe, developments such as e-Safety have led to the i2010 Intelligent Car Initiative. This aims to accelerate the deployment of intelligent vehicle systems on European and international markets, using a mix of policy, research and communications instruments. Specifically i2010 intends to ensure interoperability across different EU countries and harmonisation of technical solutions through a comprehensive European approach, support ICT-based research and development in the area of transport and facilitation of the take-up and use of research results, and raise awareness among consumers and decision-makers of the potential benefits of ICT-based solutions.

5.13 European legislation plays a key part in adoption of regulations to improve vehicle safety. Currently, it is the intention of the EU to make Advance Emergency Braking (AEB) and Lane Departure Warning (LDW) systems mandatory on selected vehicles (classes M2, M3, N2 and N3) in October 2013 for new types and in October 2015 for all new vehicles, with an option for M1/N1 vehicles, if fitted.

## Market data trends and growth predictions

5.14 For the infrastructure part of the ITSS road safety market, most of the benefits are integrated with the network management systems described in chapter 4. This includes such items as pedestrian detection, pedestrian crossings, cycle lane management, provision for the visually impaired as well as facilities for smoothing traffic. It is not possible to disaggregate the costs of the safety benefits so these elements are covered within the total revenues for network management.

5.15 The revenues and growth forecasts in US$million for the automotive part of the ITSS safety market are shown in the following two graphs, one for total world and the other for total Europe.

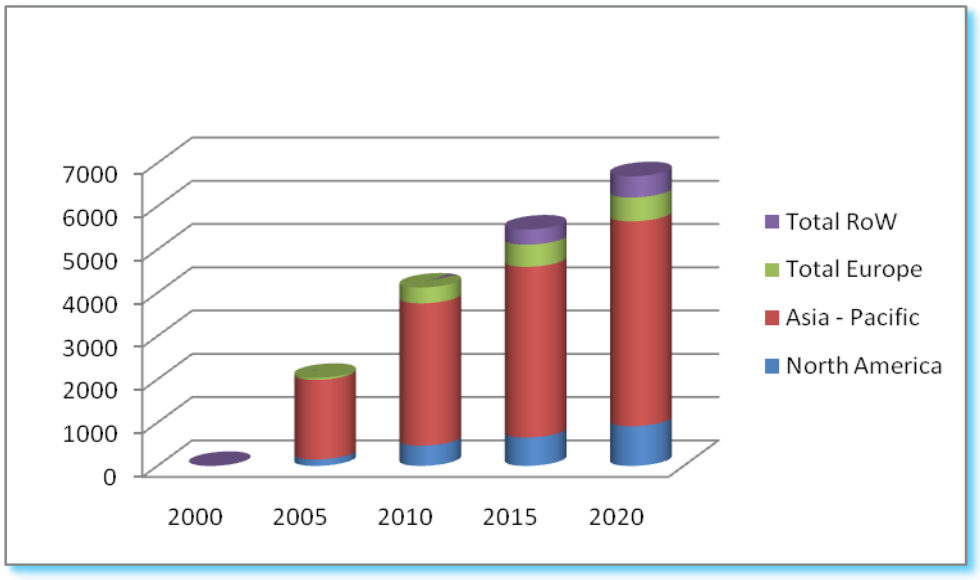



*Figure 5-1 2000-2020 ADAS by World Region: revenues in US$million*

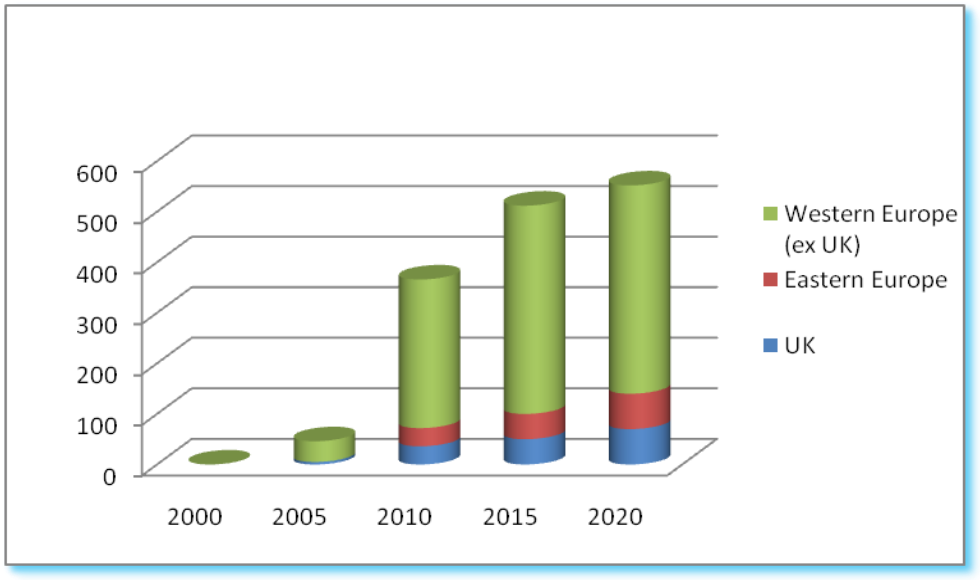



*Figure 5-2 2000-2020 ADAS by Europe Region: revenues in US$million*

5.16 The key *emerging* global markets for infrastructure Road Safety ITS are closely linked with Network Management markets, particularly for Advanced Traffic Management Systems, namely China, India, South Africa and South America. For the automotive part of the ITSS safety, the market is initially developing in Europe, North America and Japan, with roll out to emerging markets following.

## Leading Vendors

5.17 Leading vendors for infrastructure Road Safety ITSS) are similar to the vendors for Network Management.

5.18 For automotive Road Safety ITSS, leading global vendors and an indication of their interests is given in the following table.

| Supplier | Europe | North America | Asia-Pacific |
|---|---|---|---|
| Autoliv | Night Vision Systems | Night Vision Systems | Presence in Australia, China and Japan<br>Night Vision Systems |
| Aisin | Present only in the aftermarket | Present only in the aftermarket | ABS, ESC, brake assist systems,<br>IPA, BSD, LDW, traction control systems<br>Developed first IPA in partnership with Toyota |
| Continental | ACC 77/26 GHz supplies DC<br>Vision sensor-based LDW expected<br>Acquired Motorola automotive<br>Plays an important role in active / passive integration<br>Develops ESC | ACC with stop and go functionality, IPA, LDW, BSD and ESC | No presence |
| Delphi | ACC 77 GHz supplied to Jaguar<br>Vision-based LDW, infra red-based BSD and Night Vision Systems expected | Active NVS, LDW, IPA-radar based, BSD, ACC, and ACC-stop and go | No presence |
| Denso | No presence | Collaboration with Mobile Eye on image sensing and processing | Presence in Australia, China and Japan<br>ABS, traction control systems, ESC, ACC, AFS, LDW, BSD and IPA |
| Robert Bosch | Radar 76/77 GHz ACC supplied to Audi and BMW and NVS to DC<br>LDW expected in 2008 | IPA and NVS | ABS, traction control systems and ESC |
| Siemens VDO | Lidar-based ACC, 24 GHz based BSD, FIR-based LDW and NVS expected in near future | 24 GHz radar-based BSD, and active and passive NVS | No presence |
| TRW | 76/77 GHz radar-based ACC<br>24/79 GHz radar-based low-cost ACC, vision-based LDW, NVS and 24 GHz radar based BSD expected | No presence | No presence |

## Related Topics

5.19 Several topics related to Road Safety are covered in chapter 10, Security and Crime Reduction. These topics include: eCall, Stolen Vehicle Tracking, CCTV, ANPR and Incident Management.

## Road Safety ITSS Summary and Conclusions

5.20 Pressure from consumers and politicians will continue to drive the development of systems to improve road safety in both the infrastructure and automotive sectors. Volume markets will increase as the safety technologies move away from niche markets.

5.21 There would seem to be clear benefits to UK in becoming more deeply involved in European and perhaps US initiatives aimed at achieving road safety benefits through the development of technologies that enable communication between vehicle and roadside, and vehicle to vehicle.

# 6 Travel and Traveller Information

## Market structure and demands: the ITSS role

6.1 Pre-trip information has traditionally been available to the travelling public through radio and television services. An accurate, reliable and relevant flow of information to travellers during a journey is equally important. The advent of the Internet has created opportunities for public and private sector web-based journey planning and information services that are now maturing into real-time information sources in a way that provides broader information, for example about accessibility issues to support vulnerable travellers.

6.2 There are several aspects of travel and traveller information involving the use of ITSS media for in-vehicle, portable, internet and roadside based applications, including:

- *Floating Vehicle Data*, a mechanism to measure the rate of traffic flow and provide an ITSS basis for some businesses to provide real-time and targeted information to drivers via the in-vehicle Radio Data Service – Traffic Message Channel (RDS-TMC);
- *advanced systems that take account of real-time traffic conditions* in giving visual and/or audible in-vehicle route guidance to drivers;
- *mobile telecommunications companies* offering real-time services to subscribers, providing benefits to the travelling public, recognising the legislative road safety restrictions in place about mobile phone use whilst driving;
- information provided at the roadside through *variable message signs* giving network operators an essential tool for real-time, visual messages that are informative, advisory, or mandatory;
- *advanced signage* that can inform drivers of parking availability on a real-time basis;
- *websites* that enables users to see current road traffic conditions such as road traffic incidents, road works and congestion on the road network; and
- real time rail, air and sea information available via the *internet and mobile telephones.*

6.3 In the market analysis for travel and traveller information, the means of data acquisition and information delivery are often closely associated with other ITSS theme areas, making it difficult to separate the market values for the purposes of this report. We have separately identified the market values for roadside variable message signs; other market values are included in the relevant chapters, i.e. network management (chapter 4), public transport (chapter 7) freight efficiency (chapter 8), and automotive telematics (chapter 11).

## Market analysis: RDS-TMC and TPEG

6.4 RDS-TMC has developed across Europe with most manufacturers offering the traffic service in three countries, France, the UK and Germany. TPEG is the next generation of RDS-TMC service focussed on travel and traveller information over a variety of media e.g. DAB, DVB and Internet.

6.5 TMC (Traffic Message Channel) is the main current technology for delivering traffic and travel information to drivers. It is typically digitally coded using the FM-RDS system on conventional FM radio broadcasts. It can also be transmitted on DAB or satellite radio. Both public and commercial services operate in many European countries.

6.6 The traffic information process in RDS-TMC comprises three parts:

- Data collection - different sources including automatic sensors
- Data processing **-** data validation and fusion of multiple sources, location encoding (maps), event encoding, and creation of the live event list for broadcasting
- TMC distribution and broadcast - reception by in-vehicle GPS navigation systems, decoding and interpretation of data, to provide dynamic route guidance. When data is integrated directly into a navigation system, the driver has options for alternative routes.

6.7 In this process, the information service provider is responsible for the content, the management of the message and its transmission. The navigation equipment manufacturer is responsible for tuner reception, integration with the vehicle's navigation and the HMI.

6.8 The Market Demand for RDS-TMC units in the UK, France and Germany in 2007 and 2008 (estimated) is shown in the chart below:

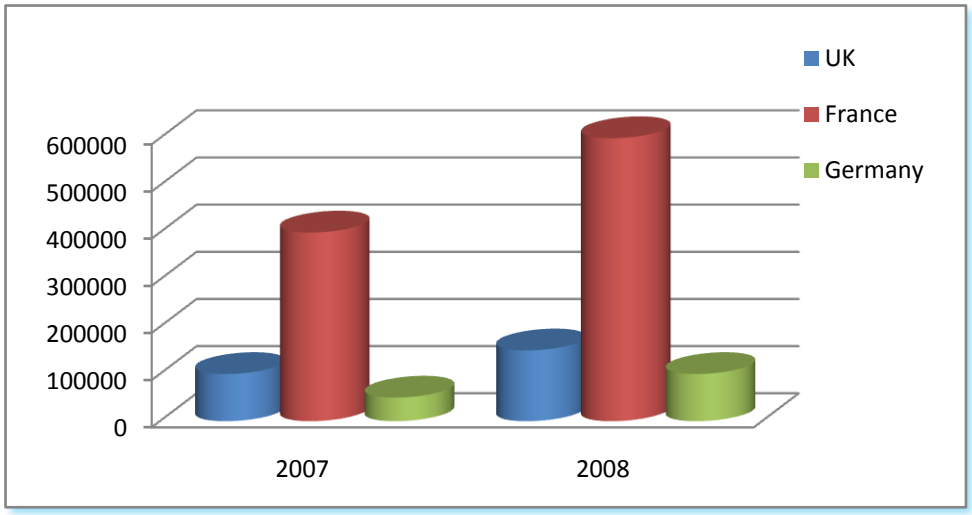



*Figure 6-1 RDS-TMC In-Car Systems Unit Shipments*

6.9 France, the UK and Germany have developed commercial RDS-TMC services for in-car use. ITIS Holdings, Mediamobile and T-Mobile T-Traffic are the three major service providers of commercial real time traffic information over the RDS-TMC platform in Europe. Such information provided by these brands is critical in developing dynamic navigation systems which have the capacity to re-route based on the traffic forecasted ahead. These systems will aid in reducing fuel consumption, improving efficiency and reducing emissions.

6.10 The in-vehicle RDS-TMC systems market is closely tied with the embedded navigation systems market. Each traffic incident is sent as a TMC message, with the TMC message covering one event code and one location code. The TMC message is coded according to Alert C standard and translated by the TMC receiver in navigation system. Location code tables are managed on a national level and numbers are assigned to the road network and stored in maps by the map providers, Navteq and Tele Atlas.

6.11 The RDS-TMC services are built into the vehicle navigation systems. RDS-TMC messages are decoded by the FM transmitters and displayed on the navigation system. Most vehicle manufacturers offer RDS-TMC as a standard service with the navigation system. For example, BMW has a 5 year contract with ITIS Holdings to offer RDS-TMC services.

### Products and Services:

6.12 Most in-vehicle RDS-TMC systems are operated by the three major companies in the three major regions, as shown in the table:

| Mediamobile | ITIS Holdings | T-Traffic | TomTom HD Traffic |
|---|---|---|---|
| France | UK | Germany | Netherlands, Germany, UK, France |
| 400,000 customers at end of 2007 | 100,000 customers at end of 2007 | 50,000 customers at end of 2007 | Aiming to reach 50% of TomTom user base by 2009 |
| Audi, BMW, Honda, Jaguar, Mercedes, Nissan, Porsche, Renault, Toyota, Volvo | BMW, Ford, Mercedes, Nissan, Toyota, Volvo | Audi, BMW, Ford, Mercedes, VW | Netherlands – Vodafone 2007<br>Germany – T-Mobile 2008<br>UK – Vodafone 2008<br>France – SFR 2009<br>Belgium – Base 2009 |

## Specific national characteristics

**6.13** **France -** free and commercial services available

- **Free**: Operated by motorway toll road operators like AREA, ASF, ATMB, SANEF, SAPN available on the 107.7 traffic channel, only on motorways.
- **Commercial**: V-Traffic provided by Mediamobile, a partnership between TDF, Renault, TrafficMaster and Cofiroute. Pay service received on the France Inter frequencies.
- Via Michelin and Carte Blanche provides traffic information service transmitted by Towercast Network (NRJ Group). PSA is a key customer.

6.14 **Germany -** public and commercial services available

- **Commercial:** TMC*pro* operated by T-Mobile Traffic is a pay service available since 2004. Content provided by ddg Gesellschaft für Verkehrsdaten mbh, a wholly owned subsidiary of T-Mobile Traffic GmbH.

6.15 **Italy -** two free services are operated

- A public RDS-TMC service free of charge is available on the RAI FM network on Radio 1 (covers only Turin to Venice) and content is provided by CCISS (National Traffic Information Centre).
- Another free TMC service is provided by RTL and transmitted on radio station RTL 102.5 which covers more than 90% population of Italy.

6.16 **United Kingdom -** two commercial services are operated

- ITIS Holdings provide a commercial TMC service named iTMC broadcast on Classis FM. Service bundled with price of car or car navigation systems or PNDs.
- RAC Trafficmaster Telematics (RTT), joint venture between RAC motoring services and Trafficmaster, uses 3 commercial radio broadcasters GWR, Capital Radio and Chrysalis.

6.17 **Spain -** only public TMC services are operated

- TMC service is available on RNE 3 provided by SCT, DT and DGT (Traffic General Directorate).
- RACC 1 is working on urban TMC services starting with Seville and Barcelona over the RNE 2 broadcast channel.

6.18 **USA -** commercial services offered

- XM and Sirius offer TMC messages over satellite radio service.
- Clear Channel and Tele Atlas operate a TMC service using FM-RDS channel.
- Navteq also operates Navteq traffic service.

6.19 **Australia and China -** currently evaluating the possibilities of introducing a RDS-TMC based traffic information service.

## Next generation - TPEG

6.20 As a single delivery channel for traffic information, RDS-TMC is a constrained solution with a small data handling capacity, which is not ideal for providing information relating to multimodal transport media. TPEG is being developed to address these issues. It covers both traffic and travel related information for multimodal transport media, and is designed specifically for multiple delivery channels, including digital broadcasting such as DAB, Internet, Digital TV (DVB), GPRS and Wi-Fi.

**6.21** TPEG works on standardised digital event codes and digital geo-referenced codes, with the addition of verbal announcements. Its objectives are end user focused traffic and traveller information, the provision of structured language-independent messages, and the provision of information for multimodal transport. Current TPEG applications include:

- **RTM** – Road Traffic Messages, which deal with traffic information and can encode a wide range of road traffic information such as accidents, congestions, obstructions and delays.
- **PTI –** Public Transport Information, which deals with public transport including rail, bus, air traffic and ferry services. This application is currently specified in ISO TS 18234-5.

**6.22** TPEG applications under development include:

- **PKI –** Parking Information, which allows information about parking facilities to be transmitted. This application is currently specified in ISO TS 24530-5.
- **CTT –** Congestion and Travel Time, which focuses on providing information to drivers on congestion levels and journey times.
- **TEC** – Traffic Event Compact, which covers traffic event information, aimed primarily at dynamic route guidance navigation devices.

6.23 Key initiatives include:

- ITIS Holdings and BBC are carrying out TPEG TAP (TPEG Automotive Profile) testing in the UK.
- Other trials have been completed or are ongoing in the Netherlands, Germany, Belgium and South Korea with other trials planned in Switzerland.

6.24 TAP is being specifically developed for traffic and traveller related information only. It supports different applications such as the traffic event compact (local hazard warning and road related information), traffic status and forecasts, driver assistance and information on parking. From the European automotive market perspective – BMW is leading the development of the TAP profile and first applications are expected in late 2009/early 2010.

6.25 Hazard warning and PKI are typical travel related information services. Local hazard warning will warn the driver of problems ahead, with two options: either through the navigation system or through the DAB radio. Parking information will advise the driver in searching for available parking spaces. More accurate and in-depth traffic information is provided through the TAP profile. The actual traffic situation overview will provide actual traffic forecasts, and will aid in dynamic route guidance and in the provision of and route and travel times. A further application of driver assistance deals with reading VMS information and projecting it to the driver. The purpose here is to provide information to the driver at a personalised level.

6.26 In summary the benefits of TPEG are:

- Standard is ideal for multimodal transportation information and delivery over multiple media
- Multimodal transport information – covering multiple transport means
- Ideal for many delivery media – designed to be delivered over multiple mediums like DAB, Internet, Digital TV
- Multiple receiver compatibility - can work on receivers in navigation systems and simple PDA's
- Only traffic and travel related information - extension of RDS-TMC in providing more than traffic information but only travel related

6.27 It is expected that TPEG will enter the European market in 2009/2010. Currently the TPEG forum and its members are finalising the applications and the first TPEG commercial services will be market ready by late 2009. The set of applications and services will evolve; currently the focus is on providing services like RTM and PTI, whilst in the future the idea is to cover services like congestion and travel time.

6.28 TPEG is the first tool to integrate public transport information. In a project led by the EBU (European Broadcasting Union), Germany and France have tested PTI service. The BBC and ITIS Holdings were key members of the EBU project on TPEG, and the UK is expected to see the first launch of TPEG because of the domination of the DAB standard in the UK.

## Roadside Variable Message Signs

6.29 No third party commercial market information providers, including Frost & Sullivan and ABI Research, have conducted research into the global markets for roadside variable message signs. This has been confirmed by two of the key UK suppliers. One of them estimates that the global market for the supply of VMS is in the order of $350m per annum, with one of the largest markets being the UK.

6.30 In the UK the largest purchaser of VMS is the Highways Agency, who currently purchase around £20m of VMS per annum, excluding their cantilevers, gantries and supporting civil works. This market value is expected to continue for the foreseeable future as the HA rolls out its ATM programme. Information on the Highways Agency's technology programme as at August 2008 is given in Appendix D to this report. The balance of the UK market, around £10m per annum, is for VMS for urban areas, Scotland, Wales and Northern Ireland. In the urban areas the market includes signs for traffic information and parking guidance, frequently associated with new UTMC developments.

6.31 In recent years the technology for VMS has been based on LEDs, with other technologies, such as fibre optics, now abandoned. In addition to lines of text, recent developments have seen significant growth in the use of pictograms, e.g. for indicating queues or accidents ahead. No new technologies are envisaged, rather there is a process of continuous improvement with the light emitting devices, to increase their optical performance and their ability to display colours.

# 7 Public Transport

## Market structure and demands: the ITSS role

7.1 There is increasing interest in and demand for public transport services with the encouragement of modal shift for economic and environmental reasons from the private car to public transport especially on train, metro and bus. In Europe, public transport is increasingly popular, for example, rail usage reached 1.2 billion passenger journeys in 2007/08, with a year-on-year growth of 8%.

7.2 ITSS technologies can help provide better and more inclusive public transport:

- to users through improved reliability and accessibility;
- to operators through efficiency gains; and
- to both users and operators in terms of cost-effectiveness and affordability of service provision.

## Products and Services

7.3 PTIS (Public Transport Information Systems) are used to support reliability and efficiency of bus services, including:

- smartcard ticketing technologies that benefit passengers and operators;
- automated vehicle location (AVL) technologies that bring fleet management benefits to operators;
- AVL that enables local highway authorities and bus operators to work closely together to give buses priority at traffic controls;
- roadside and in-vehicle camera technology to enforce bus lanes and to help protect the safety of passengers;
- real time information systems to underpin deployment of waiting time information at bus stops or via mobile phones; and
- optically guided buses that use ITSS to position vehicles properly at bus stops to allow disabled access.

## Market data trends and growth predictions

7.4 The revenues and growth forecasts in US$million for the public transport ITSS market are shown in the following two graphs, one for total world and the other for total Europe.

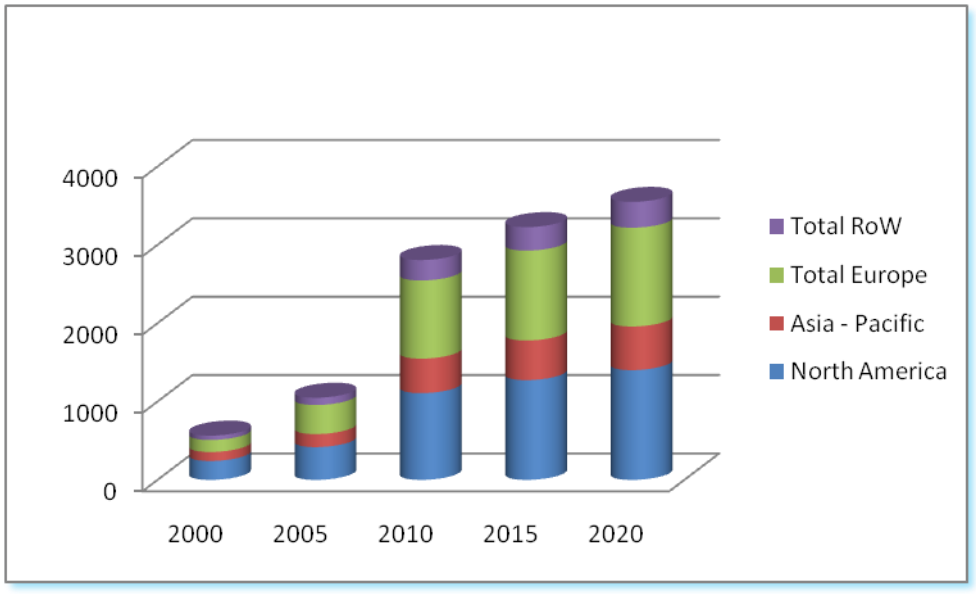



*Figure 7-1 2000-2020 Public Transport ITSS by World Region: revenues in US$million*

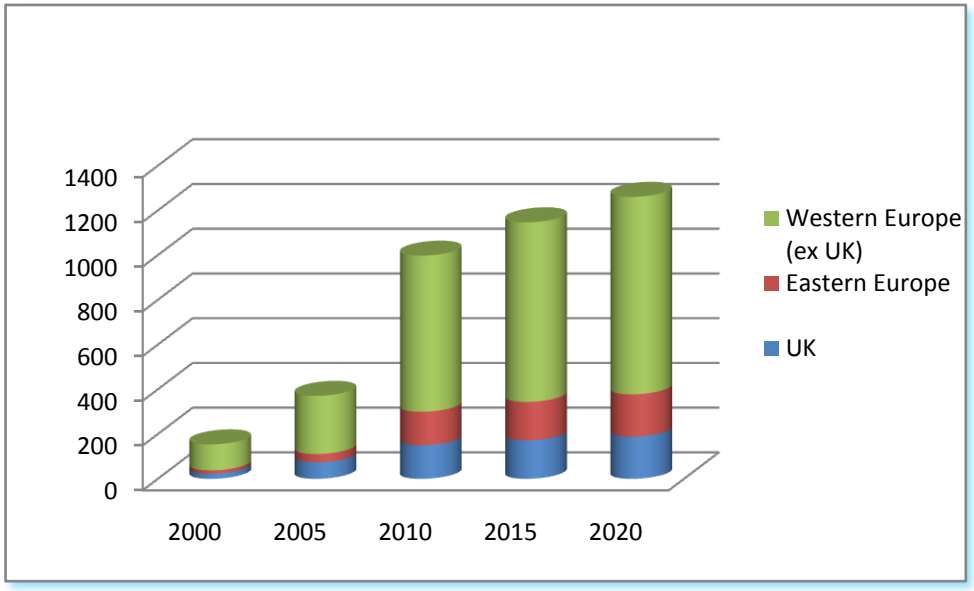



*Figure 7-2 2000-2020 Public Transport ITSS by Europe Region: revenues in US$million*

## Smartcard Ticketing - Market Overview and Trends

7.5 In the UK increased funding from the government is enabling electronic ticketing for public transport use to become more popular, giving rise to the following trends:

- Increased use of smartcards/electronic fare passes/E-cards arising from efficient technology developments, such as the Oyster card in London.
- Reduction in use of paper tickets - traditional paper tickets currently dominate the European market. With the development of efficient ticketing management systems, Smartcards are expected to expand and dominate the public transport ticketing market beyond 2010. Mobile E-Ticketing is expected to be more of a focus from 2013 and beyond.
- Higher demand for advanced payment systems - new technologies are being developed such as 'Ticket Pay and Display' machines, as used in London and Paris. Passengers can also top up their smartcard via the Internet – with an online account, the passenger can select a top up amount and choose the type of transport and time period subscription.

7.6 Specifically, DfT has unveiled a new smartcard pass, which gives older and disabled people free off-peak bus travel across England, at a cost to the government of an extra £250m each year. These new passes incorporate ITSO 'smartcard' technology, to help minimise fraud and ensure that the number of journeys is accurately recorded for reimbursement purposes between local authorities and bus operators.

7.7 The European Investment Bank (EIB) has been authorised by the EU Council to extend loans that could exceed €3.7bn until 2013 (or about €500m per year) for co-financing investment projects in public transport in Russia, Ukraine, Moldova and the Southern Caucasus. This presents potential growth opportunity for new ticketing systems.

## Smartcard Ticketing Market Drivers and Restraints

7.8 Smartcard technology provides flexibility for payment options:

- Contactless financial billing devices: lower requirements to handle cash result in improved operational efficiencies, and lower maintenance costs.
- Application flexibility: organisations can implement and enforce a wide range of security policies by deploying a system best suited to a particular application. Smartcard technology provides a flexible platform that can address both current and future needs e.g. physical access, cashless payment, and computer or network logical access.

- Higher security systems and innovative data protection software reduce the risk of transaction fraud.
- Higher memory capabilities: smartcards are being developed with high memory storage which results in the card having multipurpose use e.g. the Barclays credit card can be used as an Oyster card.

7.9 Ticketing market restraints

- "Wait-and-See" attitudes from transport authorities: though several projects are underway, not all authorities are yet convinced of the benefits.
- Reluctance of banks to be involved in transport: banks tend to be reluctant to involve themselves with Smartcards due to the large number of small transactions, as they prefer to be more involved with higher value store applications. Consequently the transport smartcard market is largely driven by the agendas of transport authorities rather than from the combined efforts of banks and ministry authorities.
- Potential area for computer hackers and viruses: as smartcards are based on computer technology, there is potential for hackers to introduce viruses to the software.
- Lack of technology to support users who are not computer literate, finding it difficult to use the flexibility option of smartcard ticketing.

## Smartcard Ticketing Market Demand Analysis and Suppliers

7.10 London is recognised in Europe as one of the most innovative for public transport ticketing. The Oyster card is expected to increase handling of revenues from £500m in 2007 to £800m by 2015, largely due to higher use of the tube and bus. The percentage of Oyster card and cash use in London is shown in the following chart:

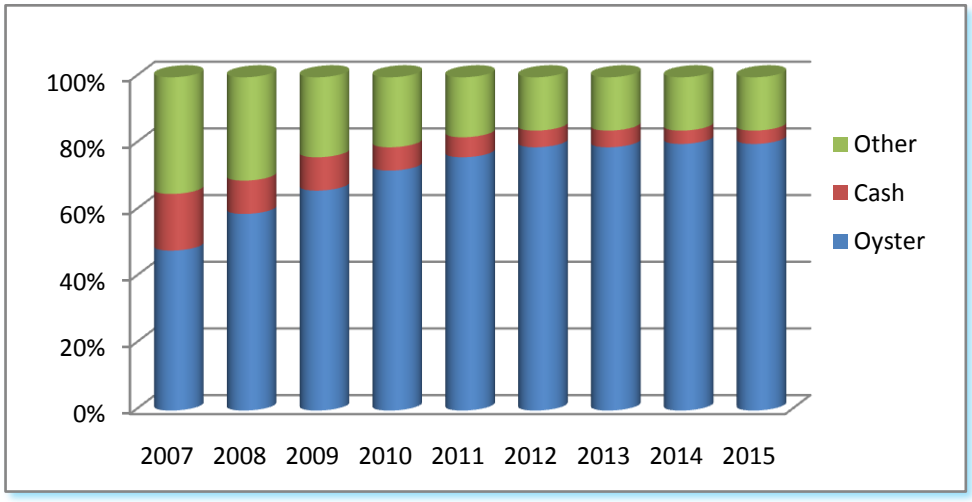



*Figure 7-3 % of Oyster card and cash use in London*

7.11 Ticketing - Key Suppliers

- ACS - IT service provider for paper ticket, magnetic ticket, contactless ticket, contactless memory cards and future virtual ticket (mobile phone).
- NXP - IT service provider for smartcard (contactless) technology such as the Oyster card.
- Industrias botella - supply ticketing for urban transport, including paper tickets and contactless tickets.

## Smartcard Ticketing – European Perspectives

- Denmark: a trial 'Uniform system' (smartcard system) is being used on trains and buses in Deroskin, and if successful, the Uniform system will have wider use in 2009. It is expected that

this smartcard will also be used as a top up card, which can be uploaded in advance or on the same day as journey. 11m passengers are expected to use this system by 2010.

- Russia: €500m a year will be invested for transport projects in Eastern Europe – Russia is the main focus for efficient ticketing to help passenger flow by 2013.
- Netherlands, Holland: The "Chip card" was introduced in the Randstad in late 2007. The Ministry of Transport are now aiming to complete the introduction of the chip card for the rest of the country by January 2009.
- Other global projects:
  - Toronto, Canada: future and existing electronic fare pass
  - Japan: mobile payment e-card
  - Queensway, Australia: existing fare pass
  - Riga, Latvia: smartcard-based ticketing system using contactless cards and tickets
  - New York, USA: existing electronic fare pass
  - Quebec, Canada: future electronic fare pass

## Real Time Information Systems

7.12 The UK's Real Time Information Group (RTIG) prepares an annual report on the implementation of public transport technology and the dissemination of Real Time Information (RTI) on buses, at stops and other locations and on other modes of transport, the latest report relating to the end of 2007. The report is commissioned by DfT, the Welsh Assembly Government and Transport Scotland, prepared by Centaur Consulting and based on information received from Local Authorities in England, Wales and Scotland in response to a questionnaire issued during autumn 2007. The main points from the end-2007 report are included below.

7.13 The summary position as at end-2007 is as follows;

- There are currently 17,529 buses fitted with RTI tracking equipment in GB, which equates to 44% of the total GB bus fleet. 64% of all respondents have an operational system, which accounts for 123 towns and cities with a population of 10,000 or over.
- The number of equipped buses has risen by 469 in the past year, which would have been higher but for one major RTI system in the North West being switched off during 2007. Regionally, England had equipped 48% of its fleet, Scotland 25% and Wales 36%.
- By end-2007, an estimated 2.8 billion passenger journeys (58%) had taken place on RTI equipped vehicles, a rise of 239 million since end-2006.
- There are currently 7,438 equipped signs in GB. The majority (97%) of these signs are at-stop signs, 70% mounted in shelters and 27% fitted as flags. The remainder are found in transport hubs and private buildings.
- 'Virtual' mechanisms for distributing RTPI to the public continued to gather interest with local authorities; approximately 25 local authorities are using mobile or internet technology by the end of 2007, an increase of 10 local authorities since end-2007.
- One large RTI system was turned off during 2007.

7.14 Future trends: 2008-2009

- Further steady growth is estimated in during 2008 and 2009, with a 16% increase in the number of equipped buses in GB since end-2007. Five GO regions, one more than 2008, will have fleets with more than 50% of buses equipped.
- The number of RTPI displays is set to increase by 32% at the end of 2009 and will go over the 10,000 mark for the first time, with the largest rises being seen in the Metropolitan areas, with 30% more signs being fitted.

- Virtual mechanisms will see further growth, in particular SMS, with 18 more authorities introducing this functionality by end-2009.
- Significant growth is also expected for a range of on-board RTPI technologies, including passenger displays, automated audio announcements, next-stop and final destination visual displays.

7.15 Other public transport technology trends

- Integration between RTI and UTMC has grown substantially and is set to continue to grow into 2008 and 2009. By end-2007, 57% of those with RTI systems now link them with UTMC rising to 67% and 74% in the following two years. The numbers of junctions with bus priority is also rising steadily in most areas. In 2007, there are now 1831 junctions with bus priority compared with 1728 in 2006; by 2009 the number will have risen to 3627.
- The survey asked respondents whether they had CCTV systems fitted. 60% had CCTV installed in at least one of four locations: internally on buses, externally on buses, shelters and other locations. By far the greatest proportion (98%) was installed internally on buses. Respondents also indicated that the reason for installing was most likely to be for driver and passenger security.
- Respondents were also asked to indicate whether RTI signs were set up to display emergency messages. This facility seems to be widely available with 78% of LAs with RTI systems able to display emergency messages. However, some comments from respondents suggest that operational processes may not support the technology or that the technology may not be sufficiently reliable yet.
- There has been significant growth in the use of RTI data for performance data – 40% of respondents with an operational RTI system now use historical data to inform discussion in the context of Punctuality Improvement Partnerships. In 2005 there were no local authorities using this functionality.

7.16 Expenditure

- Total annual expenditure has continued to rise. In 2007 England and Wales spent £57m and Scotland spent £5.9m, both rising on the previous year's spend. The total spend in GB in 2007 was £62.9m.
- Spend in 2004 on RTI in England and Wales was £44.1m. In 2005, England and Wales spent £52.8m, a rise of £8.7m. In 2006, England and Wales spent £36.2m, a drop of 31%. In 2007, England and Wales spent £57.0m. This is up significantly on 2006, and shows a modest increase on the figures for 2005. 2007 also shows an increase of 8% on the 2006 projections for 2007. Scotland's expenditure for 2005 was £9.8m, 2006 was £5.1m and 2007 was £5.9m.
- There remains significant variation among the GO Regions: London had by far the highest expenditure at £32m. However, the proportion of GB expenditure for which London accounts is expected to drop over the next two years. Scotland also shows significant variation in expenditure in its Regional Transport Partnerships. Strathclyde continued to have the highest annual expenditure in 2007, rising slightly from their 2006 figure to £4.2m.

# 8 Freight Efficiency

## Market structure and drivers

8.1 For the purposes of the report we have included within the freight efficiency section the breadth of commercial vehicle ITSS applications except for public transport vehicle applications and emergency service vehicle applications, which are covered in other chapters.

8.2 The market for ITSS related to freight efficiency and commercial vehicles is both established and fragmented. The range of purchasers includes: car rental companies, car sharing organizations, construction companies, delivery fleets, enterprise field force management, field service/repair companies, government fleets, heavy equipment, intermodal container tracking, less-than-truckload carriers, long-haul trucking, military, municipalities, truck leasing/rental companies, short-haul trucking, taxi/private for-hire companies, trailer tracking and utility companies.

## Market demands: the ITSS role

8.3 New technologies and ITS help support an efficient road freight and commercial vehicle industries in two respects:

- all vehicles benefit from many of the ITSS measures put in place to improve road network management; and
- the industry can improve its own efficiency by adopting ITSS technologies.

8.4 In particular, efficiency in commercial vehicle operations and road freight logistics is supported through in-vehicle systems that offer route guidance and through scheduling tools that enable better fleet and driver management. Satellite tracking and Radio Frequency Identification (RFID) providing information on the location of the vehicle or freight are becoming more common, with the additional benefit as a useful weapon in combating load theft.

8.5 DfT published in January 2007 a Telematics Guide in two documents, the *Local Authority Freight Management Guide* and *Information Technology for Efficient Road Freight Operations*. Both cover the wide variety of technologies on the market under the Transport Energy Best Practice Programme, with the aim of helping businesses understand the potential of telematics and make informed decisions on investment.

## Market Segments and applications

8.6 The following table provides an overview of the UK market's segments, applications, unit costs, vendors, target customers, estimated users and total addressable market.

| *Market Segment* | *Segment Application Needs* | *Average Hardware Costs ($/Unit)* | *Leading Telematics Vendors* | *Target Customers* | *Esti-mated Users (000s)* | *Total Addressable Market (000s)* |
|---|---|---|---|---|---|---|
| Rental Vehicles/Car Share | AVL/AVI<br>Geo-fencing<br>Remote Diagnostics<br>Remote Shutdown<br>Routing/Navigation | Hardware: $500-$1000<br>Below Average Monthly Fees~$15 | Cybit<br>Quartix<br>Thales<br>Urbigo<br>Vetronix | Avis, Budget, Enterprise, Hertz, National, Ryder, Sixt Spirit, Thrifty | 7 | 600 |
| Courier | AVL/AVI, In-Cab messaging, Handheld terminal support, Delivery status/reporting, Automated Reporting/Paperless forms, (Hours of service, road use, e-signature, etc.), Routing/Navigation, Driver ID verification/auto unlock/start | Hardware: $950-$1050<br>Above Average Monthly Fees~$50 | eCourier<br>Cybit<br>Isotrak<br>Transcomm<br>Navman | Deutsche Post<br>Fedex<br>Royal Mail Group<br>TNT<br>UPS | 13 | 90 |
| Light Goods Vehicles | AVL/AVI, In-Cab messaging, Handheld terminal/PDA support and connectivity, Delivery status/reporting, Automated Reporting/Paperless forms, (Hours of service, road use, e-signature, etc.), Routing/Navigation, Driver ID verification/auto unlock/start | Hardware:$600 - $1,500<br>Wide Ranging Monthly Fees $25-$50 | Brand Communications<br>Cybit<br>Idesta Solutions,<br>Isotrak<br>Masternaut<br>MinorPlanet Systems<br>Navman<br>SimplyTrak<br>Trakm8 | Mobile Sales Forces<br>Service Engineers<br>Mobile Workers<br>Local Transport | 90 | Mobile Construction Workers: 1,710<br>Total Vehicles:2,610 |

| Market Segment | Segment Application Needs | Average Hardware Costs ($/Unit) | Leading Telematics Vendors | Target Customers | Esti-mated Users (000s) | Total Addressable Market (000s) |
|---|---|---|---|---|---|---|
| Trailers | AVL/AVI<br>Multimodal communications<br>Extended battery life<br>Cargo status notification<br>Geo-fencing | Hardware: $400-$800<br>Below Average Monthly Fees $10-15 | GE Trailer Fleet Services, CS Electronics, Seven Eye, MinorPlanet Systems, Siemens, Satamatics, AXONN, OEM Group, QUALCOMM (EutelTRACS), CSI Wireless, TransCore | Ifor Williams Trailers<br>King Trailers Ltd<br>Indespension | 11 | 360 |
| Taxis/For-Hire | AVL/AVI, In-Cab messaging / dispatching, Remote diagnostics, Wireless point-of-sale transaction support, Passenger infotainment/advertising systems<br>Navigation/Routing | Hardware: $1,300-$1,600<br>Average Monthly Fees $25-$35 | Digital Dispatch<br>Infowave<br>Mobile Knowledge<br>Siemens<br>Raywood Communications | Dial-A-Cab<br>Manganese<br>Hart Taxis<br>T.O.A. Taxis | 11 | 65 |
| Heavy Goods Vehicles (Rigids) | AVL/AVI, Geo-fencing, Advanced remote diagnostics, (total hours of operation, fuel level, engine temperature, oil status, etc.), exceptions-based reporting + daily report, Driver ID/remote access | Hardware: $1400-$1800<br>Above Average Monthly Fees~$50 | Cybit, Fleetboard UK, MAN Telematics, Siemens, Thales, Volvo DynaFleet | Bedford, General Motors, Ford, LDV Leyland, MAN, Mercedes-Benz, Volvo | 48 | 320 Rigids |
| Utilities | AVL/AVI<br>In-cab messaging/dispatching<br>Driver ID/remote access<br>Remote diagnostics | Hardware: $800-$1,200<br>Average Monthly Fees $25-$40 | Amatics<br>Brand Communications<br>DigiCore, Trakm8, Masternaut | British Energy<br>Centrica, EDF Energy, n.power, United Utilities<br>Northern Ireland Electricity, PowerGen, Scottish Power Plc | 12 | 75 |
| Company Cars | AVL/AVI<br>Driver ID/remote access/remote start<br>Remote diagnostics | Hardware: $500-$900<br>Below Average Monthly Fees~$15-20 | Cybit<br>Navman | Corporations | | 2,300 |
| Municipalities | AVL/AVI, In-Cab messaging, Driver ID, Numerous sensor input, In-Cab messaging/dispatching, Driver ID verification/auto unlock/start, Remote diagnostics | Hardware: $800-$1,200<br>Average Monthly Fees $25-35 | Amatics<br>Cybit<br>Masternaut<br>Navman | Local authorities<br>City fleet vehicles | 13 | 600 |

## Market data and forecasts

8.7 Global data

Data in this section comes from the US-based ABI Research who collect baseline shipment and market data using public and private filing and sales data for individual brand lines to obtain a sales-level estimate. From this overall market size estimates are derived based on active subscribers and shipment levels of the suppliers.

In 2005, there were 100 million trucks and truck tractors registered in the United States with an estimated over 20 million commercial trucks in use in Europe. The market data in this section also includes Taxi and for-hire vehicle tracking as this is a growing application as large fleets find that automated dispatch streamlines processes.

The following charts show the revenues and growth forecasts in US$million for Freight and Commercial Vehicle ITS Systems and Services, separately and aggregated for both Total World and Total Europe. The charts are followed by comments on regional forecasts.

## 8.8 Freight and Commercial Vehicle ITS Systems – Total World

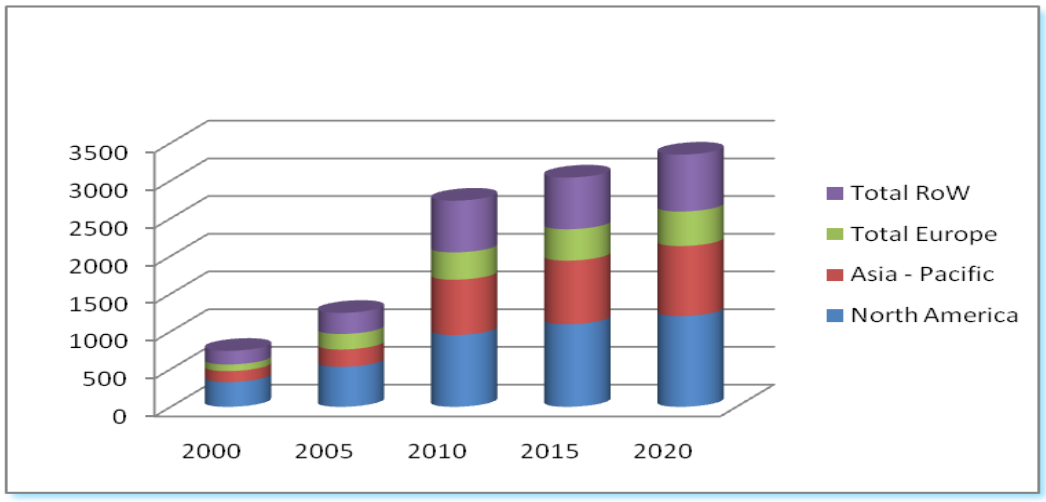



*Figure 8-1 2000-2020 Freight ITS Systems by World Region: revenues in US$million*

## 8.9 Freight and Commercial Vehicle ITS Services – Total World

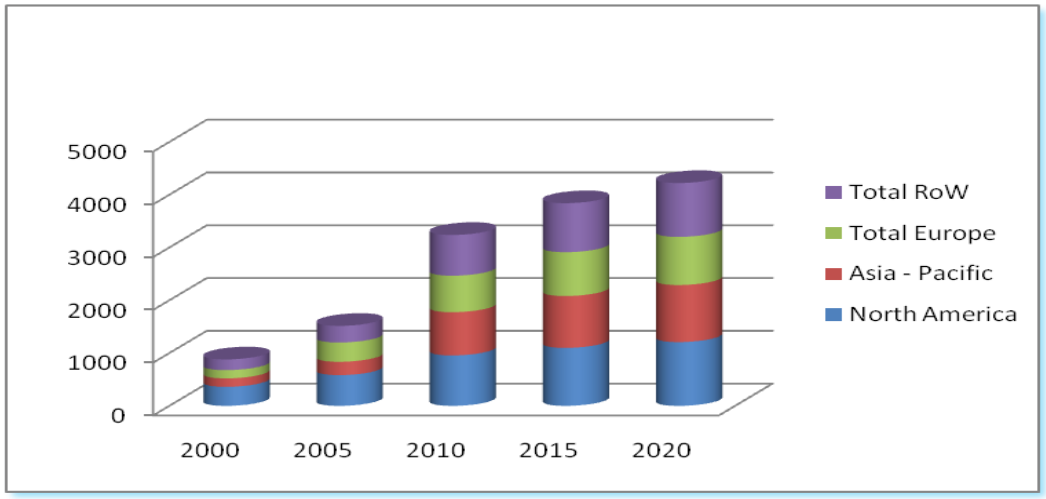



*Figure 8-2 2000-2020 Freight ITS Services by World Region: revenues in US$million*

## 8.10 Freight and Commercial Vehicle ITS Systems and Services, – Total World

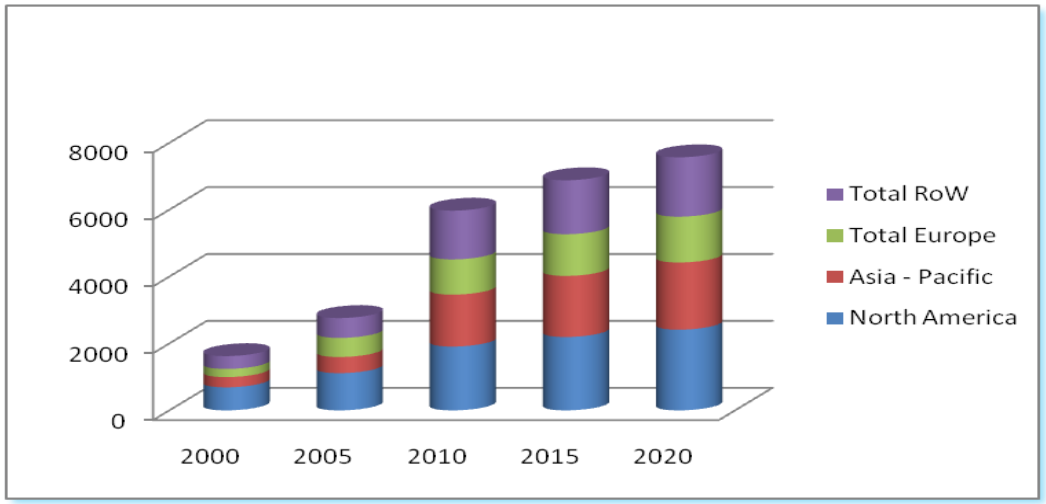



*Figure 8-3 2000-2020 Total ITSS Freight by World Region: revenues in US$million*

## 8.11 Freight and Commercial Vehicle ITS Systems – Total Europe

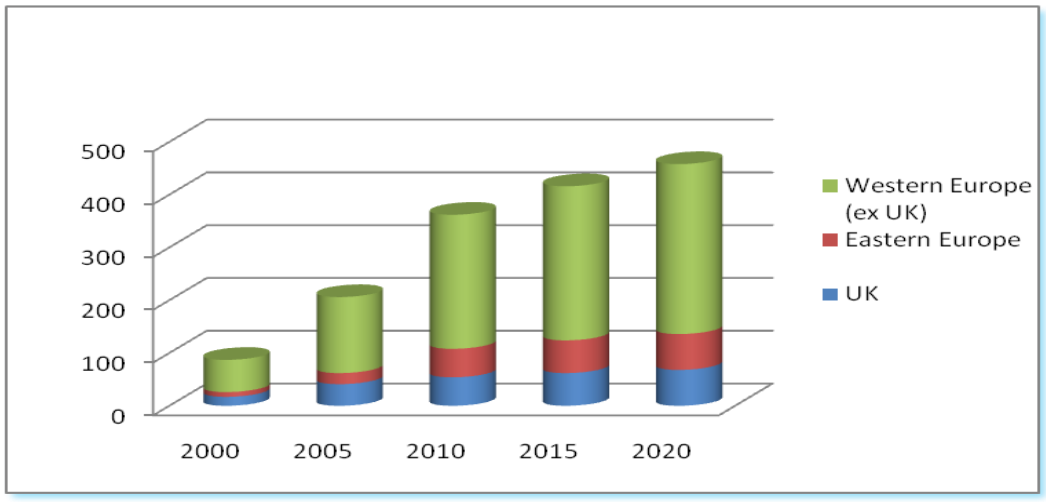



*Figure 8-4 2000-2020 Freight ITS Systems by Europe Region: revenues in US$million*

## 8.12 Freight and Commercial Vehicle ITS Services, – Total Europe

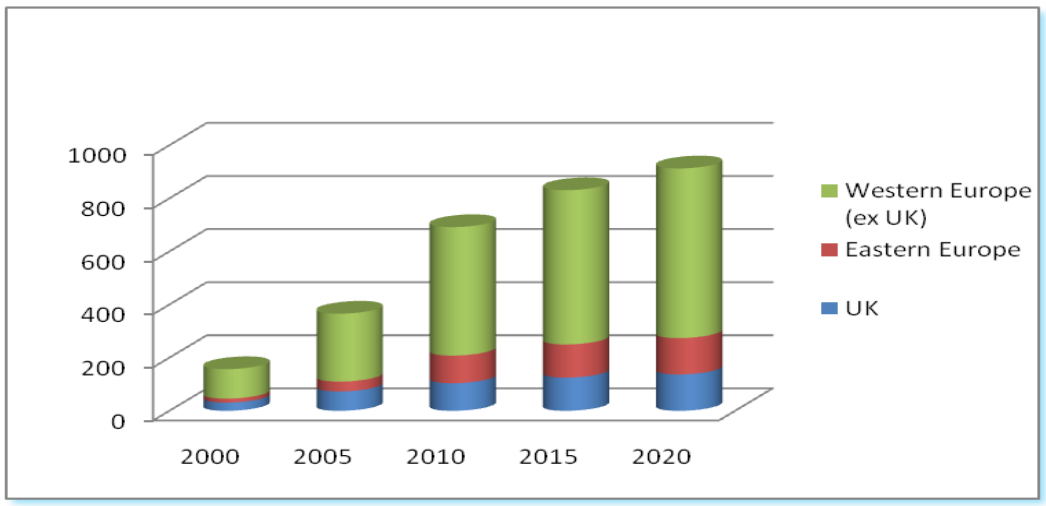



*Figure 8-5 2000-2020 Freight ITS Services by Europe Region: revenues in US$million*

## 8.13 Freight and Commercial Vehicle ITS Systems and Services, – Total Europe

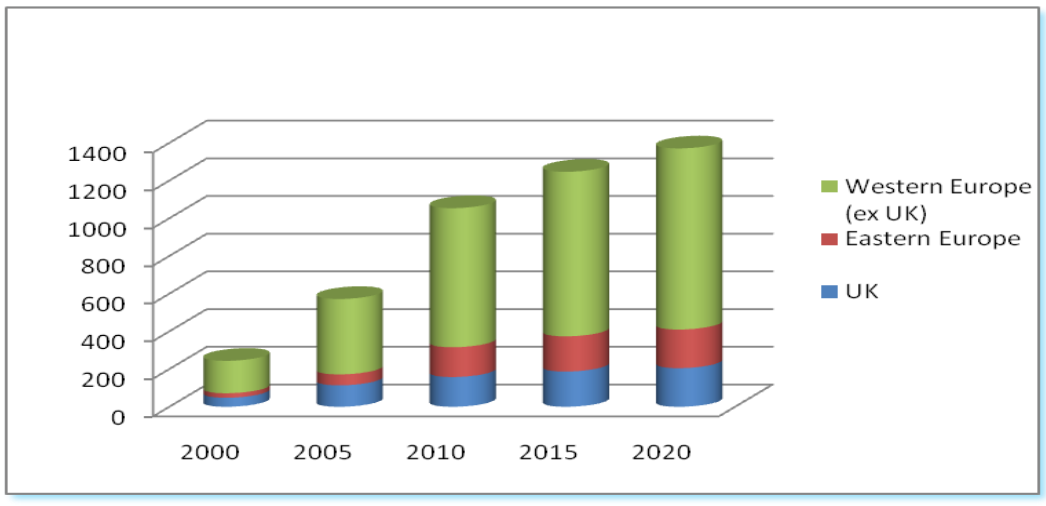



*Figure 8-6 2000-2020 Freight ITS Services by Europe Region: revenues in US$million*

## 8.14 North America Commercial Telematics Forecasts

Apart from long-haul and short-haul trucking, one of the key segments of North American commercial telematics is trailer tracking. Untethered solutions operate without any connection to the tractor. Tethered solutions obtain power or rely on communication from the tractor. Currently, ABI Research sees market penetration upwards of 10% of 4.5 million trailers in North America.

According to the latest US General Services Administration estimates, there are more than 600,000 federally owned or commercially leased vehicles, of which the Postal Service has one-third of the total. Several agencies already implement some type of tracking solution and as prices of solutions continue to fall, it will become more feasible for government agencies to extend tracking and monitoring systems to their fleets.

Currently, there are over 1.5 million subscribers of commercial telematics solutions in this region. This translated to service revenue levels of over $650 million in 2006. As a result, ABI Research forecasts that commercial telematics unit shipments will rise to over 1 million by 2012. Hardware value will grow to approximately $1.2 billion by 2012 and replacement rates will be higher than usual when moving forward, as subscribers replace their soon-to-be-outdated hardware with multimodal systems. Despite an initial cost surge for new, multimodal hardware, it is estimated that prices will steadily decline in tandem with wider-spread adoption and manufacturing efficiencies.

In summary, the North American commercial telematics industry was worth $1.2 billion in 2006 and will reach approximately $2.3 billion by 2012.

## 8.15 Europe Commercial Telematics Forecasts

European trucking is predominantly short-haul. Over 85% of European truck fleets operate locally with most hauliers moving cargo within their own national borders. However, this has been rapidly changing since the inception of the European Union. The continual elimination of trade restrictions and tariffs throughout the EU in the next few years will lead to growth in the size of trucking companies as they become international players competing in larger markets. This is expected to promote the adoption of commercial telematics. The acceleration of long-distance trucking in Europe promises to boost the market but, for now, slow and steady growth is the scenario.

The estimated current base of over 700,000 commercial telematics subscribers is expected to reach over 1.7 million by 2012. Europe will continue to have a subscriber base less than half that of North America, until at least the end of the forecast period. It is likely that some form of tracking technology may become compulsory, not voluntary, as it is in the United States and Japan.

Commercial telematics service revenue will rise to $900 million in 2012, from a 2006 level of $412 million. Prices for terrestrial-based systems vary significantly, depending on their function. Many are simple systems with no mobile communications, while more sophisticated solutions are also available that incorporate the same features as satellite systems such as AVI/AVL and two-way communications and dynamic navigation features. Short-haul trucking companies find cheaper terrestrial-based systems better suited to their needs than expensive satellite-based communications. European GSM networks are ubiquitous, with greater concentrations of base stations prevalent in this region than in North America. Thus, it is expected that the demand for terrestrial-based communication links will remain stronger compared with satellite communications.

Shipments of commercial telematics systems are expected to grow at a steady pace from 150,000 units in 2006 to nearly 350,000 units by 2012, and hardware value will grow to approximately $480 million by 2012. Europe represents roughly one-fifth of the global market, and will be dominated by a few major players, including Minorplanet Systems and Punch Telematix. However, due to cultural and linguistic differences throughout the continent, several regional players will continue. The market for European commercial telematics systems is expected to grow from $650 million in 2006 to over $1.3 billion in 2012.

8.16 Asia-Pacific Commercial Telematics Forecasts

Although Japan is small and has advanced mass transit systems, the country is heavily dependent on truck and automobile transportation. More than 60% of the total passenger movement is by automobile and 90% of the freight movement is by truck. Currently, Asia-Pacific subscriber levels are believed to be around 434,000; however, this is expected to rise significantly to over 2 million, translating to subscriber revenues over $1.3 billion by 2012. India is expected to continue to represent an increasing share of Asia-Pacific commercial telematics as its economy grows and investment is available to spend on the estimated 200,000 trucks in its vast region.

In Australia and New Zealand, primarily security issues have driven telematics uptake, as vehicle theft has plagued the region in recent times. A key challenge has been digital maps, but new mapping will drive uptake for telematics. New Zealand and Australia will always be small markets for commercial telematics, with the main growth potential lying in China and India in the short term, and Southeast Asia in the long term.

Commercial telematics shipments will increase from 125,000 in 2006 to 624,000 in 2012. Hardware value will grow to over $1 billion by 2012. The replacement rate will be high in many segments in this region due to new hardware that makes prior systems obsolete, as well as new multimodal systems to support planned satellite constellations.

The aggregate Asia-Pacific commercial telematics market is expected to reach nearly $2.5 billion from a 2006 level of just over $500 million.

## Leading Vendors

8.17 The leading global vendors in this established market are identified in the following table, which shows a simplified commercial telematics value chain:

| Content/Service Providers |
|---|
| @Road, AirIQ, Airsis, Amatics, Andronics Ltd, Aurora Software, Axonn, CargoBull Telematics, CCG Systems, Comet Software, Cybit, DigiCore Fleet Management, DriverTech, Electronic Tracking Systems, FreightDATA Software, FYM, GE Trailer Fleet Services, Gearworks, Geologic Solutions, GEOTrac International Inc., GPS-Buddy, IsoTrak, MapQuest, Maptuit, Masternaut, McLeod Software, Melton Technologies, Microsoft, Minor Planet Systems, MobiApps, Navigation Technologies, Navman, ORBCOMM, OxLoc, QUALCOMM, RoadEye, Sapias, Skybitz, Synergistic Systems, Telcontar, Tele Atlas, Televigation, Tell Systems, a, TISS, TomTom WORK, TrafficMaster, TransCore, TransDecisions, Transics, Trapeze Software Group, Trimble, VersaTrans Solutions, VIAMOTO, Volvo Truck, Webraska, Xora |
| **Network Operators** |
| Aeris.net, Bell Mobility, Cellemetry, China Unicom, Cingular, Globalstar, Hutchinson Whampoa, Inmarsat, Intelsat, Iridium, Mobile Satellite Ventures, Movistar, Motient, NTT DoCoMo, Orange, ORBCOMM, PanAmSat Corp, QUALCOMM, Reliance Infocom, SFR, SK Telecom, Sonera, Southern LINC, Sprint Nextel, Tata Telservices, Telia, Telus Mobility, TIM, T-Mobile, Verizon Wireless, Vodafone |
| **Hardware Manufacturers / Suppliers** |
| AirIQ, Amatics, Aplicoma Oy, AVL Information Systems, Axiom, Axonn, Blaupunkt, Cadec, CSI Wireless , Cybit, Datacom Wireless, Delphi Corp, Digiatal Dispatch, Electronic Tracking Systems, Everyday Wireless, FleetBoss GPS, Fleetilla, FYM, Garmin, GeoSpatial, GMV Sistemas, Guidepoint, HP, HunterPro, International Road Dynamics, Kyocera, LG, LoJack, Masternaut, Minor Planet Systems, Mobile Knowledge, MobileAria, Mobile Tracking Systems, Motorola, Navcom Technology, Navman, Orbital Sciences, Oskando, OxLoc, Palm, Panasonic, Par Logistics, PeopleNet Communications, Portman Security, Preco, Punch Telematix, QUALCOMM, Radio Satellite Integrators, Research in Motion, Samsung, Satronics, Savi Technology, Siemens, SkyBitz, SpaceChecker, Standard Communications, Symbol Technologies, Teletrac, Terion, Thales, Toad, Trackyourtruck.com, Transcomm UK Ltd, Trimble, Tyco Electronics, uLocate Communications Inc, Volvo Truck, WebTech Wireless, XATA |

## Freight Efficiency ITSS Summary and Conclusions

8.18 Economic and competitive pressures will drive this commercial sector of ITSS to create better products with enhanced facilities accompanied by downward pressure on prices. Earlier difficulties with technology reliability in different countries, including the UK, now seem to be overcome. Over the next few years markets in the UK, Europe and globally look set to grow. Despite the “credit crunch” and economic slowdown, ABI Research has reported that demand for commercial telematics continues as fleet operators seek to make operational efficiencies.

# 9 Environmental benefits

## Market demands: the ITSS role

9.1 Many of the measures described in other chapters clearly can also have a direct or indirect effect on the environment. In particular, vehicle technology plays an essential role in minimising emissions pollution. ITSS that can increase capacity of the existing road network can also help to minimise the environmental impacts of road construction. ITSS also has clear potential to contribute positively to both air quality and wider environment sustainability objectives in several ways, including:

- using ITSS to manage the existing road network to best effect can help minimise the environmental burden of major new road infrastructure;
- improved network management techniques that use ITSS to smooth traffic flow help to reduce vehicle emissions;
- ITSS used by the road freight sector is helping to improve efficiency with consequential environmental benefits; and

9.2 Future in-vehicle advanced ITSS technologies such as advanced cruise control, intelligent speed adaptation (ISA), “stop and go” systems or on-board diagnostics might offer significant environmental benefits particularly in terms of fuel efficiency which helps to reduce carbon emissions and local air pollutants.

9.3 In this chapter we give a summary of an ITSS environmental benefits analysis prepared by Newcastle University, as presented at the London ITS World Congress. We also examine one ITSS topic not covered elsewhere in the report, namely Usage Based Insurance (UBI), which calculates insurance premiums based on when, how and where the driver drives, with a higher rate for driving at peak traffic hours. A further specific area giving environmental benefits is Congestion Charging, applying congestion charges in peak traffic zones and reducing the number of vehicles on the road. Congestion charging is dealt with in chapter 4, Network Management.

## Analysis of Environmental Benefits

9.4 Given that it takes about sixteen years for 90% of vehicles sold in a year to reach end of life, there is an evident need to find short term solutions for environmental pollution hot spots. It has been demonstrated in trials that traffic management systems that control flow and minimise stopping and starting result in significant reductions in emissions. Several factors affect pollutant levels including speeds, road capacity, engine performance and driver behaviour. Whilst engine and fuel technology developments will bring benefits in reducing emissions, and whilst there can be encouragement for modal shift away from the car to public transport, the reality is that efficient traffic management will minimise the impact of pollution.

9.5 In urban networks there are arguments in favour of managing traffic so that tail pipe emissions are dispersed in more open environments rather than in urban canyons. However, trials in Leicester to relocate emissions to a different part of the network where there was an open space overall, created more emissions as optimisation of the traffic flow was often lost in the relocation process. However, the natural ventilation of the built environment at the relocated junction, reduced concentrations therefore improved the exposure and health of the population across the network.

*9.6* For interurban networks, the results of the Highways Agency ATM trial on the M42 have been encouraging. The HA’s ATM Monitoring and Evaluation 12 Month Report published in June 2008 states that: *Based on constant traffic composition and flows between winter 2003 and winter 2006, the effects of ATM on emissions from all vehicles were:*

- *CO reduced by 4%*
- *PM reduced by 10%*
- *HC increased by 3%*
- *$CO_2$ reduced by 4%*
- *fuel consumption reduced by 4%*

This shows that ATM resulted in a small reduction in fuel consumption and a small reduction in all of the emissions apart from HC. To fully understand the reasons for this increase will require further investigation. The reductions in emissions are similar to those obtained from two studies of the impact of Variable Speed Limits on the M25. Therefore the overall message from this analysis is that there is no evidence that the ATM scheme itself has led to an increase in emissions of CO2, CO, NOx and PM on the M42"

9.7 The priority given to public transport through such measures as bus priority at traffic signals and dedicated bus lanes encourages modal shift away from the private car by making the public transport much more attractive. Passenger and management information systems as well as the technologies to affect the bus priority improve bus patronage are good examples of ITSS delivering environmental benefits.

9.8 Encouragements to cycling and walking, particularly for short journeys, where vehicle emissions are worse due to cold engines, can all be aided by various measures, such as pedestrian and cycle crossing facilities (Pelican and Toucan), CCTV surveillance, all red phases for pedestrians and more cycle friendly signal optimisation. Such actions are particularly effective when implemented with demand management measures such as road user charging taking advantage of the spare capacity and preventing higher speeds which, for some pollutants, partially erode the benefits achieved by the reduction in traffic flow.

9.9 Information systems providing information to drivers on, for example, regarding alternative routes, all help to reduce delay and emissions and may also redistribute such emissions over a wider area reducing the risk of hot spots forming.

9.10 Congestion charging and Low Emission Zones, as implemented in London, have been helpful in reducing emissions, and offering incentives to low polluting vehicles.

## Usage Based Insurance Market Overview

**9.11** The Usage Based Insurance (UBI) concept is based on several factors which have an indirect impact on reducing emissions. These factors include: where and how much the customer drives? When the customer drives? How the customer drives? The concept was introduced in the US by Progressive Company's AUTOGRAPH product. Norwich Union's Pay-As-You-Drive (PAYD) was the first to initiate UBI service in Europe in 2006.

9.12 The concept was developed to link the insurance policy and premium with the driver's risk, rather than on the traditional method based on just demographics and age. The product uses GPS based 'track and trace' technology to chart the path of the vehicle on a map which is pre-loaded with set rates. A GSM/GPRS module fitted to the black box is responsible for transferring the journey data to the data servers for processing the insurance bill. Tariff rates for drivers driving at peak hours (either during the day or midnight) are higher thereby increasing the premiums. Drivers are restrained from driving at peak hours, which ensures reduced emissions on the road.

9.13 Countries like Belgium and the United Kingdom are working on Pay As You Pollute (PAYP) Insurance for reducing emissions. Variations include: Usage-Based services such as PAYD, Usage-Based Rental/Leasing, Pay As You Drive Tolling and Pay As You Drive Tax.

9.14 Market trends:

- Norwich Union has suspended UBI in the UK for passenger vehicles
- France is set to take off beyond CNIL privacy objections – Solly Azar is ready with product
- In Austria, insurance discounts are offered to drivers with lesser emissions - Uniqa
- PAYD is sold along with stolen vehicle tracking solutions in Italy by insurance companies
- Emission reduction is a key objective behind PAYD usage in Japan and NA
- Italy represents the single largest market for UBI in Europe

9.15 Technology trends:

- Usage based insurance is eventually expected to lead to new taxation models adopted by governments (e.g. Texas)
- Pay As You Drive (PAYD) is a patented technology (EP0700009) owned in the UK by Norwich Union
- Since the PAYD telematics black box is similar to the one used for eCall (GPS, GSM), introduction of eCall voluntary agreement will ensure a successful package
- Pay How You Drive (PHYD) currently offered by Airmax and Lloyd Latchford, Royal and Sun Alliance focuses on CO2 emissions for fleets in calculating premiums
- Most of the PAYD schemes operating in Europe focus on collecting journey information through GPS and GSM/GPRS
- Companies in Italy, Spain, France and Germany are working around PAYD patent
- Norwich Union owns the patent for PAYD in the UK. However, the auction held to sell the patent in other regions like Germany, France, Spain and Italy saw little take up
- PHYD is currently being offered by a group of Insurance companies in UK and the basic concept is to connect to vehicle CAN BUS and calculate premiums for commercial vehicles on emissions and driving patterns
- Telematics companies like OctoTelematics and Cobra have developed usage based insurance concepts without legally infringing the PAYD patent EP0700009 for Italian and French insurance companies (Unipol, Solly Azar, etc)
- In the US in many states like Oregon and Philadelphia, local governments are considering the possibilities of using PAYD to reduce emissions and also introduce new taxation models for low emission cars

9.16 Regulation and standards:

- eCall voluntary agreement might ensure UBI offered from an OEM level
- Regulatory trends
- Data Protection Act (e.g. CNIL in France)
- Installing stolen vehicle tracking solutions in the UK and Italy in high end vehicles

9.17 European applications:

- There is an EU voluntary agreement to introduce eCall by 2010 on all new type approved vehicles. The target is for all car manufacturers to offer eCall as a standard listed feature. Since the basic hardware is the same for eCall and UBI, both are expected to benefit. Besides eCall, many countries are expected to use UBI for other elements like congestion charging, Pay As You Pollute and Pay As You Toll.
- In the UK, Italy, Belgium and the Netherlands, insurance companies insist on fitting of SVT solutions on high end vehicles. Insurance discounts are offered to customers fitting SVT. Insurance companies are extending this trend to UBI offering discounts to low mileage and low emission vehicles.
- Certain European countries, such as France, have data protection regulations that prevent sharing the user's confidential information with any third party. The CNIL was the body which prevented insurance companies from launching any typical UBI policy in France. Insurance companies like Solly Azar and AXA are currently working on introducing a non privacy invasive solution.

## UBI Existing Products and Services

| Country | Insurance Companies | Telematics Partner | UBI Developments |
|---|---|---|---|
| UK | Norwich Union, AXA, Royal & Sun Alliance, Zurich | Trafficmaster and Octo Herald | 26,000 estimated UBI subscribers in 2007<br>NU recently suspended its PAYD service<br>Cobra is in discussion with insurance companies to launch service in early 2009 |
| Germany | HUK-Coburg, Allianz, WGV, DBV Winterthur, Swiss Re | HP/T-Systems | WGV aiming for 2009 commercial launch<br>Pilot testing of companies in progress, approx 3000 subscribers to be tested in 2008 |
| France | Axa, Covea, Aviva, Sofca, AGF, Solly Azar, MACIF | Cobra, Traquer,<br>T-Systems, Octo Telematics | All projects in testing phase. Estimated launch in 2009<br>15,000 drivers to be tested in 2008 |
| Italy | Unipol, Generali, Lloyds Adriatico, Uniqa, Axa, Aviva, Cobra | Octotelematics, VIASAT, Altea and Cobra | 67,000 estimated UBI subscribers in 2007<br>Octo telematics is aggressive and estimates above average growth. Octo has nearly 70% telematics hardware market |
| | Mapfre | Octotelamatics | Commercially available product with more than 10,000 customers |
| Switzer-land | Zurich Schweiz | Agentes | Market release of product expected in 2009<br>Pilot testing with 2000 users |
| | Uniqa | Octotelematics | Used more as an environmental bonus for consumers with under 400 customers to date |

## UBI Market Drivers and Restraints:

9.18 UBI Market Drivers:

- Reduced risk for insurance companies and eCall voluntary agreement will push the demand.
- Consumer savings on insurance premium**: c**ertain section of the customers, mainly low mileage drivers and young drivers, will be able to save up to 30% on the annual premium due to PAYD.
- Reduced risk for insurance companies**:** UBI provides large incentives to users for altering their driving pattern positively, thereby reducing the risk of accidents. Fewer accidents mean fewer claims, directly impacting on company profits.

- PAYD enables insurers to calculate risk more accurately, so helping them to price the service aggressively.
- eCall voluntary agreement will require VMs to integrate telematics hardware, providing a standard open platform for various value added telematics services. This will standardise the data transfer methodology. Other telematics services such as SVT, RVD and eCall can be packaged with PAYD service and offered in the same telematics hardware unit, providing a revenue generating model for service providers.
- Reduced vehicle travel improves road safety and emission reduction**:** PAYD is predicted to reduce vehicle travel significantly, thus reducing emission and improving road safety.
- Insurance fraud reduction**:** insurance fraud is common in most European countries. Conventional insurance systems loses track of the customer after purchase of the policy; UBI remains as a tool to keep track of customers.

9.19 UBI Market Restraints:

- Infringement of privacy will be a major stumbling block: Tracking daily movements for a saving of 25% on premium may not find favour with customers, who regard privacy as extremely important. Insurance companies face a potential restraint as the system's basic principle is to keep track of its customers through a GPS black box. Norwich Union attributed its PAYD project abortion to this factor.
- Increase in premium for high mileage drivers: The system provides no benefits to high mileage motorists and hence there is a general tendency of non acceptance among them. Insurance companies will find this a gap that has to be filled.
- Initial cost of the hardware unit – customers hesitate to pay: Currently customers are required to purchase the hardware unit (telematics box) to use the PAYD service. Since the customer has to pay initially for the hardware, which is not the case in conventional insurance, there are low takers currently. However, this restraint would disappear when the eCall voluntary agreement is implemented.
- Legislation which might demand the accident data as mandatory: Telematics based insurance concept will give the power to insurers to be in constant touch with their clients. Governments will look into this as a platform for them to get access to all accident data. This could be a potential threat to certain trade secrets of the insurance industry
- Data Protection Acts that disallow the sharing of data: Data protection is rigid in many European countries like France and this may act as a restraint to setting up the system in such countries. Conventional insurance does not have any such constraints.

## UBI Market Demand Analysis:

9.20 Market for Usage-Based insurance: total take-up rates of UBI service (Europe), 2007-2015:

| Country | 2007 units | 2015 units |
|---|---|---|
| Austria | 600 | 44,000 |
| Switzerland | 2000 | 48,500 |
| Germany | 0 | 60,300 |
| Benelux | 10,760 | 160,500 |
| France | 0 | 187,500 |
| UK | 26,000 | 25,500 |
| Italy | 67,000 | 815,800 |

CAGR 2007-2015 40%

## Market Demand Analysis:

9.21 Market for Usage-Based insurance: Revenue Forecasts (Europe), 2007 – 2015. Two forecasts are given, and optimistic forecast with a CAGR of 35% for 2007-2015 and a Frost & Sullivan forecast with a CAGR of 29% for 2007-2015.

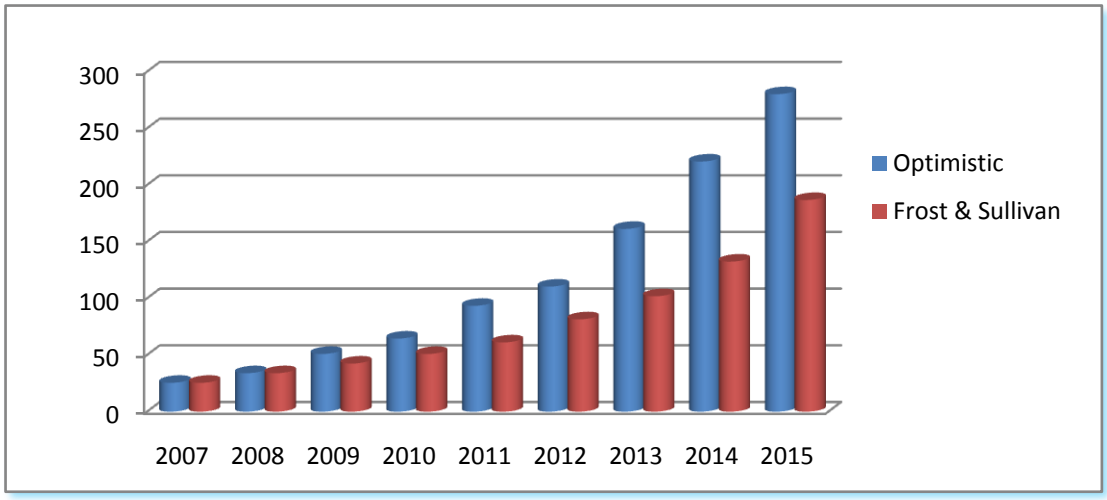



*Figure 9-1 Revenue Forecasts (Europe) 2007-2015 - Market for Usage-Based Insurance*

9.22 With the growth of UBI in Italy and the United Kingdom, the revenue is likely to grow at a steady rate. The pilot projects conducted by Cobra and OCTO are expected to be launched commercially by 2009 and the market will grow steadily until the introduction of eCall.

9.23 Austria, Switzerland, Spain and France are the other main countries where the concept is estimated to earn most of the revenue. It is expected that the market will take-off and have a steep growth only after the introduction of eCall.

9.24 The cost of manufacturing the telematics system used for UBI service is lower than other telematics system used for eCall, SVT and RVD services. It is a basic telematics system with GPS, GSM/GPRS modules and does not include additional sensors and software coding, which are integrated in the case of eCall, SVT and RVD.

9.25 It is expected that there will be a steady drop in the system price until the introduction of eCall. The cost of the system will fall drastically post eCall launch due to economies of scale achieved by large up-take rates and the availability of cheaper technology. The telematics hardware unit's cost is expected to dip to €80 by 2015.

## UBI Global Initiatives

9.26 Outside Europe, several countries are trialling Usage Based Insurance:

- Canada - Vancouver City Council passed a resolution asking the insurance corporation of British Columbia to offer Pay As You Drive insurance. Concept is under study with launch imminent.
- Japan - Sompo Insurance and Tokio Marine offer insurance discounts for low emission cars, with close to 6m customers, but this is not traditional PAYD. Aioi Insurance Company has developed a PAYD policy using ITS technology, launched in early 2008.
- Israel - Aryeh Insurance offers PAYD mileage based insurance, and has 200,000 subscribers.
- South Africa - Hollard Insurance offers PAYD through the Skytrax GPS device (also used for vehicle tracking), and offers up to 8% savings for low mileage drivers.
- USA - Progressive Insurance Company is currently carrying out a pilot price testing study with 3000 volunteers for the Tripsense product. Oregon, Texas and Philadelphia have passed legislations for local insurance companies to offer PAYD policies based on mileage and

emissions. Progressive recently introduced My Rate PAYD concept with 10-40% discounts on insurance premiums based on driver behaviour. GMAC (General Motors Acceptance Corporation) offers discounts for consumers who drive less than a specified mileage on an annual basis (using the OnStar technology concept).

## Summary and Conclusions: Environmental Benefits

9.27 This market area has little quantitative data as this theme is only just emerging in ITSS policy and thus not yet attracting focussed industry response. There are also difficulties in defining distinct products and services as many environmental benefits arise from the use of other product and service areas. Nevertheless, this is clearly an important area which warrants further investigation particularly to attribute quantifiable environmental benefits to various ITSS measures.

# 10 Security and Crime Reduction

## Market structure and demands: the ITSS role

10.1 ITSS can contribute positively to crime reduction in its broadest sense in several ways, including:

- CCTV and ANPR technologies on the road network, and CCTV at bus stops and in buses, provide valuable tools to support enforcement authorities and act as deterrents against infringements of the law, and are a useful intelligence gathering tool;
- perimeter security measures can be enhanced by ITSS access control systems;
- enforcement authorities recognise the potential that certain existing in–vehicle equipment has for facilitating their activities, such as being able to trace stolen vehicles through satellite-based tracking services that drivers can subscribe to;
- future developments including remote vehicle stopping and electronic immobilisation; and
- electronic vehicle or cargo identification could also offer opportunities for better location referencing to minimise perceived risks, e.g. in the carriage of dangerous goods by road.

10.2 Major incidents and events – whether security-related or others such as natural disasters and major crowd events – require appropriate emergency planning strategies to ensure that people and vehicles are moved safely, easily and promptly. ITSS technologies that are resilient to the effect of an incident can support these strategies by facilitating access control and enabling joined-up services across authorities.

10.3 There is a third major strand to the security debate for ITSS. Integrity and resilience is an important issue at device and system level. This is the case for reasons of data protection and privacy but also in terms of a much wider issue of unauthorized tampering whether for criminal and malicious intent or through erosion of materials and interfaces.

10.4 Key areas on security and crime reduction covered in this chapter are:

- **eCall -** Impending European Union Voluntary agreement with ACEA (European Car Manufacturers Association) to make eCall optional to half fatalities by 2010
- **Stolen Vehicle Tracking -** Focus on theft reduction and after theft Vehicle tracking systems including Immobilizers and stolen vehicle tracking Systems. Currently SVT systems are dominant at a regional and aftermarket level
- **Incident Management -** Focus on methodologies used for managing incidents on Motorways and A roads. Currently non-intrusive technologies such as GPS leading the incident detection and may replace inductive loop detectors
- **Vehicle Identification and Enforcement -** Within the UK, ANPR and CCTV are two dominant methods used as a means to ensure legal enforcement hence crime reduction e.g. identification of stolen vehicles and number plate cloning

## Products and Services

10.5 Products and services for Security and Crime Reduction include CCTV, ANPR, Access Control, Enforcement, Vehicle Identification, E-call, and Incident Management.

10.6 There are several products that can be grouped under the title of “enforcement”, depending on the application. Some enforcement is for safety purposes, such as speed camera and red light camera enforcement. Other enforcement relates to network management policies, e.g. bus lane enforcement, turning movement enforcement, HOV (high occupancy vehicle) lane enforcement. Yet others are for revenue protection, e.g. in congestion charging, parking management and toll lane operations. Weighing enforcement combines both safety and road wear and tear protection aspects. None of the third party information suppliers have researched the enforcement area, with much of their data included under the broader application rather than the specific enforcement subject.

## eCall Market Overview

10.7 The move for eCall systems is directly prompted by the European Commission's initiative to reduce the number of fatalities by 50 per cent by 2010. eCall is a part of the eSafety initiative started in 2001, which currently translates as a voluntary agreement in which vehicle manufacturers will offer eCall as a standard listed option on all new type approved vehicle models from late 2010. Related projects include i2010 which is the intelligent car initiative focusing on three main pillars – safer, cleaner and smarter cars.

10.8 Through the introduction of an eCall system, the EC is aiming for a reduction of 50 and 40 per cent in the response time to accidents in rural and urban areas, respectively, and about 15 per cent reduction in accident severity in terms of medical treatment required. The aim is also to make cost savings of €26bn in the EU 25 regions annually.

eCall and bCall Systems Market: EU Target Reduction for Fatalities (Europe), 2002-2010

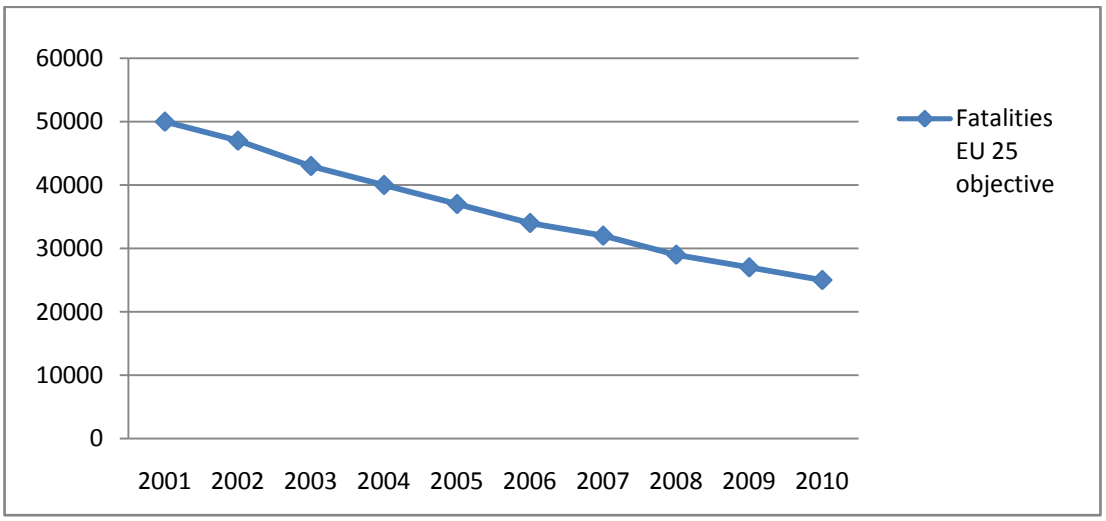



*Figure 10-1 EU Target Reduction for Fatalities (Europe), 2002-2010*

## eCall Current Market Overview

10.9 eCall market penetration in Europe is low compared to North America and Japan. The eCall and bCall systems currently offered by vehicle manufacturers are as shown in the table below:

| Vehicle Manufacturers | eCall portfolio | | |
|---|---|---|---|
| | Currently Offer | Under Development | Introduction Year |
| BMW | Y | | |
| Volvo | Y | | |
| PSA Peugeot Citroen | Y | | |
| Audi | | No Development | NA |
| FIAT | Y | | |
| Jaguar | | Y | 2010 |
| VW | | No Development | NA |
| Toyota | | No Development | NA |
| Renault | | Y | 2010 |
| Mercedes Benz | | No Development | NA |
| Ford | | Y | 2010 |

10.10 Implementation Trends

- Different types of eCall solution being proposed by ACEA – to offer flexibility for VMs and customers
- eCall will be made available as a standard listed feature option in all new type approved vehicles post 2011. eCall regulation is not possible for all new vehicles, giving an opportunity for aftermarket solutions
- Member states who have signed the eCall MoU are: Greece, Italy, Cyprus, Lithuania, Germany, Slovenia, Finland, Sweden, Norway, Switzerland, Iceland, Slovenia, the Netherlands, Brussels and Belgium
- Member states who have deferred eCall MoU signature are: the UK, France and Spain
- E112 operational/introduced: Czech Republic, Denmark, Germany, Estonia, Spain, France, Cyprus, Luxembourg, Hungary, Malta, Austria, Slovenia, Finland, Sweden and UK
- eCall trials completed/planned - Denmark, Germany, Italy, Hungary, Netherlands, Austria, Finland, Sweden, the UK and Norway
- The UK has declined from signing the MoU for eCall, surprising considering that the UK has operational PSAPs (British Telecom and Cable & Wireless) and also has active eCall services running by companies like O2. This and the French deferral pose two challenges for the EC at present.

10.11 Key Technology Trends:

- Public Safety Answering Points (PSAP) infrastructure upgrading to handle eCall is a critical issue in member states.
- In-band modem technology is cost effective and is the ideal solution.
- Possibility for aftermarket Portable Navigation Device (PND) manufacturers to supply retrofit eCall solutions for existing models.
- In April 2006, GSM Europe (GSME) released a position paper entitled “GSME Position: Options for eCall MSD signalling” in which it named in-band modem technology as the preferred eCall MSD signalling system.
- Currently one of the key issues is to upgrade the network and IT infrastructure at the PSAP end for successful transition from handling 112 calls to E112 calls to finally eCall. This requires upgrading infrastructure to include aspects like in-band modem technology.
- Only a few member states have the PSAPs infrastructures set up namely the UK and a few others. This reinforces the need for member states to cooperate on eCall and develop infrastructure to develop this on a pan-European level.
- The Minimum Set of Data (MSD) has been positively voted upon by European standardisation authorities to become a standard for a public eCall service.
- For existing vehicle models ACEA is proposing a low-cost mobile phone-based eCall solution, as the voluntary agreement is expected to apply to only new type approved vehicle models.

10.12 Existing Products and Services

| Vehicle Manufact-urers | Solution | Subscriber Base (2007) and Suppliers | Countries Offered |
|---|---|---|---|
| BMW | BMW Assist - BMW customers buy the navigation system and pay extra for eCall GSM telephone with dedicated SIM, costing approx €1,400 for navigation and eCall combined package. | 60,000<br>Suppliers:<br>Continental VDO ATX | UK, Germany, Italy |
| Volvo | Volvo On-Call: Volvo offers a dedicated eCall unit with an add-on security package. The customers buy the GSM telephone with dedicated SIM and eCall hardware at a cost of €1,200-1,400. | 25,000<br>Suppliers:<br>Autoliv<br>Wireless Car | Belgium, France, the UK, Italy, Luxemburg, Spain, Sweden, Germany, the Netherlands, Denmark, Norway, Portugal, Switzerland and Austria |
| PSA Peugeot Citroen | PSA Emergency Services: PSA customers have to install the RT3/RT4 or the Navidrive platform and the actual eCall service is offered free of charge. Installing the RT3/RT4 or Navidrive telematics platform, including Navigation and GSM telephone costs €1400-1800. | 320,000<br>Suppliers:<br>Steria<br>Magneti Marelli<br>Netsize<br>Inter Mutuelles Assistance (IMA) | Portugal, Austria, France, Germany, Italy, Spain and Benelux |

## eCall Market Drivers and Restraints

10.13 Market Drivers

- EC plan with ACEA to have eCall as a standard listed option post September 2010, aiming to reduce road fatalities by 50 per cent by 2010. The agreement, framed in 2005, was initially scheduled to be launched by 2009, but because of several challenges (e.g. member states not signing the MoU, and many not having the necessary PSAP infrastructure) has currently been pushed back to late 2010.
- Consumers are willing to have eCall systems – 90% consider eCall beneficial. A Eurobarometer study conducted in 2006 revealed that safety (active, passive and post crash safety, i.e. eCall) plays a large part in vehicle purchase decisions. One finding is that over 70% of consumers want eCall to feature in their next vehicle.
- The eCall platform with the existing GPS and GSM communications modules provide the ideal launch pad for additional services, such as location based services (LBS), POI and enhanced breakdown assistance. This will lead to a more integrated telematics based off- board services platform.
- Other telematics applications, such as pay as you drive (PAYD) vehicle insurance and stolen vehicle tracking, also use the same basic hardware, thus enabling an integrated telematics offer for end consumers.
- Currently only a few vehicle manufacturers like Volvo, PSA, BMW and Fiat offer eCall and bCall service in Europe. Of these only Volvo offers a Pan European eCall service, operated by Wireless Car in Europe. For VMs like Volvo, with high safety standards, eCall is a key brand differentiator.

10.14 Market Restraints

- In the near short term, there is a need for member countries to cooperate to start on the development of PSAP infrastructure.
- For the smooth rollout of eCall regulation, vehicle manufacturers need to work with the telecom industry to ensure smooth cooperation.
- According to a recent Frost & Sullivan consumer study, although 90% of consumers consider eCall systems beneficial, about 40% do not want to pay extra for eCall, and believe that eCall systems should be part of the standard package.
- For the private automobile market, telematics is seen as niche, except for navigation, which is the only product segment to achieve significant penetration levels. All other applications, such as eCall, stolen vehicle tracking and PAYD are still in the early stages of growth. This niche status is due to the lack of a true ROI benefit associated with passenger vehicle telematics unlike commercial vehicle telematics, where ROI benefits are clearly seen.
- Consumers are averse to subscription based systems. Early 2000 saw many vehicle manufacturers such as Ford and Renault offering telematics services, soon withdrawn due to low uptake rates. Fiat also recently terminated its bConnect telematics services in Germany, France and Spain due to low renewal rates. Such aversion is likely to be a restraint for eCall systems in the medium term before regulation makes it mandatory.

10.15 Market Demand Analysis – Unit Volumes

- The eCall and bCall Systems Market Size Analysis for Europe 2005–2017, is shown in the chart below:

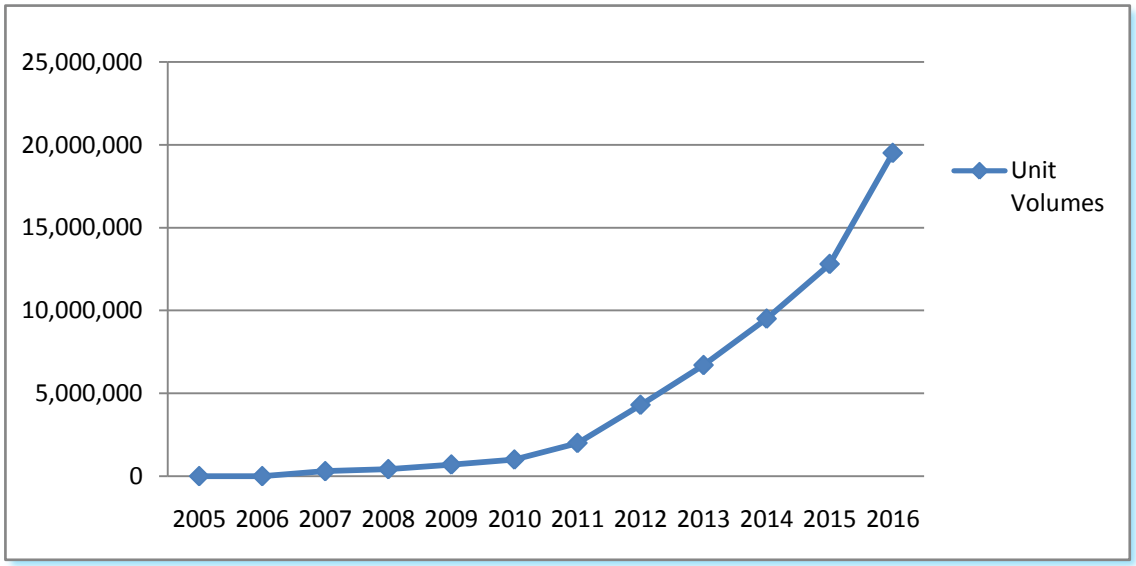



*Figure 10-2 eCall and bCall Systems Market for Europe 2005–2017- unit volumes*

- Frost & Sullivan believes that the market size for eCall systems in 2007 was 420,000 vehicles, the major contributor being PSA group which sold more than 320,000 vehicles in Europe fitted with eCall. Market penetration across Europe will reach 100% for eCall by 2017, when all existing vehicle models will be replaced by new models after type approval post September 2010 or September 2011. This amounts to a CAGR from 2007 to 2017 of 41.8%.

## 10.16 Market Demand Analysis - Revenues

- The eCall and bCall Systems Market Revenues Analysis for Europe 2005–2017, is shown in the chart below:

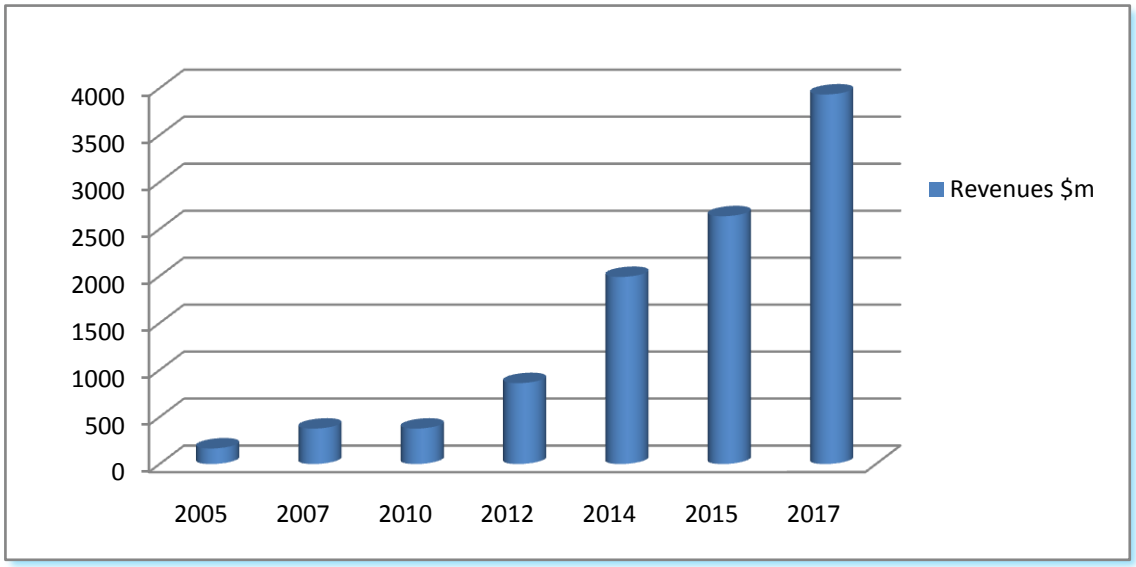



*Figure 10-3 eCall and bCall Systems Market Revenues for Europe 2005–2017*

- It is believed that vehicle manufacturers offering eCall currently work on a unit cost of approximately $600, including the cost of parts outsourced by the VM, those built in-house and the cost of communications (embedded SIM). The retail price is approximately 3x cost. For the future, the cost of making an embedded in-vehicle eCall solution is forecast to be $200-250 by 2017.
- The eCall and bCall Systems Market Unit Cost Analysis for Europe 2005 – 2017, is shown in the chart below:

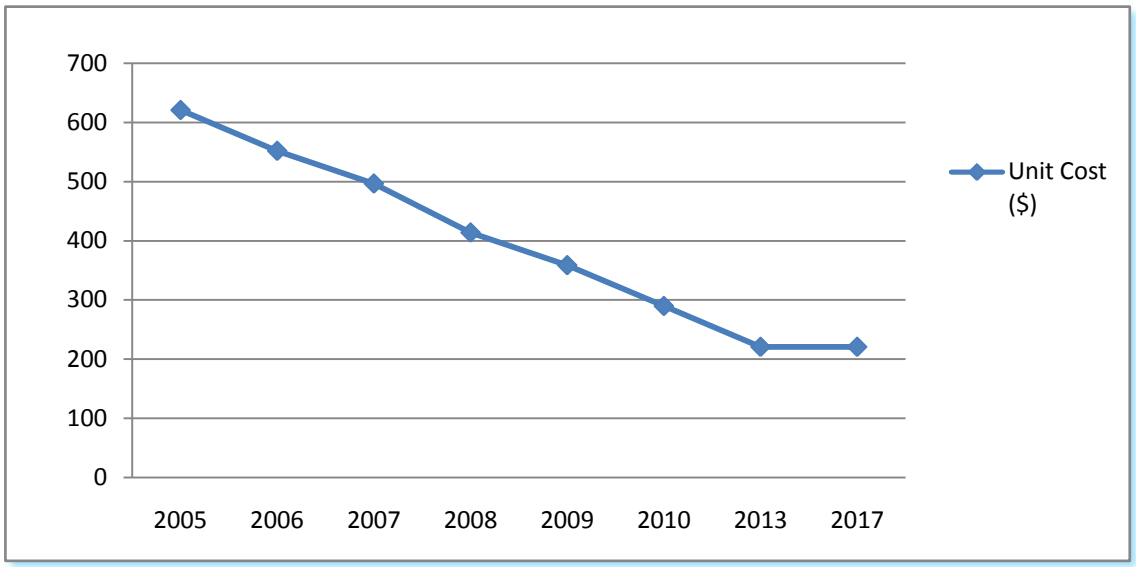



*Figure 10-4 eCall and bCall Systems Market Unit Cost Analysis for Europe 2005 – 2017*

## eCall Industry Structure

10.17 The eCall value chain and industry structure includes the following parties:

- Communication Devices
- Electronic Component Supplier
- Application Software Supplier
- System Integrator
- Vehicle Manufacturer
- Telematics Service Provider
- Telecom Infrastructure
- Wireless Operator
- End Customer

10.18 Key Suppliers

- The eCall and bCall systems market eCall hardware manufacturers positioning for Europe 2007, is shown in the table below:

| Hardware Supplier | Customer | Volumes |
|---|---|---|
| Magnetti Marelli | PSA Peugeot Citroen & Fiat | Very High |
| netsize | PSA Peugeot Citroen | Very High |
| Continental | BMW | Moderate |
| Autoliv | Volvo | Moderate |

- The eCall and bCall systems market service providers positioning for Europe 2007, is shown in the table below:

| eCall Service Provider | Customer | Volumes |
|---|---|---|
| WirelessCar | Volvo | Moderate |
| Inter Mutuelles Assistance | PSA Peugeot Citroen | Very High |
| ATX | BMW | Moderate |

10.19 European eCall Market

- UK: BMW and Volvo offer eCall services. In addition, aftermarket providers, such as TrafficMaster and O2, offer eCall services for many vehicle manufacturers.
- Germany: BMW, Volvo and PSA offer their eCall services. PTV also provides aftermarket eCall service to ADAC (German Automotive Club).
- France: Volvo and PSA offer their eCall services. PSA is leading the eCall market in France with over 400,000 customers to date. Aftermarket companies such as Traquer are trying to enter the eCall aftermarket.
- Spain: PSA and Volvo offer their eCall services. No other activities at present.
- Italy: BMW, PSA and Volvo offer their eCall services. Aftermarket providers, such as OctoTelematics and Cobra, provide aftermarket eCall services to other VMs, such as Volkswagen and Porsche.

10.20 Global Initiatives

| Regions | Service | Services Included | Companies | Customers |
|---|---|---|---|---|
| USA | OnStar | Emergency services; vehicle tracking; diagnostics; breakdown assistance | GM, OnStar | > 4m |
| Europe | BMW Connected Drive | Emergency services; breakdown assistance; vehicle tracking; | BMW, Volvo, PSA Peugeot Citroen | < 0.5m |
| Japan | G-Book, Carwings | Emergency services; audio/video downloads; internet access; real time map updates; dynamic POI | Toyota, Nissan | > 3m |

- There is a much stronger uptake of eCall services in the US and Japanese markets compared to the European Market.

## Stolen Vehicle Tracking - Market Overview

- Stolen Vehicle Tracking System Market Overview for Europe 1990-2015, is shown in the following diagram:

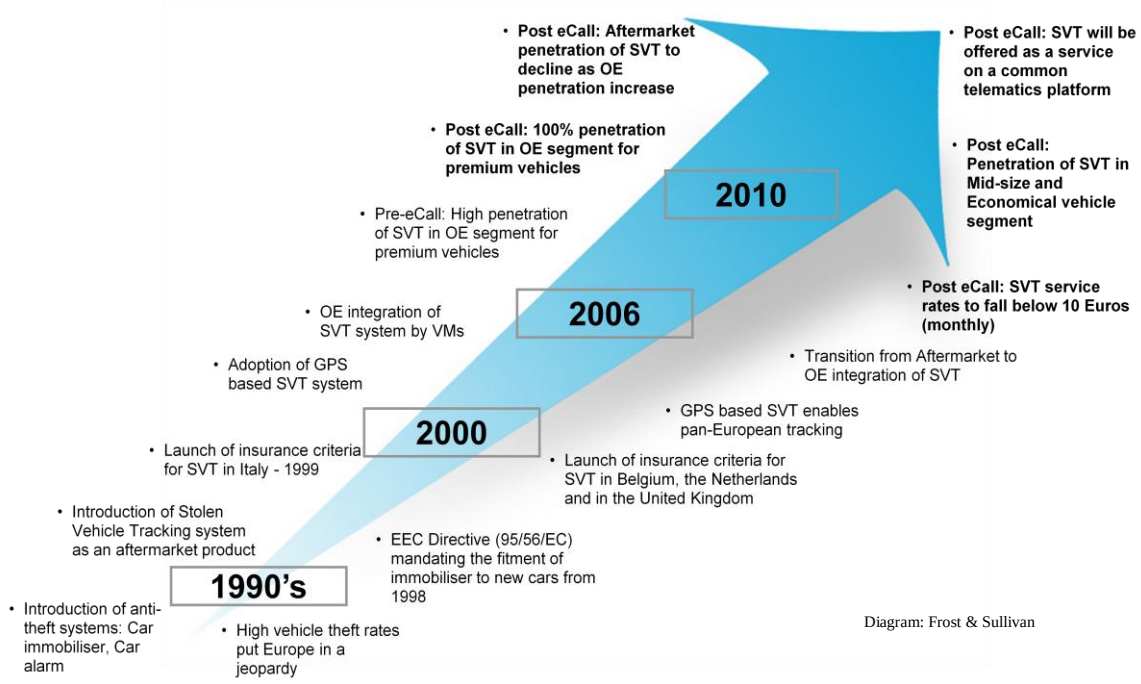



*Figure 10-5 SVT Market - Overview for Europe 1990-2015*

10.21 Stolen Vehicle Tracking Market Trends

- Stolen Vehicle Tracking (SVT) systems are dominant as aftermarket services in Europe, unlike access and security systems, such as immobilizers and Remote Keyless Entry (RKE) which are factory fit features.
- UK and Italy are the largest markets for SVT systems in Europe due to the requirements of insurance companies.

- eCall voluntary agreement is expected to bring SVT as an OEM service packaged with eCall service.
- Cobra, Tracker, Traquer, TrafficMaster are the key companies in the SVT sector in EU.

10.22 SVT Technology trends: the chart below shows the technology roadmap for Europe 2007-2015

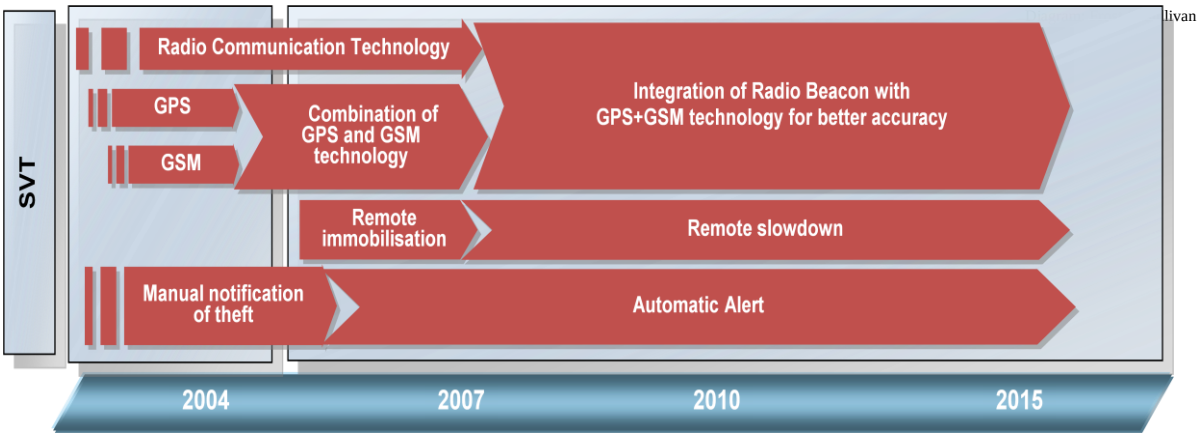



*Figure 10-6 Technology roadmap for Europe 2007-2015*

10.23 Regulatory Trends

- Insurance companies in the UK, Italy, Belgium and Netherlands require the fitting of SVT solutions on high end vehicles. For other vehicles insurance discounts are offered to customers who fit SVT, the basic concept being to minimize the risk of vehicle theft.
- The European Standardisation Committee has created a work group (WG14) to draw European standards for after-theft systems. Once this is finalised, some form of voluntary or mandatory agreement can be expected for SVT.
- The testing and approval of the security devices is undertaken by non-profit institutions on behalf of the insurance companies within each country. The Motor Insurance Repair centre, at Thatcham in the UK tests and approves vehicle security systems on behalf of UK insurers. Thatcham defines systems under different categories ranging from alarm and immobilisers to after-theft vehicle tracking systems.
- Similarly in Belgium, the Car Intruder Systems (CIS) department of ANPI laboratories performs tests on electronic and mechanical anti-theft systems, according to the requirements of Assuralia. In the Netherlands SCM carries the testing and approval of security systems.
- Mandatory insurance requirements by country are shown in the table below:

| Country | Insurance Requirement | | |
|---|---|---|---|
| | Alarm | Immobiliser | SVT |
| UK | Y | Y | Y |
| France | Y | Y | Y |
| Italy | Y | Y | Y |
| Spain | | | Y |
| Germany | | Y | |
| Belgium | Y | Y | Y |
| The Netherlands | Y | Y | Y |

10.24 Existing SVT Products and Services – factory fit

| VM | SVT service | System Supplier | Service Provider | OEM/OES/ Aftermarket installation | SVT system Strategy |
|---|---|---|---|---|---|
| Aston Martin | Aston Martin Watch | Autotxt | Eurowatch | OEM | Offered as standard feature in certain models in UK. |
| Audi | Vehicle Tracking | cobra | cobra | OES/ Aftermarket | Currently offered as OES aftermarket system with local agreements at dealer level.<br>Recently signed a pan-European agreement with Cobra for developing telematics unit for various telematics services including SVT. |
| Bentley | GPS Tracking | cobra | cobra | OEM | SVT system is integrated at the factory level. Offered as standard feature in certain models in UK. |
| BMW | BMW Tracking<br>(only Italy) | MFFA system | Traffic-Master OCTO | OES/ Aftermarket | BMW has local agreement in each country for SVT. (For example, the agreement with TrafficMaster in UK is valid for next 3 years.) BMW, Munich has approved Metasystem as supplier in Italy, Spain, and Germany. |
| Ferrari | Ferrari Tracking | cobra | cobra | OEM | SVT system is integrated at the factory level. The tracking service is activated by registering online after customer request. |
| Fiat | Fiat Blue&Me Nav | Magnet Marelli | OCTO | OEM | SVT is offered as an optional telematics service. Currently offered in Fiat Bravo and Fiat 500 in Italy. |
| Jaguar | Jaguar Watch | Autotxt | Eurowatch | OES | Pan-European Agreement with Autotxt and Eurowatch. SVT system is integrated at the dealer end. |

10.25 Existing Products and Services - aftermarket

| VM | SVT service | System Supplier | Service Provider | OEM/OES/ Aftermarket installation | SVT system Strategy |
|---|---|---|---|---|---|
| Land Rover | Land Rover Watch | Autotxt | Eurowatch | OES | Pan-European Agreement with Auto-txt and Eurowatch. SVT system is integrated at the dealer end. |
| Maserati | Vehicle Tracking | cobra | cobra | OES | Pan-European Agreement with Cobra. Activated at the dealer end |
| Mitsu-bishi | Vehicle Tracking | Traffic-Master | Traffic-Master | Aftermarket | Offered as aftermarket fitment in certain countries through regional agreement. Trafficmaster provides SVT system in UK. |
| Porsche | Vehicle Tracking | cobra | cobra | OEM/OES | Pan-European Agreement with Cobra. The vehicle is pre-wired and the SVT is integrated at the car importer level before reaching the dealer. SVT subscription is activated after selling the vehicle to the customer. |
| Volvo | Volvo On-Call | Autoliv | Wireless Car Mondial Assistance | OEM | SVT is offered as an optional service on their existing eCall system. Wireless Car offers the IT infrastructure. Mondial Assistance provides the tracking service. |

## SVT Market Drivers and Restraints

10.26 Market Drivers

- Strict insurance requirements and discounts on insurance premiums in countries such as the UK, Italy, Belgium and the Netherlands, have been the prime driver enforcing the installation of SVT system in high value passenger cars. The impact of the insurance requirements is expected to disappear once VMs start to integrate SVT as a factory fit option.
- The trend towards integrating SVT services with telematic systems for eCall purposes, currently offered by a few participants such as Volvo, Aston Martin, will be followed by other vehicle manufactures.
- The fear of car theft and the carjacking have made car owners aware of the need for advanced security systems. The possibility of tracking the stolen vehicle and the proven recovery rate of 90% has increased the confidence of vehicle owners in SVT.

10.27 Market Restraints

- The high cost of SVT systems hinders penetration into low-end and mid-size passenger cars. However, this restraint will diminish in significance as the system cost goes down once the volumes pickup after the eCall voluntary agreement is implemented.
- Currently offered as an optional fitment and integrated in the vehicle at the request of the customer, the SVT system remains as a cost incurred with no benefit for the VMs.

- The integration cost of SVT systems is high since it requires thorough knowledge of existing OE systems. Local technical assistance for installation and integration of SVT with existing systems has been poor. The installation and integration of systems are normally done in approved installation centres, which tend to be costly.
- Due to the high system cost, high integration cost and low customer awareness, the uptake rates for SVT have been low.
- Integration of SVT at the OE level will bring down the aftermarket demand.

10.28 SVT Market Demand

- The Stolen Vehicle Tracking System Market total unit shipment of SVT systems for Europe 2006-2015, is shown in the chart below:

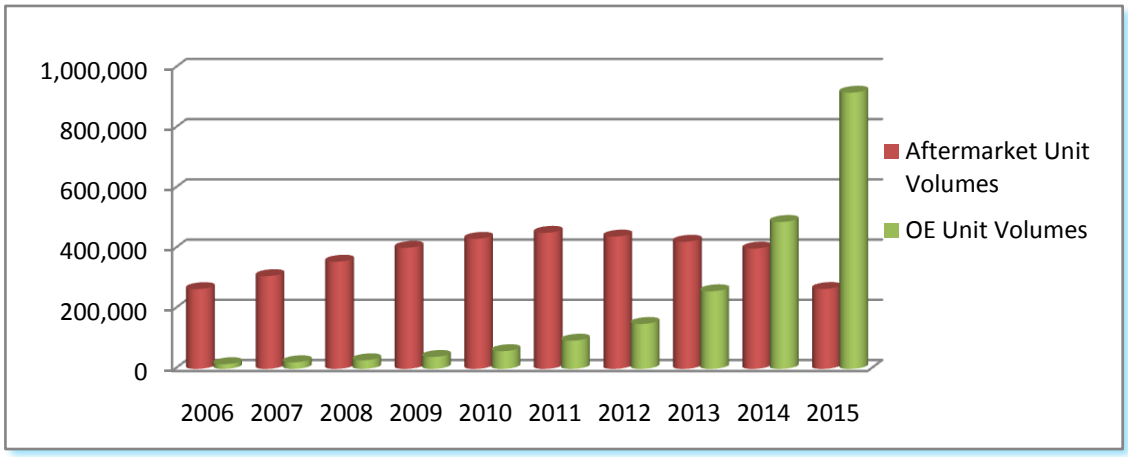



*Figure 10-7 SVT Market - Total unit shipments SVT systems Europe 2006-2015*

- Frost & Sullivan believes that the unit volume SVT shipments in the OE segment will grow at CAGR of 59.3% from 22,000 units in 2007 to 917,000 units in 2015. In contrast, the unit shipment of aftermarket SVT systems will decline at a CAGR of 1.8% from 308,000 units in 2007 to 265,000 units by 2015.

## SVT Industry Structure

10.29 The SVT value chain and industry structure is shown in the following diagram:

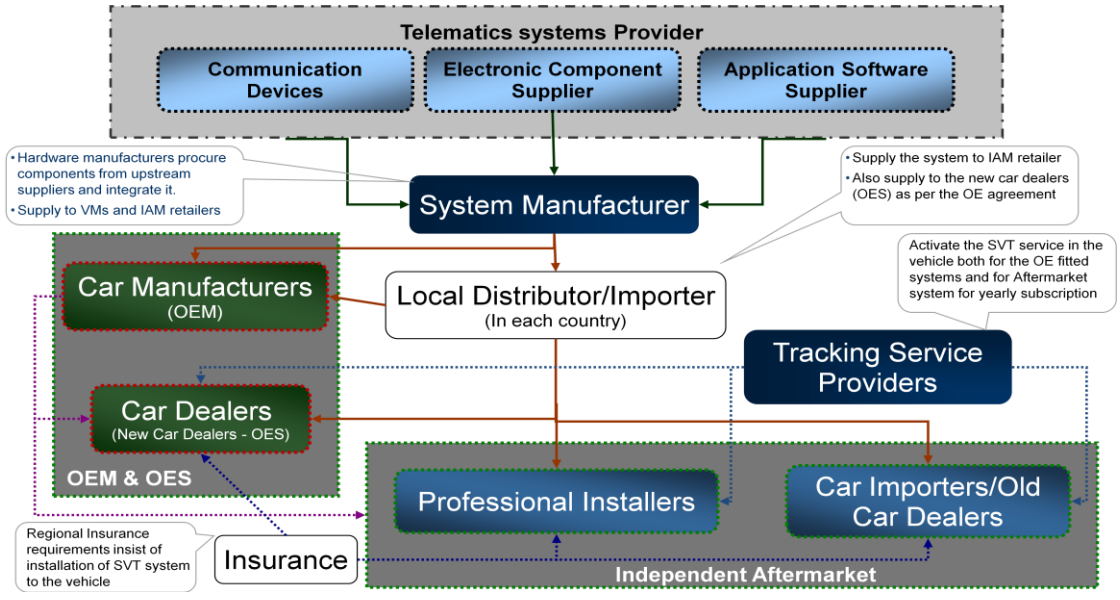



Diagram: Frost & Sullivan

*Figure 10-8 SVT value chain and industry structure*

10.30 Key SVT Suppliers – Aftermarket, and European Market Shares

- Tracker Network (UK) Limited (Tracker): 33%. One of the earliest companies in Europe to enter into the SVT market using VHF radio technology in the early 1990's. Tracker dominates the UK aftermarket for SVT system with about 72% market share in 2007.
- Cobra Automotive Technologies (Cobra): 24%. The recent acquisition of NavTrak in UK, Identisat in France, LIS in Spain has made Cobra the second largest SVT system provider in Europe. Cobra is also one of the leading suppliers of anti-theft vehicle security systems.
- Groupe Traqueur (Traqueur): 6%. Like Tracker, Traqueur in France is also a license of Lo Jack for VHF radio technology. Traqueur is a leading provider of SVT system in France.
- ViaSat: 6%. One of the leading SVT system providers in Italy and Belgium.
- MetaSystem SpA (MetaSystem): 7%. Set up a dedicated telematics service provider called Octotelematics. MetaSystem is also a traditional vehicle security system manufacturer.
- Others: 24%. Comprises regional participants like TrafficMaster, Detector, SecurySar, Lo Jack, Punch Telematics, Omni Bridge, FYCO, AVL, Eureca, Technocon, C-Sat and more.

10.31 Key SVT Suppliers - OE Market, and European Market Shares

- Cobra Automotive Technologies (Cobra): 69% Supplies SVT systems in the OE segment to Porsche, Bentley and Ferrari for integration on the assembly line. The recent acquisition of NavTrak has made Cobra the supplier for Bentley and Ferrari.
- Auto-txt: 16% Supplies SVT systems in the OE segment to Aston Martin, Jaguar and Land Rover. Eurowatch Central is the tracking service provider for these VMs. SVT is integrated on the assembly line for Aston Martin and is standard fit for some countries like the UK. SVT is offered as an OES (dealer fitment) system for Jaguar and Land Rover. The system is offered under a pan-European agreement between the VMs and Auto-txt.
- Autoliv 15% Supplies the telematics unit for Volvo On Call as used for eCall purposes and the same unit is used for SVT. Wireless Car provides the IT infrastructure for tracking, with Mondial Assistance as the SOC partner for Volvo On Call.

10.32 European SVT Market

- UK: 2007 volumes: 143,776 (AM), 16,696 (OE); 2015 volumes: 142,300 (AM), 247,475 (OE) Strict insurance requirements translates to high demand for SVT
- Germany: 2007 volumes: 4943(AM), 264 (OE); 2015 volumes: 357(AM), 159,072 (AM) No major insurance push to install SVT
- France: 2007 volumes: 36,564(AM), 238(OE); 2015 volumes: 33,086(AM), 79,246 (OE) eCall voluntary agreement is expected to push SVT into OE Segment in France
- Spain: 2007 volumes: 8164 (AM), 150(OE); 2015 volumes: 5308 (AM), 86,695(OE) Market growth again is largely dependent on eCall voluntary agreement
- Italy: 2007 volumes: 90,486 (AM), 3799 (OE); 2015 volumes: 75,799(AM), 144,185(OE) High aftermarket demand because of strict insurance requirements

## Incident Management

10.33 Market Overview

- The Incident Management process has 7 key stages with ***4 application areas*** for ITSS:
  - ***Incident Detection***
  - ***Incident Verification***
  - Response
  - ***Communication to Motorists***
  - Site Management

- ***Traffic Management***
- Site Clearance

- A traffic incident refers to any event that can degrade safety and/or slow traffic including disabled vehicles, collisions, maintenance activities, adverse weather conditions and debris on the roadway. A traffic incident creates an unplanned event creating a temporary reduction in roadway capacity that in turn impedes the normal flow of traffic.
- Incident Management is a systematic, planned and coordinated use of human, institutional, mechanical and technical resources to reduce the impact and duration of incidents and improve the safety of motorists, victims and incident responders. Incident management also increases operating efficiency, safety and mobility of the highway by reducing time to detect and verify an incident occurrence, implementing appropriate response and safely clearing the incident.
- In Europe, it was reported in 2005 that 20-30% of all accidents on motorways were caused by preceding (primary) incidents and that more than 50% of these secondary incidents occurred within 10 minutes of the first incident. This suggests that the time to detect and verify an incident is the crucial factor for an incident management system.

10.34 Market Trends - Primary aim is to reduce response times:

- Real time detection of incidents and decrease of time required to validate incidents. Implementation of advanced technologies for data acquisition and analysis
- Shorter incident response time, by improving information dissemination to emergency services and recovery vehicles
- Integration of rapid and accurate travel information – collected and disseminated to vehicles to improve traffic flow following an incident
- Increased road safety to reduce secondary incidents in and around primary site
- Emission reduction through lower congestion and decreased travel times
- Use of existing floating car data – via mobile phones or using vehicles as probes
- Over 70% of incidents are proactively spotted by on-road or CCTV. This increases safety and improves customer service, as there is less chance of secondary incidents occurring
- In the West Midlands 90% of incidents are reached within 15 mins (target 75%). 83% are cleared within 30 minutes (target 75%)

10.35 Key Incident Management Technology Trends

- The use of vehicles on the road as probes to identify congestion problems
- Automatic Vehicle Location – tracking with GPS and mobile communications
- Variable Messaging Signs (VMS) to communicate to road users who may be affected
- Use of CCTV and video streaming to monitor congestion and incidents
- Detector technology, including inductive loops, infra-red, microwave and ultrasonic
- Reports from the public or bus/coach operators and monitoring of emergency services
- The key growth area is in detection of incidents via AVL (using GPS and GSM communication) and vehicle probes
- ITIS Holdings in the UK utilise GPS units tracking buses, heavy vehicles and some premium car fleets which act as probes across the inter-city network
- A system of video detection exists in the UK using cameras on high poles (called Immediate Detection of Stopped Vehicles) which immediately detects a stopped vehicle and then takes about 30 seconds to raise an alarm

10.36 Incident Detection and Verification Technologies

- A current trial system on the M4 (J4-10) uses inductive loop data gathered from the road to detect anomalies in traffic flow arising from an incident. The system then selects an appropriate camera to display an image of the incident, thus speeding up the incident detection process and simplifying operator interaction with the CCTV system.
- Vehicle probe technology is emerging as a means of monitoring traffic without the need for deploying and maintaining additional roadside equipment. The probes measure travel time using data from the vehicle. Reduction in hardware and communication costs and the dramatic rise in fleet tracking devices have driven this technology forward.
- The real time detection of incidents using in-car technologies is becoming a new method for incident detection. The deployment of an airbag triggers a signal that can be transmitted to the authorities to inform them of an incident.

*10.37* Communication to Motorists - Informing Travellers

- The Highways Agency has recently undertaken trials to develop Traffic Radio on a DAB platform as a central point for traffic information over the radio. 5 regional streams will cover the UK and a 5 minute “news loop” will be updated regionally every 10-15 minutes at peak hours and every 20-30 minutes at other times.
- Traffic England brings real time traffic information from the Highways Agency National Traffic Control Centre to computers via a downloadable desktop application.
- Travel and delay times are also provided on VMS across motorways and some A roads in the UK, allowing drivers to make informed decisions during their journeys.

## Incident Management Market Drivers and Restraints

10.38 Market Drivers

- Heightened safety concerns on the road: the UK government places the reduction of traffic incidents as a key priority for future transport improvements. Improved speed of resolving and removing traffic incidents are key drivers for this.
- Advancements in technology and available data through GPS and vehicle probes: due to increased capability of mobile communications, such as mobile phones and GPS systems, road data can be accumulated and filtered to identify traffic incidents in real time. Vehicles can be used as probes identifying delays which could be caused by incidents.
- Traffic information media: the involvement of private sector companies who gather and disseminate traffic condition information from road transport authorities drives the industry forward as this allows motorists to re-route their journey using reliable data. This in turn reduces congestion in and around the incident area.
- Technology flexibility - dual purpose roadside equipment e.g. cameras used for multiple purposes: the flexibility of technology to serve more than one purpose drives the incident management market as it then becomes cost effective to install and use technologies.
- Real time and accurate data: incident management currently uses several technologies to capture and disseminate information to all parties involved in the incident management process. This allows for (almost) real time data acquisition and increases accuracy.

10.39 Market Restraints

- Privacy concerns for using GPS and GPRS information for tracking incidents: there are heightened concerns regarding the use of information collected through personal devices such as mobile phones and GPS systems. Use of this data rapidly speeds up detection and response times, however the public feel uneasy about their journeys being analysed.

- High levels of costs to retro-fit permanent solutions such as induction loops or cameras on the roadside: cost-benefit is difficult to prove and alternative, non-intrusive technologies will be demanded.
- Requirement of quick response times means emergency services must be located close to incident hot spots, however for remote areas this is not feasible from a cost perspective: the restraint to have response teams on 24 hour standby to serve all roads is very costly. Therefore it is necessary to identify hot spots for incidents and focus teams in those areas.
- Inter-agency cooperation: the success of incident management depends on cooperation between involved parties and training to ensure that information is managed efficiently.

10.40 Casualty Statistics

- Number of road deaths in 2006 - top 9 countries

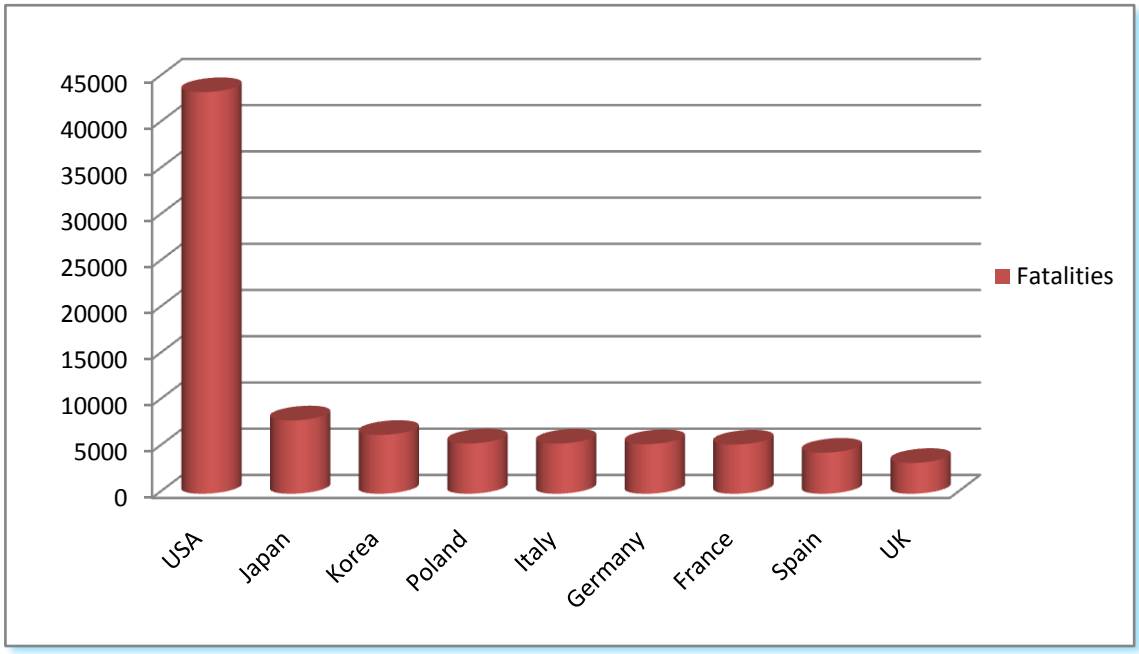



*Figure 10-9 Number of road deaths in 2006 - top 9 countries*

- In the UK in 2007, the number of people killed in road accidents fell by 7% from 3,172 in 2006 to 2,943 in 2007, and 30,720 people were killed or seriously injured, 4% less than in 2006. In total there were 247,780 road casualties in the UK in 2007, 4% less than in 2006.
- Measures have been taken in the UK to improve statistics. In July 2005 the Highways Agency announced a new PSA (Public Service Agreements) aimed at tacking road traffic congestion, focusing on journey reliability and tackling measures used during incidents such as off-network diversion routes, driver location signs and police collision investigation equipment. Benefits have already been realised:
  - Diversion routes being used 23% more than forecast
  - Faster response to incidents by police and traffic officers
  - 18% reduction of average vehicle delay on the 10% worst journeys on the M42
  - 37 minutes reduction on incident clearance
  - Quicker dispatch of incident support units resulting in 20% reduction in response times

10.41 Industry Players in Incident Detection

- Idris Technology - developed an incident detection system which tracks vehicles on a multi-lane road and alerts operators in the event of a stopped vehicle or exceptional incident
- Initial Electronic Security - developed the National Roads Telecommunications Service (NRTS) including CCTV traffic monitoring, message signs and emergency telephones
- Traficon - video detection solutions for traffic data acquisition, automatic incident detection and presence detection
- Citilog – video incident detection with a self-learning algorithm able to report incidents accurately and reliably, able to be integrated into any CCTV system
- Image Sensing Systems – incident detection systems
- Transdyn – a traffic management system that allows clients to clear incidents, disseminate real time traffic information for reducing the impact of accidents, stalled vehicles, adverse weather or congestion
- EIS - develops and manufactures sensor-based electronic systems for traffic management
- Telegra - a range of products including VMS, displays and roadside outstations that integrate amongst other factors automatic incident detection equipment

10.42 Incident Management Global Initiatives

- Singapore is a leading country in ITSS, with four main subsystems in their Expressway Monitoring and Advisory System (EMAS) – detection, surveillance, information and traffic control.
- The USA leads the advancement of traffic incident response along with the UK. As a result of 9/11, greater funding has become available for larger integrated multi-agency incident management systems. The objective is to integrate public safety, transportation, public works operations and maintenance facilities with on-scene emergency response vehicles.
- Also in the USA projects include vehicle probes installed on buses to monitor incidents. In 2007 Pennsylvania DOT unveiled its US$350,000 incident command centre.
- Saudi Arabia is planning to spend $130m over the next 2 years on Telvent traffic management systems which include automatic incident detection.
- Australia's incident management systems have resulted from measures taken to manage incidents during the Sydney 2000 Olympic Games.

## Vehicle Identification and Enforcement – CCTV and ANPR

10.43 CCTV and ANPR Market Overview

- In the UK, the use of Automated Vehicle Identification (AVI) has been in place for many years, and it has been a successful tool for Vehicle Identification. The leading technology is the use of Automatic Number Plate Recognition (ANPR) coupled with Closed Circuit TV (CCTV) to obtain number plate images which are then interpreted using optical character recognition technology. This data is then matched with internal police databases to identify the vehicle and owner.
- Current uses of ANPR include:
    - London and Stockholm Congestion Charging Scheme
    - Road Tolling for free flow lanes
    - Traffic activity and offences e.g. red light cameras, speed cameras
    - Advanced Parking Systems
    - Petrol Stations
- ANPR was invented in 1976 at the Police Scientific Development Branch (PSDB) of the UK Home Office. Prototype systems were working by 1979 and contracts were let to produce

industrial systems, first at EMI Electronics then at Computer Recognition Systems (CRS) in Wokingham, UK. Early trial systems were deployed on the A1 road and at the Dartford Tunnel. The first arrest due to a detected stolen car was made in 1981.

10.44 CCTV and ANPR Market Trends

- Continued strong uptake of CCTV and ANPR throughout the UK with other regions following the example of the UK, US and Canada.
- In recent years the application of ANPR has had much success, and continued widespread application is expected in car parks and public places.
- Revenues from enforcement to governments remain a political issue, unlikely to reduce in the future with citizen's awareness of such schemes.
- Increased capabilities of software character recognition – e.g. to identify foreign vehicles.
- Increased competition in camera and software suppliers due to strong global uptake rates and the linking in of CCTV and ANPR into full scale advanced traffic management systems.
- The number of CCTV and ANPR cameras in the UK is not readily available for this study as each county in the UK manages their own geographical area, but it was found in the USA that the CCTV surveillance market in 2005 was $9.3bn dollars and this is expected to grow to $21bn by 2010.
- ANPR technology is expected to have a 20% growth rate in Europe until 2015.

10.45 CCTV and ANPR Key Technology Trends

- Most advances in technology will revolve around ANPR. CCTV will be focused on image resolution and connectivity
- For some applications, DSRC tag based technology is likely to replace ANPR in the future – however ANPR will be used as a back up or enforcement system for non-tag users
- CCTV with semi-automated movement to track movement of objects or zoom in
- Wireless connectivity of CCTV images to the monitoring station
- The ANPR cameras with the ability to read multiple number plates in a single field of view are found to be effective in speeding up operations
- "Intelligent" ANPR cameras capable of working in extreme environmental conditions and sending vehicle number plate results through GSM/GPRS
- Improvements in CCTV Image quality – e.g. distortion free wide-angled camera lens

10.46 CCTV and ANPR Regulation and Standards

- Legal frameworks vary from country to country and there is no global code of practice regarding private sector use of ANPR
- In the UK the legal regulation and standards revolve around three elements for vehicle identification and enforcement:
    - DFT / DVLA - statutory requirements that vehicles bear number plates and that they are not obscured or altered
    - Data Protection Act 1998 – Mandates authorisation or restriction on the use of image and of associated data
    - Highways Agency / Private Operator - Authorisation of photography for law enforcement purposes or as a condition of entry to a facility
- The authorisation or restriction on the use of images and of associated data causes the most discussion and objection; however the 1998 Data Protection Act seeks to protect citizens. It should be noted that legal challenges in the UK have centred on arguments that official use of ANPR involves requiring individuals to identify themselves as drivers, something that represents self-incrimination and violates the right to silence under the *Human Rights Act*

## CCTV and ANPR Market Drivers and Restraints

10.47 CCTV and ANPR Market Drivers

- Automated means of Vehicle Identification - reduction of overhead costs: in the UK the automated process to identify vehicles significantly reduces overhead costs such as staffing and manual checking of the vehicle database of the DVLA.
- Multiple uses of output from the system are cost-effective: CCTV and ANPR can have many uses thus providing cost effective means for all parties involved. E.g. the police service can use the system for investigating incidents; authorities can use the system for traffic management and identifying incidents and congestion etc.
- Upgradeability of the ANPR system is not intrusive as it is software based and can be performed remotely.
- Public acceptance of the technology: generally both CCTV and ANPR technologies have existed for some years and are accepted by the public. CCTV is widespread e.g. in shopping centres and streets, and benefits have been seen through high profile police investigations using CCTV images.

10.48 CCTV and ANPR Market Restraints

- Privacy concerns about tracking citizen's movements: Privacy concerns about being tracked by CCTV and ANPR cameras are high in the UK as reported in the press and media. High profile plans to install cameras in housing estates also raise privacy issues. Regulations, such as the Data Protection Act, are in place to address these concerns.
- Misidentification and high error rates - need for human intervention to double proof image with the registered database. There are error rates with ANPR systems, but these are improving with better software; however there have been cases of citizens being arrested in error for serious crimes based on their number plate being identified incorrectly.
- Image resolution, obscuring objects and circumvention techniques for CCTV. CCTV is only viable if it has an unobscured view of its surroundings. Low image resolution due to adverse weather conditions, partial obscuring of the camera image, and circumvention techniques can make the system unreliable. For ANPR, unclean number plates and different fonts make it difficult for the character recognition software to work consistently.
- When compared with alternative vehicle identification methods such as tag and beacon, for some applications, CCTV and ANPR are more costly. However, it is expected that ANPR will continue to be used as a system for non-tag holders and as a cross-check of information.

10.49 CCTV and ANPR Key Suppliers

- Applied Traffic - One of the UK's leading traffic monitoring companies – high speed weigh-in-motion with ANPR integration
- Derwent - UK based company specialising in traffic cameras with ANPR technology – REG
- Speed Check Services - SPECS is the only Home Office Type Approved (HOTA) average speed enforcement system using ANPR based technology
- Quercus - Spanish ANPR providers for the UK and USA markets
- Sagem Sécurité - Sagem Défense Sécurité is a high-technology company in the SAFRAN Group who supply ANPR systems
- Appian Technology - Recently awarded two contracts (£410k) with UK police for ANPR technology in the south of England
- CitySync - CitySync provide ANPR technology which is working in airports, ports, congestion charging and at border crossings
- PIPS Technology - Design and manufacture of ANPR and optical character recognition software

- Tattile Traffic Division - Italian company specialising in intelligent cameras with ANPR for security and monitoring systems
- Chubb - One of the largest fire and security organisations in the UK with clients in the public, private, government and military sectors – key provider of CCTV

10.50 CCTV and ANPR Key Global Initiatives

- The UK, Canada and USA lead the market in terms of security and road management
- Widespread use across Europe including the following applications:
  - Airport use: London Heathrow, Amsterdam Schipol
  - Port Users: Eurotunnel, Algeciras in Spain,
  - Northern Ireland, Highways Agency, DfT
  - London and Stockholm Congestion Charging
  - Border crossings – Bulgaria, Turkey and Cyprus,
  - European Space Agency
  - Police, MoD, Vatican City State
  - Lithuania
- China also demonstrating use of ANPR for Vehicle Identification
- Australia and New Zealand have been performing in depth investigation into the viability of ANPR and have recently launched schemes
- South Africa- using Eyetrust ANPR system started in early 2008
- Widespread use across the USA and Canada, known as ALPR (Automatic Licence Plate Recognition)

## Market data trends and growth predictions

10.51 The revenues and growth forecasts in US$million for the Security and Crime Reduction ITSS market are shown in the following two graphs, one for total world and the other for total Europe. The data is derived from taking a view on a proportion of the market values for network management and for automotive telematics.

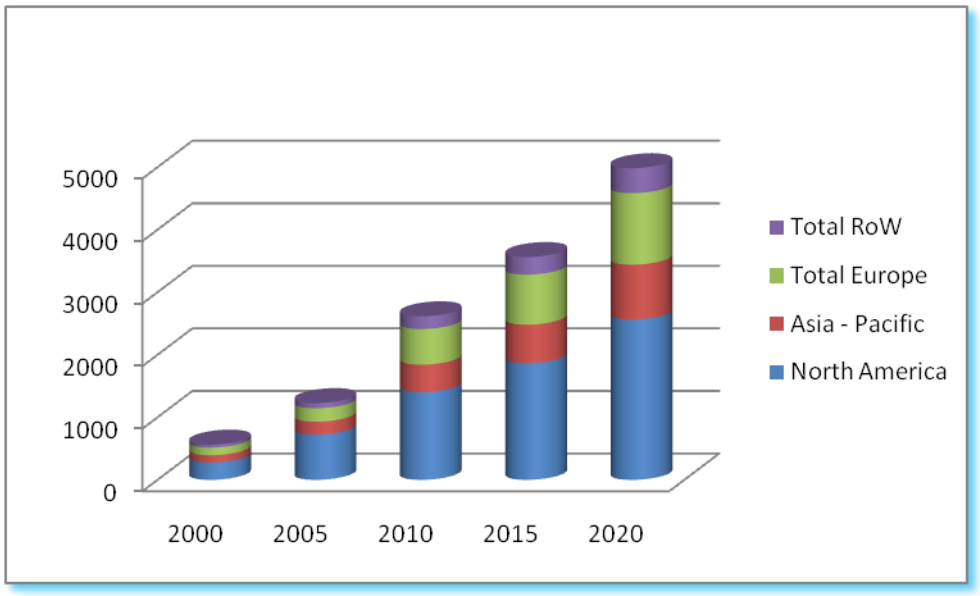



*Figure 10-10 2000-2020 Security, Crime Reduction by World Region: revenues in US$m*

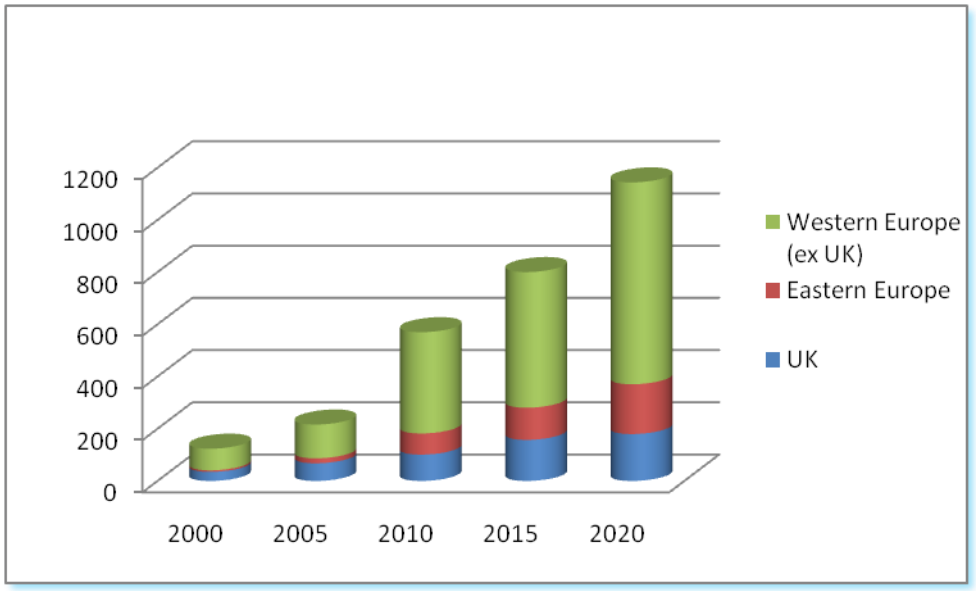



*Figure 10-11 2000-2020 Security, Crime Reduction by Europe Region: revenues in US$m*

10.52 One of the most significant market segments is that of emergency response agencies, such as police, fire, and ambulance services. These agencies have unique and demanding requirements for commercial telematics systems that incorporate many elements. According to ABI, there are over 670,000 public emergency response vehicles in the United States alone, including police cars, ambulances, and fire apparatus. Approximately 75,000 new vehicles are purchased for law enforcement in North America every year, with an estimated market penetration of approximately 12% for GPS-enabled telematics hardware.

## Leading Vendors

10.53 There are many vendors for this ITSS theme, some addressing only one of the identified product areas. By way of example only, the following are some of the key vendors for Enforcement systems:

- **Decatur Electronics** - Speed Display Radar, Speed Guns, Speed Display Trailers and Moving Radar
- **Gatsometer** - Speed Equipment and Traffic Light Cameras
- **IMS** - Digital Traffic Enforcement Cameras
- **OLVIA** - Speed Enforcement Cameras and Traffic Control Systems
- **RADARLUX** - Speed Measurement Cameras with Digital Picture Documentation
- **Redflex Traffic Systems** - Digital Photo Enforcement Technologies
- **RedSpeed International** - Speed Enforcement Systems
- **ROBOT Visual Systems** - Global Expertise in Traffic Safety Solutions
- **Sagem Défense Sécurite** - Radar Speed Measurement, Automatic Red-Light-Running Control and ANPR
- **Sensys Traffic** - Speed and Red Light Enforcement Systems
- **Sodi Scientifica** - Digital Video Laser Speed and Red Light Enforcement Systems
- **Speed Check Services** - Speed Enforcement Systems
- **Tenix Solutions** - Traffic and Parking Enforcement and Technology Outsourcing
- **Truvelo** - Speed Measurement, Traffic Data and Automatic Traffic Enforcement Systems
- **VITRONIC** - Machine Vision Solutions for Traffic Enforcement

# 11 Automotive Telematics

## Market structure and drivers

11.1 A shift in emphasis from the vehicle to the driver and vehicle passengers has seen rapid worldwide growth in information and entertainment (infotainment) systems, all designed to make the driving and travel experience more comfortable and enjoyable. This has led to the introduction of several telematics and infotainment devices, including navigation systems, rear seat entertainment systems and wireless Bluetooth in-vehicle telephony.

11.2 Navigation systems are broadly classified into two categories: fixed navigation and portable navigation systems. Fixed navigation systems are further classified as turn by turn and map based navigation systems. Portable systems are in two main categories: mobile phone based navigation and dedicated navigation systems.

11.3 The emphasis of the ITSS Market Analysis study is on navigation and information rather than entertainment aspects, though frequently these become integrated through the shared use of communications or onboard systems. Where possible the market data in this chapter relates only to the navigation and information aspects, but where integrated information only is available this is used and annotated.

11.4 The automotive telematics and infotainment systems' markets are clearly divided into two types: Original Equipment (OE), where the systems are supplied as part of a vehicle purchase, and Aftermarket (AM), where the systems are supplied as separate purchases.

11.5 The market is driven by several factors including:

- Increasing demand for more infotainment features from consumers
- Enhanced offerings from vehicle manufacturers to differentiate products
- Declining prices generating more consumer demand
- Advent and growth of consumer electronics stimulating growth of automotive electronics
- Improving HMI generating better consumer acceptance

## Market constraints

11.6 Several factors constrain growth of the market, including:

- Limits on consumer spending on telematics and infotainment systems, against the background of rising fuel and other motoring costs
- Initial high cost of systems have delayed rapid market acceptance
- Perceived complexity and ergonomic issues restricting adoption

## Current market in Europe

11.7 The following two graphs show the size of the telematics and information systems market in Europe in 2006. The first shows the number of units sold against each product category and the second graph shows the sales value in US$m. For completeness these two graphs include navigation units, but we have excluded from the study further consideration of Personal Navigation Devices (PND).

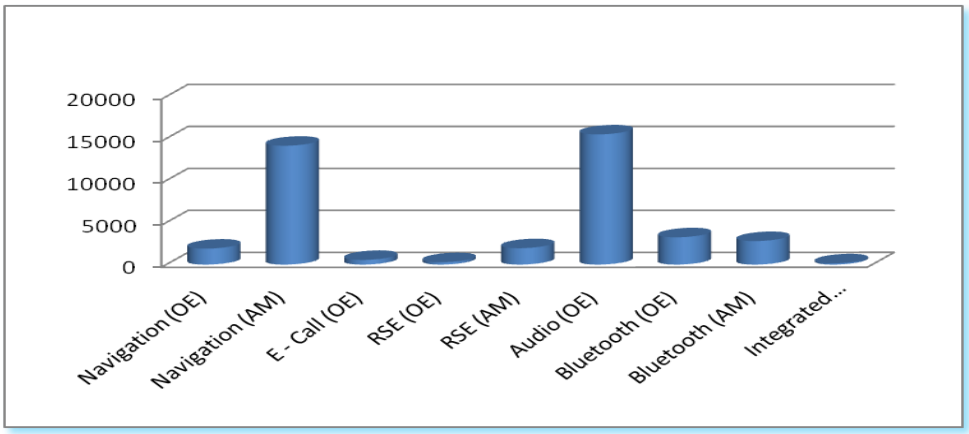



*Figure 11-1 Telematics and Infotainment Systems - Actual Units ('000) sold Europe 2006*

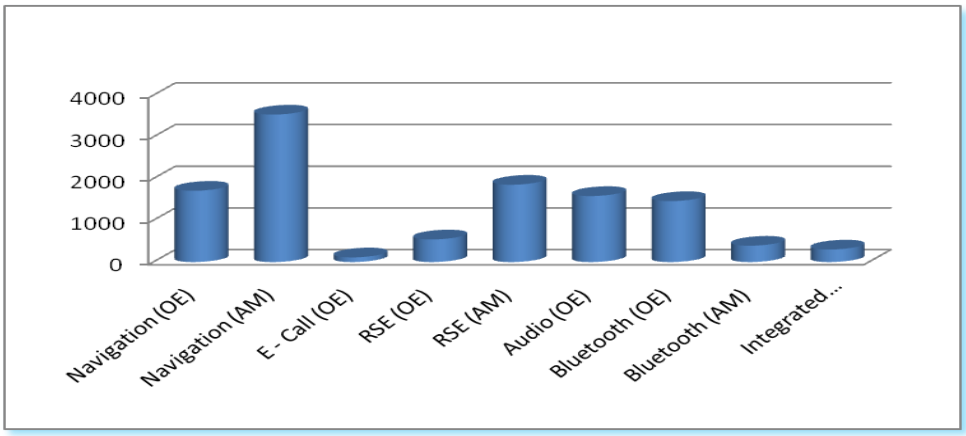



*Figure 11-2 Telematics and Infotainment Systems - Actual Revenue (US$m) Europe 2006*

## Technology trends

11.8 In mapping technology, premium vehicles are expected to shift from 2D to 3D map images. Google Earth, Microsoft and 3DVU are actively promoting 3D imagery. This transition has already started in Japan and Korea. BMW has an arrangement with Google Earth in Europe and North America to use this feature in the BMW Assist Navigation System, already available. Google Earth, Volkswagen and NVIDIA are already collaborating for 3D maps into VWs by 2009. A key trend in the market is the data fusion of 2D mapping data, elevation data and aerial satellite imagery.

11.9 Some major VMs are leading the use of digital map data in navigation systems. Examples include:

- BMW Dynamic Pass Prediction. Developed in conjunction with Navteq, the system uses a pass/no pass logic for road sections which are unsafe for overtaking.
- BMW Adaptive Cruise Control. Developed using digital map data for road condition sensing, including road type and curvature to determine an exact rate of acceleration.
- Toyota Curve Warning and Driving Stability Improvement System. Developed by Toyota jointly with AISIM, the system uses digital map data to sense curvature radius.

- Consumer Electronics is expected to drive the use of WiMAX into the automotive sector. This will happen as WiMAX chipsets drop in price to a more affordable level. For automotive applications WiMAX connectivity will provide telematics and infotainment with content to facilitate vehicle to roadside communication.

11.10 There is expected to be significant growth in the use of 60-80 Gb Hard Disk Drives (HDD), initially in premium vehicles. Already in Japan 27% of car models are available with HDD, whereas across Europe just 2% of cars offer HDD. HDD is used to integrate complex and feature rich multimedia in-car systems, to facilitate 3D imagery navigation and to enable the set up of audio/video databases. Flash memory cards are expected to continue for lower end vehicles.

11.11 There is some movement towards a standardised telematics platform, with three key initiatives: Blue&Me, Sync and VW & Intel. QNX Neutrino is currently the industry leader for operating systems used by proprietary platforms for telematics and infotainment. Fiat and Ford have introduced digital entertainment and telephone platforms with Microsoft. Some VMs are undecided and are divided between the IBM platform (with Linux or QNX) and the Microsoft WMFA platform. Standard platforms are critical to ensure smooth connectivity to CD devices within the vehicle.

11.12 It is anticipated that more than half of the vehicles sold in 2010 will be equipped with Bluetooth, particularly Bluetooth A2DP. This is expected to replace wired connections, with premium vehicles the first to be equipped.

11.13 E-call services in the European market are currently operating at a low level, with examples being BMW Assist, Volvo on call, Fiat Blue&Me nav and some Opal models with the On-star functionality. The smooth implementation of E-call is expected to boost applications like B-call and Remote Vehicle Diagnostics (RVD), which use the same hardware platform.

## Market trends and growth predictions

11.14 Key recent market developments include:

- Development of Pay As You Drive (PAYD) insurance, from Norwich Union. This GPS based system is intended to save up to 30% of insurance costs for drivers driving less than 6000 miles a year. Although Norwich Union aimed for 100,000 customers by the end of 2007, the scheme has now been withdrawn. Elsewhere in Europe, WGV is field testing in Germany with HP and Oracle. System offers customers a choice of rate structure for their premiums based on their driving pattern. Historical data is used to alert the driver on accident warning. System provides a platform for additional services, such as sat nav and traffic information. PAYD has its detractors and there were no bidders at the recent European auction for the key Patent. There are issues too over customer privacy and the risk of legal challenge if companies overrule the Patent.
- There is a trend from onboard embedded navigation to off board services. Onboard embedded navigation suffers from high initial system costs with low market penetration and no successful off board service models in the OE market. Companies in the LBS sector, such as Orange, Vodafone and TomTom, are creating innovative LBS services, with a simple service model and no hardware cost. Off board navigation using mobile phones is becoming an increasing reality and off board services are expected to penetrate 25-30% of the market by 2015.
- Several small new entrants to the LBS market are creating specific applications. Examples include Smart Agent, who has developed a mobile GPS system to assist users in providing information on homes for sale and rent. Jentro has developed Activepilot, providing off board navigation, LBS services and E-call services; the phones also act as sensors to generate traffic flow information through Floating Car Data (FCD) technology. Atlas CT has developed a social networking system entitled reLive, allowing users to take photographs and notes and link them to map locations.

- Remote Vehicle Diagnostics (RVD) using telematics has not been successful and lack the key business case for VMs. Whilst BMW and Volvo have kept their RVD services going, Mercedes Benz Teleaid service was dropped in 2005 due to low uptake.
- Stolen Vehicle Tracking is becoming more important particularly for premium vehicles, e.g. Jaguar and Land Rover currently provide a complete pan European service.

## Global Telematics Markets

11.15 The following charts show the revenues and growth forecasts in US$million for Automotive Telematics and Infotainment Systems and Services, separately and aggregated for both Total World and Total Europe. The charts are followed by comments on regional forecasts.

11.16 Automotive and Infotainment Telematics Systems – Total World

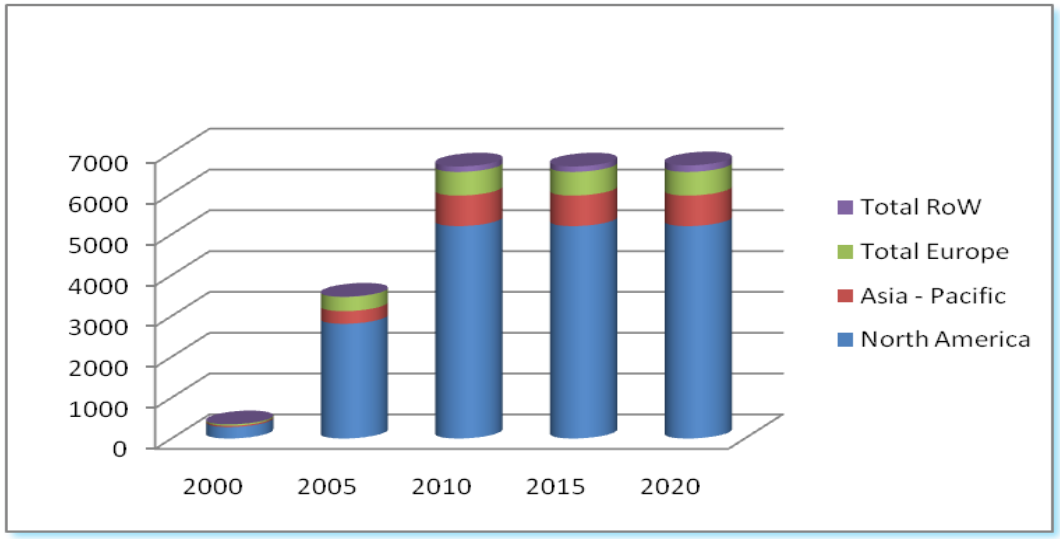



*Figure 11-3 2000-2020 Automotive Telematics Systems by Region: revenues in US$m*

11.17 Automotive and Infotainment Telematics Services – Total World

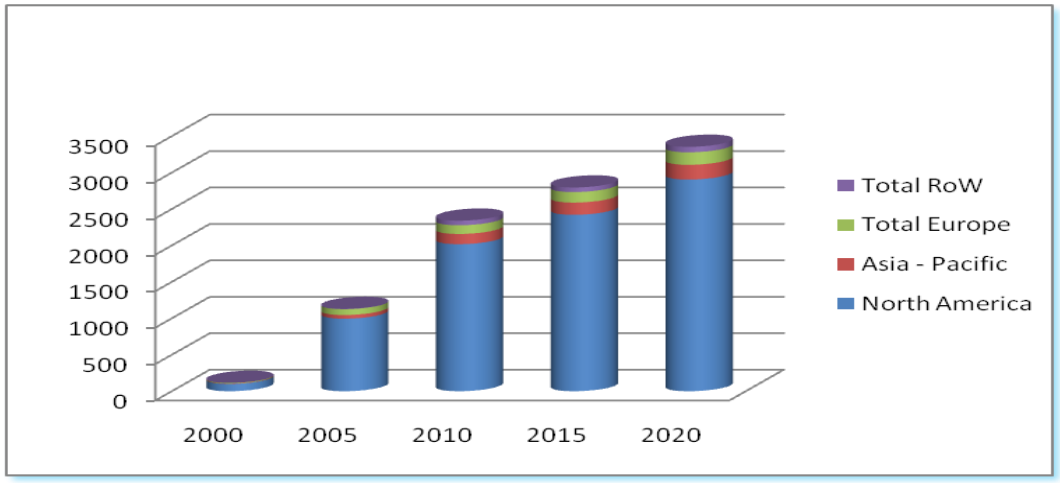



*Figure 11-4 2000-2020 Automotive Telematics Services by Region: revenues in US$m*

11.18 Automotive and Infotainment Telematics Systems and Services – Total World

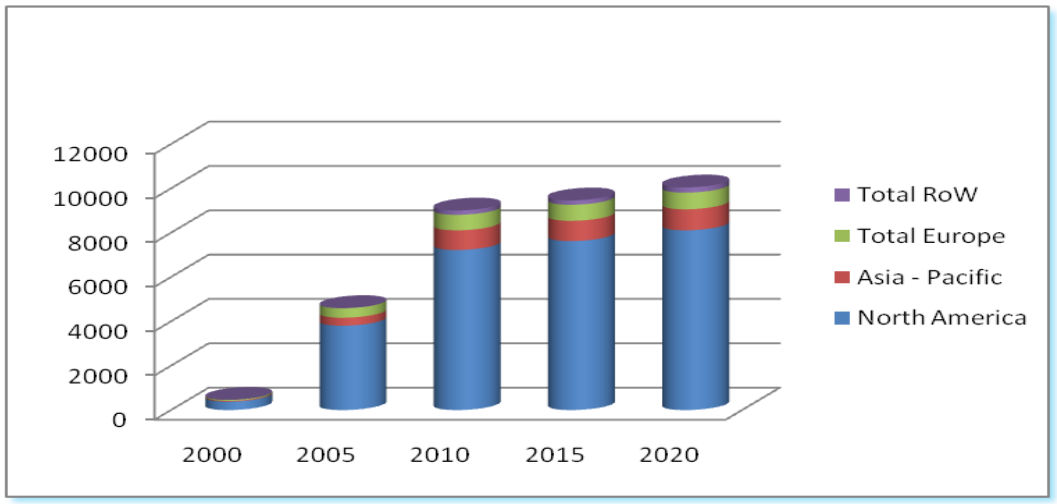



*Figure 11-5 2000-2020 Total Automotive Telematics by Region: revenues in US$m*

11.19 Automotive and Infotainment Telematics Systems – Total Europe

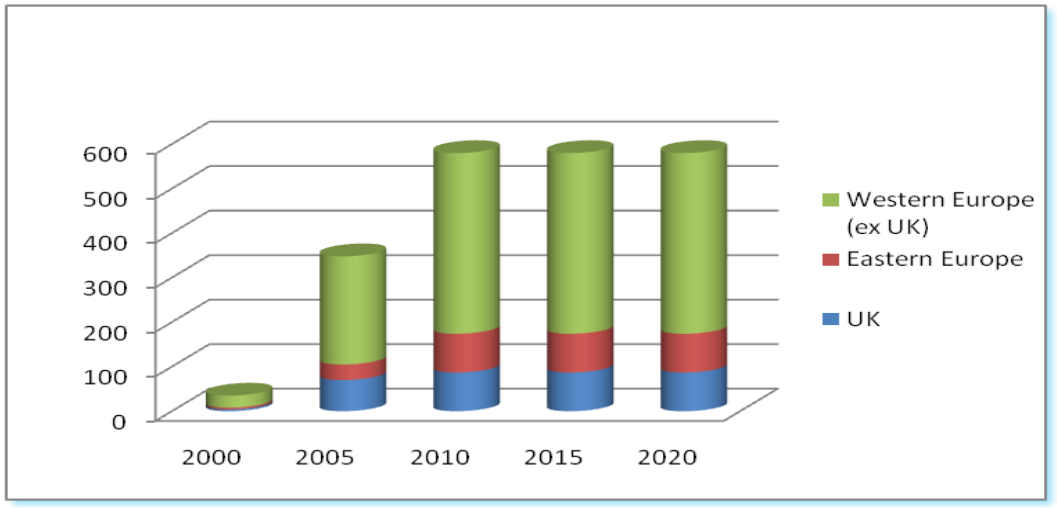



*Figure 11-6 2000-2020 Automotive Telematics Systems: Europe Region revenues US$m*

11.20 Automotive and Infotainment Telematics Services – Total Europe

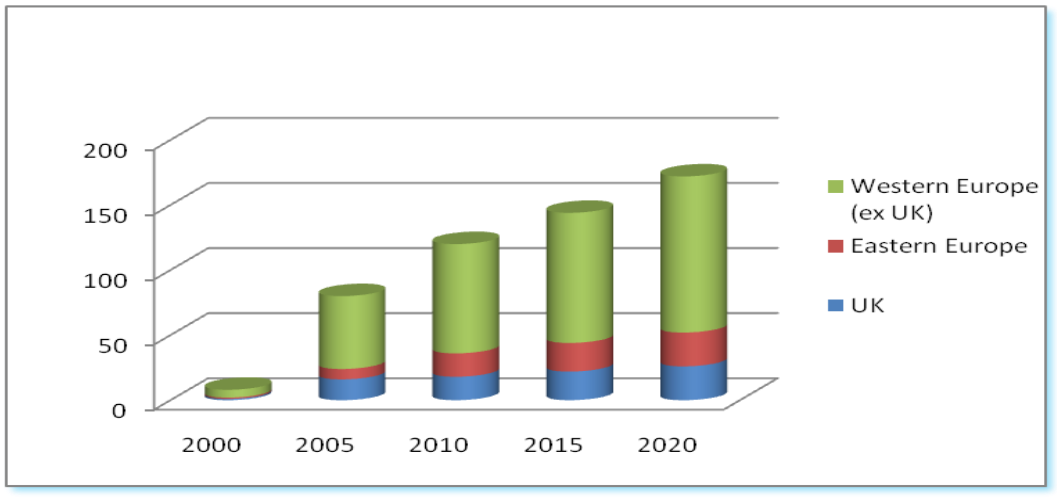



*Figure 11-7 2000-2020 Automotive Telematics Services: Europe Region revenues US$m*

11.21 Automotive and Infotainment Telematics Systems and Services – Total Europe

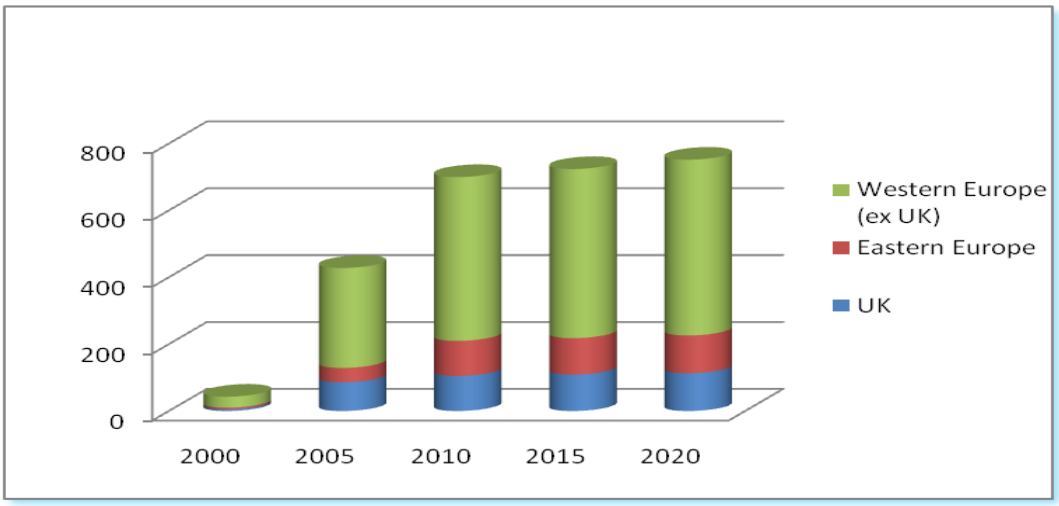



*Figure 11-8 2000-2020 Total Automotive Telematics Europe Region: revenues US$m*

11.22 North American Telematics Market

- North America remains the largest telematics market from both OEM and aftermarket perspectives, generating more than 85% of global market revenue including service and hardware. If not for the sheer volume of new GM OnStar subscribers replacing those who decide not to renew after their first (free) year of service, levels would be much lower. ATX's customers are making an effort to increase their subscriber base by offering free 4-year initial subscription on all models. OnStar's subscriber retention levels have remained steadily since the company stated that it had crossed the 50% mark in 2003. In ABI Research's estimation, current subscriber renew-rates hover above the 50% mark.
- North America enjoys the highest telematics subscription rates of any region. However, that uptake was artificially created by OnStar, which finds itself in a push to maintain subscriber levels by expanding service offering on GM models. OnStar will be factory–equipped on all GM vehicles in North America by the end of the 2007. GM has started to offer a Direction and Connection package, which is a premium service with turn-by-turn off-board navigation as standard to all Buick and Cadillac models and some of the Saab and GMC models. It is estimated nearly 20% of the new vehicles purchased in the region are currently equipped with telematics; this number will increase to 30% by 2012.
- It is also estimated that North American telematics subscribers will reach 10 million by 2012. This will occur, not only as a result of OnStar's continual push, but also from higher volumes from ATX and at least one additional player entering the arena within the next two years, such as Hughes Telematics. Hughes Telematics partnered with DaimlerChrysler to equip telematics solutions in Dodge/Chrysler/Jeep models.
- Under ABI Research's forecasts, recurring annual service revenue will reach more than $2 billion in 2012 from a current level of $1.2 billion. Considering 85% of telematics units shipped in 2006 are from OnStar and 87% of GM models are offered with OnStar already, ABI Research does not expect significant shipment growth during the forecast period. Approximately 5 million units are expected to be shipped in 2012 and more than half of these will be from GM itself. The rest will be Mercedes, BMW, Chrysler/Jeep/Dodge, and at least one Asian OEM telematics offering expected to be unveiled by this time.
- North America is expected to command the lion's share of the global market for some years to come and soon will solve many of the problems currently plaguing it. As all the major US carmakers face mass restructuring, they will turn to telematics to help them in their core business: selling cars. As new, vehicle-centric services take the helm, OEMs stand to realize both the tangible and intangible benefits of telematics to their core business.

- ABI Research does not see long-term prospects for consumer aftermarket telematics in North America. Hovering around 60,000 aftermarket subscribers, the market is not expected to take off beyond security on some very high-end vehicles and a niche market of parents looking to keep tabs on young drivers, though the latter may actually fall to handset LBS-based offerings. The only real growth prospect seen is telematics as a platform for traffic information, where cellular-based high bandwidth data could be more of a selling point. This is more likely to be navigation-centric, and will likely grow out of a connected navigation system, not a telematics-centric system. In the end, this function could be entirely encompassed by high-end connected navigation systems.

11.23 European Telematics Forecasts

- In Europe, systems similar to OnStar have been slower to develop because of the wide availability of substitutes to telematics. European drivers are mostly not interested in e-mail and wireless web connectivity in the vehicle, but rather in accurate navigation data tied in with the latest traffic information.
- Current ABI Research forecasts place the European telematics subscriber base at approximately 600,000, growing to approximately 1.0 million by 2012. Increased adoption is not anticipated in the next few years, and the subscriber base is expected to decrease, as OEMs such as Mercedes, and Audi will discontinue their telematics programmes.
- A resurgence of the OEM telematics market is not expected until 2011/2012, due to Europe's e-Call initiative, and to some extent, the commercial launch of the Galileo constellation.
- Telematics service rollouts are regionally focused due to unique geographical consumer needs, demographics, road infrastructures, and language barriers. For example, BMW, Mercedes Benz, and Audi's telematics services are mostly limited to Germany and Austria, while BMW offers the service in the United Kingdom as well. Most drivers prefer and are accustomed to an onboard navigation system in lieu of operator assistance. In this diverse market, this may be due to a host of reasons including driver autonomy, pride, or language barriers. With over 160 million vehicles in use in the EU, the opportunity is significant. Several VMs are providing telematics services to their customers, including: Audi, BMW, Renault, Citroen, Mercedes Benz, Peugeot, Alfa Romeo, and Volvo.
- ABI Research forecasts only $150 million in service revenue by 2012. This could break the $billion mark, but not until well after then. European consumers have less inclination than their US counterparts to pay monthly fees, especially for services they may deem unnecessary. European wireless subscribers already enjoy an enhanced level of location-based services and real-time traffic information in many areas, making telematics a difficult sell. It will be up to the wireless carriers to push new telematics services, which have yet to prove their true merits alongside already-established services, such as real-time traffic and in-vehicle navigation systems.
- The European OEM telematics market shows some mixed signs. While Volvo's On Call service is expanding its coverage with cross border service in 13 countries, Audi and Mercedes Benz are discontinuing their services after fulfilling their existing subscribers' two year service agreements. Although BMW Telematics showed no sign of decreasing interests from its customers, Audi and Mercedes do not have enough interests from customers to generate sustainable revenue. ABI Research believes that these two major automakers will return to the telematics business and the EU's decision on e-Call should play a major part there.
- Telematics providers want to wait on EU's standardization on e-Call before making any major movement. Nearer to 2012, when e-Call is mandated, significant shipment of telematics hardware is expected. Increasing government legislation such as e-call may spur telematics in this region.
- Specific countries such as Sweden want to implement mandatory, in-vehicle GPS units by 2015 that will warn or command motorists to slow down when they are exceeding the speed limit in specific areas. GPS (or rather GALILEO) satellites will measure vehicle speeds and locations against a national database with built-in speed markers to determine if a motorist is

exceeding the speed limit for that area. DaimlerChrysler plans to employ similar technologies by 2012 that will deactivate a vehicle's cruise control automatically when it enters a school zone or highway exit ramp. Even if future telematics devices are not used to protect against speeding, other justifications would surely be found to make them mandatory, such as GPS-based, road-toll collecting implemented in Germany.

- In the aftermarket, it is expected that growth rates will trail OEM counterparts. Examples are the successful partnerships with the RAC on TrafficMaster's RAC TrackStar; the use of telematics as a navigation platform; and boxes available for cars where drivers bring their own SIM. Yet, the stolen vehicle and tracking market still has much more limited appeal than the PND market, and the number of connected navigation users could easily exceed aftermarket telematics subscribers.
- Several OEMs are importing vehicles into Europe and are fitting aftermarket systems into them at the dealership level. These systems are a standard offering on an increasing number of vehicles and are considered to be an aftermarket implementation. OEM competition to the aftermarket is far less of an issue than it is in North America; the products simply are not offered on as many models, and plans are more limited.
- While some are simple GPS-based tracking systems, others offer more comprehensive services such as remote unlock, server-based navigation, some concierge services and Pay As You Drive insurance. For these reasons, more maintainable shipment levels are expected compared to the North American market.
- An average hardware-cost hovering just above $700 is assumed, decreasing slightly in the coming years. Hardware costs may rise between 2007 and 2009, as addressable hardware capable of receiving GPS and GALILEO signals may begin rollout.

11.24 Asia-Pacific Telematics Forecasts

- With the majority of activity occurring in Japan, South Korea, China, and Australia, the current level of subscribers is just under 1 million. By 2012, more than 3.5 million subscribers are expected. The market is predominantly centred on Japan at the moment, as VMs see telematics as a differentiator rather than a separate offering. Japan will continue to dominate the landscape, but South Korea and China are making a push for greater in-vehicle telematics use and this is reflected in the figures. The market for consumer in-vehicle telematics is still virtually nonexistent in India, but efforts to introduce them in the region should begin later in the decade.
- This translates to service revenue of approximately $213 million by 2012. Service revenue will be lower in the Asia-Pacific region compared to the other regions, partly due to OEM subsidies and comparable services available via the mobile handset. Many current offerings enable users to operate their own handsets for many services, blurring the line between telematics and normal wireless service revenue.
- OEM-targeted shipments of telematics hardware will reach nearly 1.5 million units by the end of 2012 — equalling a market value about $1.3 billion. While subscribers are expected to increase to 22% of the world share, service revenue will amount to only 8% of world service revenue. This low growth is attributable to the unwillingness of consumers to shift from handsets to in-vehicle systems for infotainment services. Telematics subscribers in Japan pay low, if any, fees for service, since they use their own cellular handsets as communications links. Telematics Service Providers in this region do not always require subscription fees for services; they offer basic service free and the user can provide their own data connection through cell phones. While this may contribute to significant data charges for in-vehicle use, this is not dedicated in-vehicle hardware, so is not included in the associated revenues.
- Most products in the Asia-Pacific telematics aftermarket tend to be nationally oriented. The four major nations featuring products at present are Japan, South Korea, Taiwan, and Australia. Japan has a large OEM subscriber base for telematics. However, on the aftermarket side, there are only a few consumer offerings. Australia has two aftermarket telematics providers based on the Intelematics product platform: the company's own CarCom, and a product called TLC

(Tracks, Locates, Communicates) from MotorOne. Both are higher-end offerings with recurring monthly fees that provide both tracking and call-centre-based Mayday services. Korea has three OEM telematics brands: Ssangyong Everway, RenaultSamsung NateDrive, and Mozen for Kia and Hyundai. However the current subscriber base is very small due to a lack of consumer awareness of telematics services. In Korea, navigation devices are much more favoured and well recognized by consumers than telematics systems are. Taiwan has a telematics service called TOBE from Yulon Motor, which is the only TSP in Taiwan. It is offering a new TOBE system as a standard feature on Nissan vehicles.

- Overall, emerging markets in Asia have some of the largest growth potential. However, it is noted that much of this potential is mitigated by the possibility of functions being offered in connected navigation systems and LBS-equipped handsets.

11.25 Rest of World Telematics Markets

- Approximately 2% of new vehicles in the rest of the world will be equipped with telematics by 2012 and it is estimated that there were approximately 40,000 consumer telematics subscribers in this region in 2006. Many new systems have been introduced, hinting at the potential for future growth. Rest of the world telematics subscriber rates are expected to reach over 400,000 by 2012. Growth will be steady, with no real subscriber mass achieved until the latter part of the decade.
- In this region, stolen vehicle tracking is the most demanded feature, but this demand is often met by a number of aftermarket players and specialized security firms. ABI Research is aware of only one OEM operating in Latin America, which commenced operations in 2005: GM's Chevrolet's ChevyStar in Colombia.
- It is expected that service revenue will increase steadily from a 2006 level of $7.7 million to nearly $100 million by 2012. New systems are being introduced throughout the region and though a slower growth curve is foreseen for these regions, as consumers will not immediately perceive the benefits of having such systems in their vehicles, nor be willing to pay for them.
- Because of the small market size, unit shipments are in the thousands. Shipments of telematics hardware are expected to grow from a 2006 level of 20,000 units to 180,000 units by 2012. This translates to hardware values of nearly $130 million. It will take some years to introduce new audiences to telematics, and as a result, the biggest growth is foreseen as occurring beyond 2008.
- No significant volumes from Latin America, the Middle East, or Africa are anticipated over the forecast period. Only 150,000 vehicles with OEM telematics are expected to be shipped in 2012 representing less than 2% of new vehicles in the regions. The majority of these will be in Latin America, from OEM-systems such as Chevy Star, currently offered in Brazil, Ecuador, and Venezuela.
- It is expected that the aftermarket telematics market will increase from roughly 28,000 in 2006 to over 100,000 subscribers in 2012. While higher per-shipment costs are associated with telematics offerings in these areas, subscriber revenue per-user could be potentially lower because there are virtually no premium offerings other than the panic-security feature. However, the cost for a similar function level is higher.

## Summary and Conclusions

11.26 Consumer preferences competitive pressures and legislation will drive this commercial sector of ITSS to create better products with enhanced facilities accompanied by downward pressure on prices. Over the next few years markets in the UK, Europe and globally look set to grow, subject to the impact of the economic slowdown.

# 12 Communications Services

## ITSS Communications Services Market

12.1 By definition there is a communications aspect in every ITS System and Service, including all of the ITSS themes covered in this report. In many ways, “communications” is at the heart of every ITS System and is the glue that holds every ITS System together. For the purposes of the report we have divided the Communications Services Market into two parts, (though clearly there will be communication between them).

12.2 The first part covers infrastructure communications services, including fixed line and fixed wireless services that support ITSS themes such as network management, road safety, travel and traveller information, public transport, security and crime reduction.

12.3 The second part covers mobile communications services, involving wireless communication with a moving vehicle. These services also support the same ITSS themes and, in addition, automotive telematics and freight efficiency. In this context “mobile” has a broader meaning than “cellular phone”. In the study our analysis has focussed on these mobile aspects, rather than fixed links and the latter have been grouped with the relevant ITSS themes.

## Purpose of wireless communication

12.4 The key purposes of wireless communication are:

- **Enhanced safety and security of the vehicle** — Wireless is deployed in safety related applications like collision avoidance in the form of radar, emergency services, vehicle-to-vehicle and vehicle-to-infrastructure communication and others.
- **Personal device connectivity** — There is increasing demand from consumers to use their personal portable devices like the iPod inside the vehicle. Wireless standards like Bluetooth are the key way to interface these devices to the vehicle.
- **Mobile internet access to the vehicle** — Vehicle manufacturers who are looking to provide internet access inside the vehicle in Europe are investigating wireless standards like WiFi and Wimax for this purpose.
- **Remote monitoring and diagnostics —** Remote monitoring and diagnostics applications currently use wired transmission of the error codes in the harsh automotive environment. Vehicle manufacturers are currently investigating the possible usage of wireless technologies and standards for this purpose.

## Wireless technologies

12.5 The key wireless technology types are:

- Bluetooth
- Wimax—Worldwide Interoperability for Microwave Access
- WiFi—Wireless Fidelity
- NFC—Near Field Communications
- Zigbee
- UWB—Ultra Wide Band
- DSRC—Dedicated Short Range Communications

12.6 These technology types, their relevant Standards, data ranges and maximum network speeds are as in the table below.

| Wireless Technology | Wireless Standard | Data Range | Maximum Network Speed |
|---|---|---|---|
| Bluetooth | IEEE 802.15.1 | Effective to 10 meters | 3 Mbps (for Version 2 |
| Wimax | IEEE 802.16d | Effective to 50 km | 70 Mbps |
| Wifi | IEEE 802.11 a/b/g | Effective to 50 meters | 54 Mbps (802.11a)<br>11 Mbps (802.11b)<br>54 Mbps (802.11g) |
| NFC | RFID like Technology | Effective to 0.2 meters | 212 Kbps |
| Zigbee | IEEE 802.15.4 | Effective to 20 meters | 250 Kbps |
| UWB | IEEE 802.15.3a | Effective to 10 meters | 50-100 Mbps |
| DSRC | WLAN type | Effective to 10 meters | 54 Mbps |

12.7 A comparison of the four main technologies is given in the following table, based on their application areas, strengths, weaknesses and potential automotive usage scenarios. The comparison is made only for the four key wireless technologies, namely Bluetooth, WiFi, UWB and Zigbee, since these four are perceived as the most important technologies for the European Automotive industry in terms of their features, benefits and respective application.

| Standard | Bluetooth | WiFi | Zigbee | UWB |
|---|---|---|---|---|
| Main purpose of application | Hands free wireless calling<br>Eliminate wired cable connections | WLAN—mobile internet<br>Connecting vehicle to home | Remote monitoring<br>Sensors based applications | Collision avoidance radar<br>Bluetooth related applications |
| Strengths | Established standard in vehicles today<br>Easy connectivity of mobile devices | Most dominating technology in the WLAN Segment<br>Ideal for Mobile internet services | Low power consumption<br>Smaller data packets | Simple and cheap to build<br>Very low power consumption<br>High bandwidth and broad frequencies |
| Weaknesses | Interference with Wifi<br>Power consumption not ideal | Traditionally consumes very high power<br>Still not proven for automotive requirements | Low Bandwidth offering | Very short data range<br>Interference with other wireless standards |
| Potential Automotive Use | Portable devices connectivity<br>Diagnostics tools and Voice applications | V 2 V (Vehicle to Vehicle communications) using DSRC (derivative of Wifi technology)<br>V 2 I (Vehicle to Infrastructure Communication)- DSRC | In vehicle communications<br>Mobile/static sensor network based applications | Robust inter vehicle communications<br>Communication application that requires high bandwidth |

## Key Automotive Wireless Applications

12.8 Bluetooth is the standardized wireless technology for many applications - Bluetooth currently has a good business case inside the vehicle because of legislation for mandatory hands-free telephony. This has given vehicle manufacturers the opportunity to investigate more upcoming applications for Bluetooth, such as remote vehicle diagnostics and wireless control of rear seat entertainment (RSE) systems replacing the current Infra Red (IR) technology. Thus Bluetooth is irreplaceable for many applications and is expected to remain the key wireless technology at least until 2010. Bluetooth Interface systems or Bluetooth car kits are a fast growing segment that has a varied list of market participants, from traditional automotive companies to mobile phone manufacturers.

12.9 Radio Frequency (RF) is currently the leader for sensor based applications. Automotive sensor based applications like tyre pressure monitoring, remote keyless entry and temperature monitoring use RF technology currently. RF is perceived in the industry as the ideal technology for sensor based applications because of its features, distance of operation and the cost. Zigbee is expected to replace RF technology in the sensor domain in the medium term.

12.10 DSRC is essential for the safety applications - it is currently deployed in Electronic Toll Collection systems. However, the Car 2 Car communication alliance is expected to use DSRC for vehicle to vehicle and vehicle to infrastructure applications which is a key safety initiative.

## GPS enabled Mobile Phones

12.11 Mobile phones are becoming increasingly capable of delivering applications like Navigation, and look set to challenge the rapidly growing market for Personal Navigation Devices (PND). According to a new report just issued by ABI Research, annual sales of GPS-enabled mobile phones are expected to generate over $50 billion in revenues in 2008, rising to $100 billion in 2012. The market for these handsets is expected to grow from around 240 million units in 2008 to over 550 million handset shipments in 2012. At present, most current GPS-enabled handsets are CDMA devices, but increasing numbers of GPS-enabled handsets for 3G/WCDMA networks will start to appear in the market from 2008 onwards.

12.12 ABI Research believe that the consolidation and restructuring of the mobile industry – including Nokia's acquisition of NAVTEQ, Broadcom's acquisition of Global Locate, CSR's acquisition of NordNav Technologies and Cambridge Positioning Systems, and the battle between TomTom and Garmin to acquire Tele Atlas – give a clear indication of the plans and commitment of industry players to address the GPS-enabled handset market.

12.13 From cost and technology perspectives, chipset manufacturers now have solutions in place that will allow the integration of GPS in handsets at low cost and provide significant improvements in terms of accuracy, time-to-first-fix, and reception in indoor environments. On the services side, mobile operators and navigation application developers are coming up with attractive LBS offerings. Also, handset vendors are showing greater interest not only in providing GPS-enabled handsets, but also in introducing their own GPS-centric applications and services.

## ITSS Applications for Mobile Phones

12.14 Overall, the mobile telephone market is rapidly becoming a significant aspect of ITSS and its development is likely to have significant impact on the development and growth of automotive telematics as well as other ITSS markets. Rapid developments in mobile and cellular technology make quantifying the impact a difficult task. In preparation for this report, the Mobile Data Association (MDA) has provided an analysis, as follows, based on the twin themes of Connected Cars/ vehicles (CC) and Connected Roads/infrastructure (CR). These are linked, but CC has more Automotive industry dependencies and CR more Transport Policy related dependencies. The table shows examples of where the wireless industry is likely to make the biggest market impact over the next 2-5 years. The higher number (3) broadly reflects the highest market impact, and (1) the lowest. There are no entries marked (0) as wireless is likely to impact all categories, even if the actual choice of technology and timing may differ.

| Product and service sectors | Impact on ITSS market | | Principal Examples of Applications for 2009-2012: |
|---|---|---|---|
| | CC | CR | |
| Improving road network management | 1 | 3 | • Road Pricing/ Congestion management/toll payments using GPS, and wireless payment mechanisms<br>• intelligent parking and remote payment<br>• CCTV/ ANPR with data return via wireless<br>• Traffic management options using wireless data sensors<br>• Bluetooth uploads and wireless backhaul<br>• Mobile network sensors to assist with congestion management, and prevention |
| Improving road safety | 1 | 1 | • Accident reporting<br>• Connected Car communications architecture into cars / vehicles for accident prevention and reporting<br>• Support to 999/112 and E Call variations |
| Better travel and traveller information | 3 | 2 | • Connection to the web allowing better mapping updates and (real time) accuracy. Also information updates can then be tailored and personalised / localised in a way that broadcast cannot easily handle<br>• Mobile network sensors to assist with provision of information<br>• Speed alerts, weather / traffic conditions, coupled to points of interest, e.g. restaurant / hotel , energy station information<br>• Upload of data from vehicles, e.g. fleet management or personal security related<br>• GPS / Cell ID and Location Based Services to help identity management, including payment and ticket redemption, Licence fee payment and better vehicle identity options<br>• Breakdown and Traffic Information services before, during and after trips, including Multimodal |
| Better public transport on the roads | 1 | 1 | • Mobile ticketing<br>• Remote/intelligent parking services,<br>• Breakdown recovery - alerts and rescue |
| Freight efficiency | 2 | 1 | • GPS / Cell ID and Location Based Services<br>• Fleet Management<br>• Breakdown services<br>• Asset tracking, traceability of goods/ vehicles<br>• Anti theft and immobiliser services<br>• Tracking time of arrival for broader efficiencies and customer care |
| Reducing negative environmental impacts | 1 | 1 | • Sensors, information services and alerts<br>• Cell phones able to assess/ measure carbon footprints<br>• Mobile tachographs to report / include energy usage<br>• GPS / Cell ID and Location Based Services to combine pickups and drops |

| Product and service sectors | Impact on ITSS market | | Principal Examples of Applications for 2009-2012: |
|---|---|---|---|
| | CC | CR | |
| Supporting security, crime reduction and emergency planning measures | 3 | 1 | • Identity management of vehicles / drivers and assets<br>• Immobiliser options and anti theft solutions, with support by the Insurance industry<br>• GPS / Cell ID and Location Based Services are key location identifiers and could replace or supplement licence plates in the future<br>• Identity is key to vehicle excise / road taxation , as well as congestion charge recovery<br>• Identity of sourced information from the vehicle also critical, as it is likely that user-generated content and Cameras from the Vehicle could provide better info upload to a portal |
| Automotive telematics | 2 | 1 | • Informed driver and breakdown services<br>• Integrated information systems<br>• Integration of GPS or cellular, but trend is towards nomadic devices<br>• Cellular with integrated GPS capability should overtake stand alone GPS nomadic devices by the end of 2007. This is potentially creating safety concerns for the longer term unless better integration and HMI issues are addressed |

## Mobile market size - subscriptions

12.15 The following table shows the mobile phone subscriptions for Total World as forecast by the European Information Technology Observatory (EITO) in May 2007.

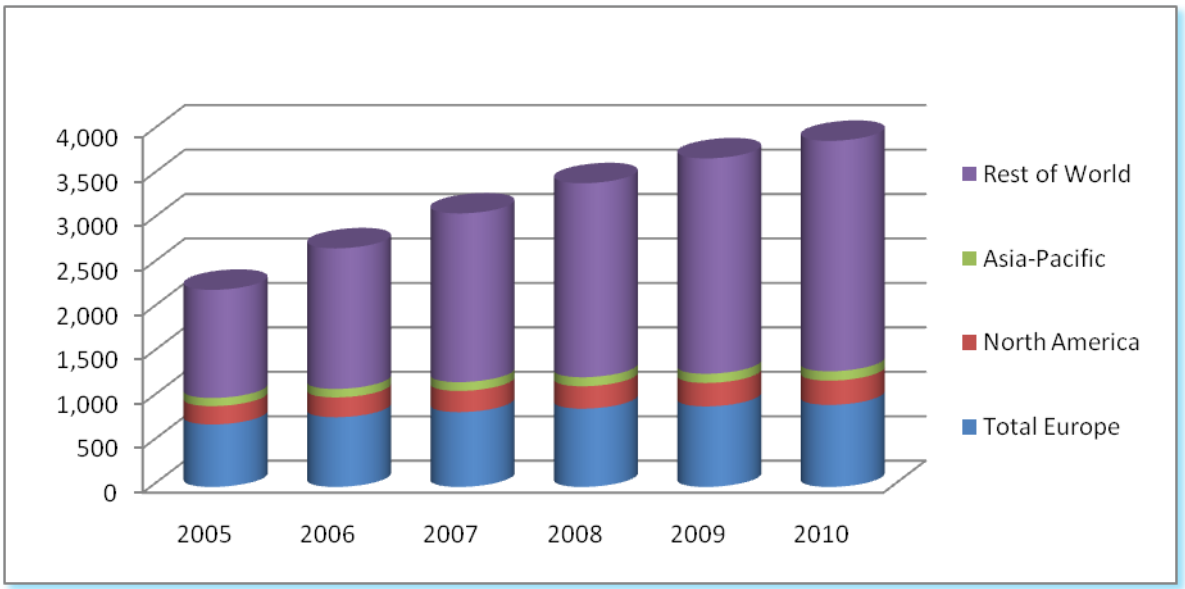



*Figure 12-1 Mobile phone subscriptions for Total World, in millions*

12.16 The following table shows the mobile phone subscriptions for Total Western Europe as forecast by the European Information Technology Observatory (EITO) in May 2007.

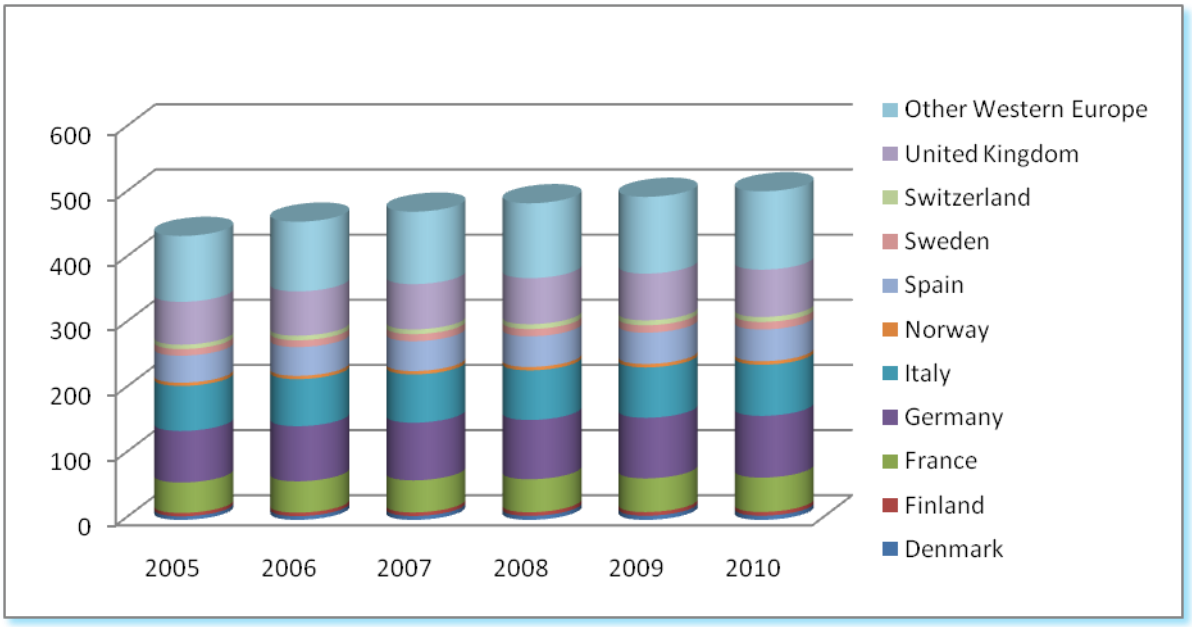



*Figure 12-2 Mobile phone subscriptions for Western Europe, in millions*

## Market trends and growth predictions

12.17 For the purposes of the ITSS Market Study, the market values of the wireless technologies referred to in paragraphs 12.3 and 12.4 above are included in the relevant ITSS theme areas, and no attempt has been made to separate these out.

12.18 For the impact of the mobile market, referred to in paragraphs 12.5, 12.6 and 12.7 above it is difficult to quantify these in financial terms due to uncertainties over the rate of growth and over the proportion of mobile services attributable to ITSS services. For this issue of the report, our estimates should be considered as tentative only and subject to further analysis.

12.19 On this basis, the revenues and growth forecasts in US$million for the ITSS Communications Services mobile market are shown in the following two graphs, one for total world and the other for total Europe.

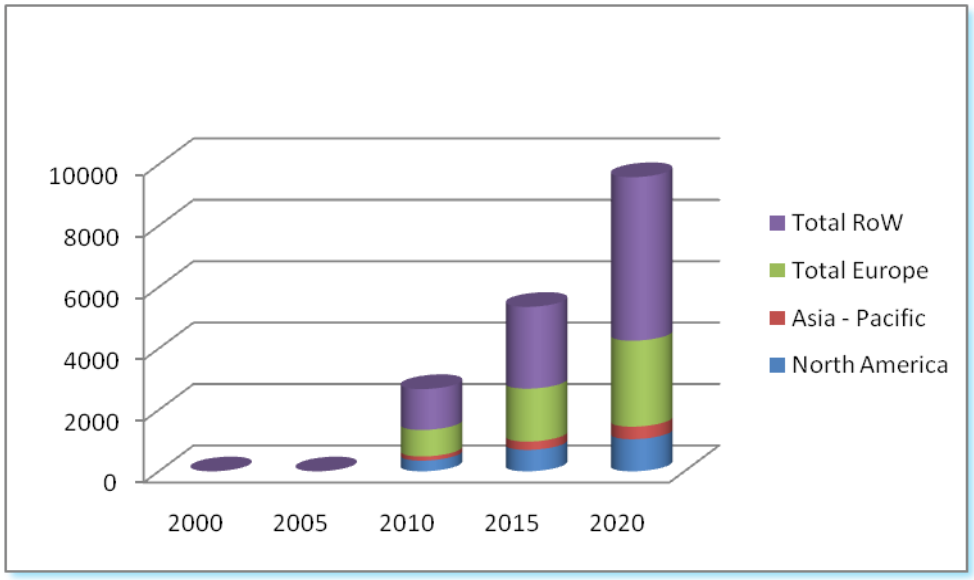



*Figure 12-3 2000-2020 ITSS Communications Services by World Region: revenues in US$m*

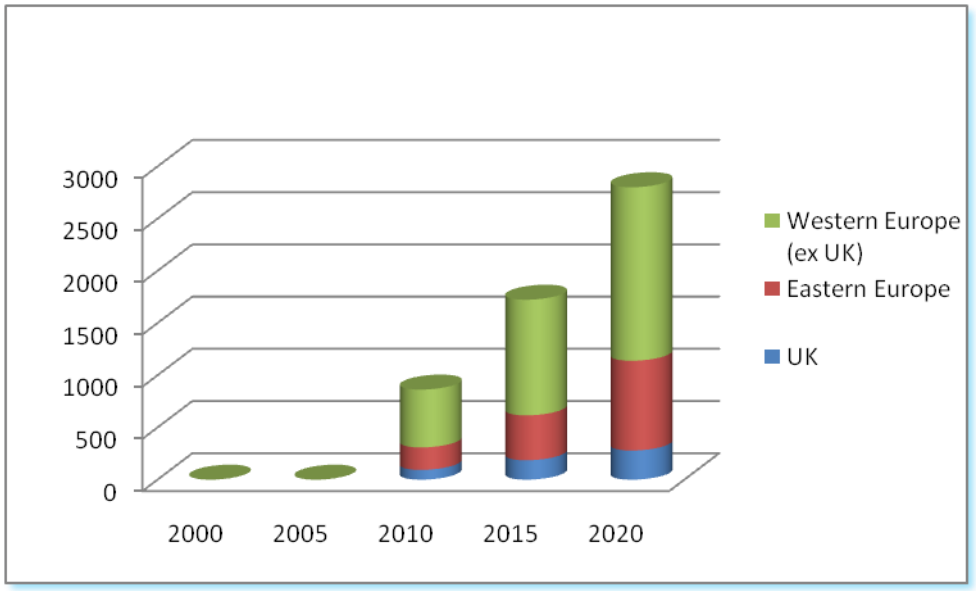



*Figure 12-4 2000-2020 ITSS Communications Services by Europe Region: revenues in US$m*

## Summary and Conclusions – Communications Services

12.20 Given that the UK has significant capabilities in communications, both mobile and fixed, this is an area that would benefit from further examination and analysis. Because of the potential for technology change and rapid growth, it is an area where the monitoring of global developments will help the UK to maintain its position.

# 13 SWOT Assessment of the UK market

## Stakeholders in the UK market

13.1 For background reference, the UK stakeholders in the ITSS market sector represent a variety of organisations, as shown in the two pie charts below. These give the percentage breakdowns for the organisations represented in the ITS-KTN membership and in the ITS (UK) membership.

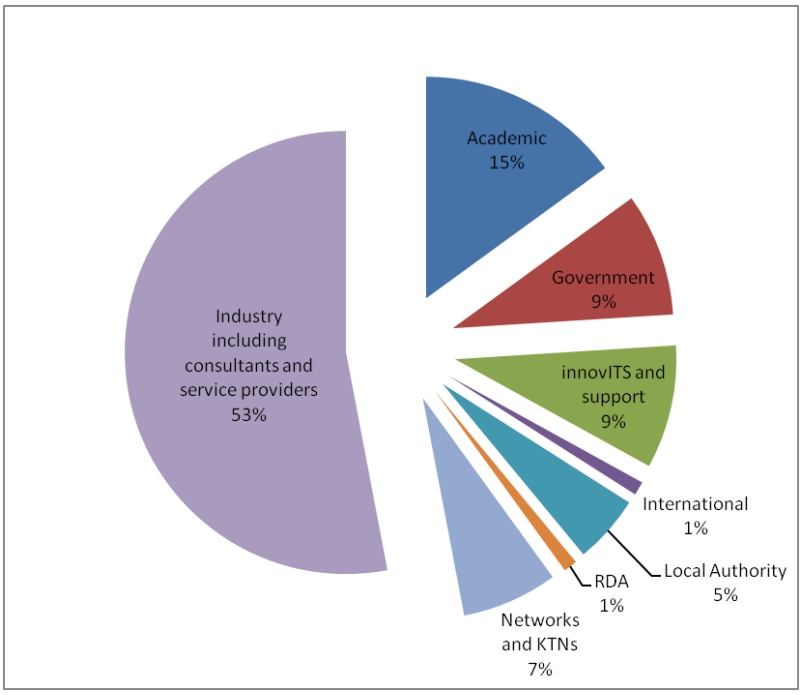



*Figure 13-1 Organisations represented in the ITS-KTN Membership*

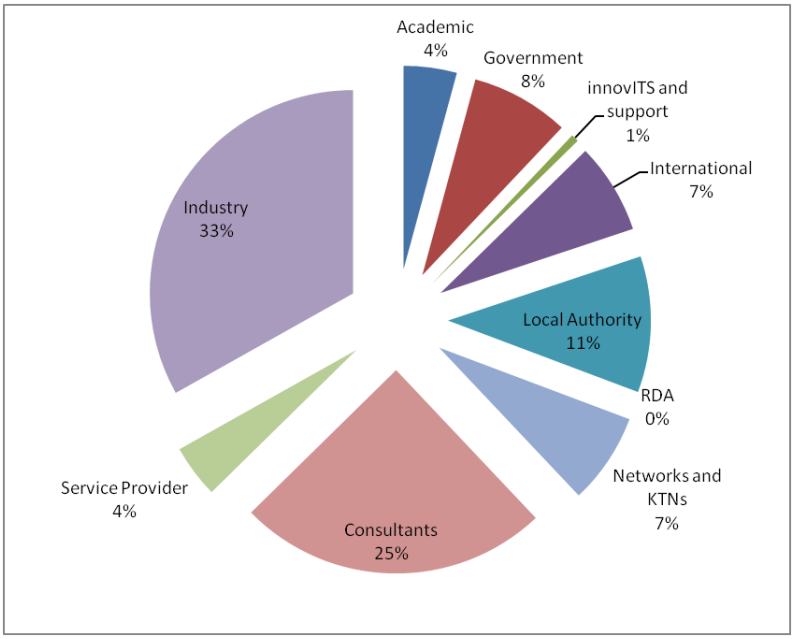



*Figure 13-2 Organisations represented in ITS (UK) Membership*

## SWOT Assessment of the UK market for ITSS

13.2 This examination of the Strengths, Weaknesses, Opportunities and Threats for the UK in the global ITSS market is based on some input from Frost & Sullivan, but largely on telephone interviews with key players in the UK. It should be considered more of an anecdotal assessment rather than a detailed analysis. Nevertheless it provides some useful insights and stimulation to further investigation.

13.3 UK strengths in ITSS:

- Key strengths arise from the UK's problems as a congested island with a restricted road network creating the need for a variety of systems to make the best possible use of the road network. Coupled with this is the UK's intellectual capability to invent appropriate solutions.
- The UK generally takes a pragmatic view in solving problems, with a very wide skill base in a variety of ITSS solutions. The UK is good at innovation and product ideas, and is also good at systems integration.
- The UK has high standards of type approval, particularly in enforcement systems that have to withstand legal challenges in the court system. It is argued by some that these standards are too high, for example requiring a criminal level of proof in road user charging instead of regarding it as a paid for service.
- The UK has a good reputation in international standards and specifications, and is well known to have good standards in place.
- The UK is strong in mobile phone technology and the developments of traffic and transport related applications. Other key strengths of the UK include: security, public transport, travel and traveller information, ticketing and incident management.
- The UTMC developments of the last decade are generally seen benefiting authorities in the UK and given industry a sound open-systems architecture for exporting elsewhere.
- On the TTI front the UK is a key leader for next generation TPEG services, which is expected to be first launched in UK in 2009.
- CCTV and ANPR are techniques and concepts which have been successfully implemented, with the UK as a founder and leader in using these technologies.
- Stolen vehicle tracking is also very strong in the UK, largely due to insurance company requirements for fitting these systems. A number of UK based companies, such as TrafficMaster, lead in this sector.
- Within Europe, London is a key leader in deployment of smartcard based ticketing systems through the Oyster card, and other markets are looking to move to smartcard technology.
- Technologies for improving incident management and response times are being trialled and deployed in the UK at a faster rate than the rest of Europe. These UK initiatives help to reduce congestion and emissions and delays to journeys.
- The UK has successfully deployed new initiatives, such as congestion charging and the low emission zone, aimed at tackling environmental issues, and the rest of the world uses the UK as a benchmark.

13.4 UK weaknesses in ITSS:

- The inertia and aversion to risks shown by the public sector, coupled with bureaucratic processes, too often leads to a lack of commitment in decision making. Frequently there is too much "navel gazing", too much research and not enough political will to make things happen.
- The UK is frequently not good at translating research into deployment, partly because we pay more attention to solving the technical issues than solving the institutional issues.
- Although the UK's public sector policies are generally sound, implementation is slow, prime examples being ramp metering and high occupancy tolling lanes. Sometimes, there are elements of "NIH" in decision-making, with a mistrust of trials conducted elsewhere.
- The UK continues to be weak in raising awareness and educating the public on ITSS benefits.
- Although the UK is skilled in the technical aspects of automotive ITSS, there is little influence on policy in this area, most decisions being made in automotive headquarters in Germany, Japan and the USA.

- The UK authorities are generally not good at recognising the driver/traveller as a "customer"; seeing things through the "customer's" eyes could help in deciding priorities. Generally there is too much "back office", and not enough customer focus. Essex CC's traffic control centre in the public atrium at county hall is a good exception to this.
- Failure to sign the eCall MoU – the UK view is that accident prevention (ADAS) systems are more efficient than eCall (post crash systems) and believes signing the eCall MoU will not have direct benefits for the UK because accident rates are lower than the EU average.
- Due to the congested nature of the UK road and transport network and the number of legacy systems, it can be costly to apply new technologies when opportunities arise. In contrast, new cities, such as Dubai, are a blank canvas.
- Although the UK has a good track record in implementing new technologies, some applications have not been fail safe, e.g. the recent Oyster card failure, when TfL lost approximately £100,000 in one incident.

13.5 UK Opportunities in ITSS

- Ticketing and the congestion charge demonstrate key opportunities for UK innovation to be applied in other countries. New congestion charge technologies, such as the 'tag and beacon', are expected to replace ANPR, giving the opportunity for increased revenues through proposed schemes, such as London, Manchester and Cambridge.
- The London Oyster card is recognised as highly innovative for public transport ticketing and is set to reach revenues of £5.8bn by 2015 providing the opportunity for higher revenues.
- There are opportunities for UK industry in the USA, particularly in areas where UK's expertise in network management, tolling / charging systems and sensor technologies could be exploited. Signalised roundabouts are a specific opportunity.
- In the longer term there are opportunities for applying ITSS to new fuelling technologies.
- The UK is well advanced in PSAP (Pubic Safety Answering Points) infrastructure development, as needed for eCall implementation, giving the UK a ready ability to implement eCall, once the MoU hurdles have been overcome.
- The London Olympics 2012 will provide opportunities to implement and showcase UK technology for managing road and information networks.

13.6 UK Threats in ITSS

- The UK risks being left behind by countries such as Holland and Germany, who have formed close technical alliances with the German motor industry. A good example is the Audi pilot project in Inglestadt, where the municipality's urban traffic control system is directly linked to equipped Audi vehicles, providing information and guidance directly to drivers.
- The pace of UK road safety improvements and reductions in casualty rates has slackened In comparison with other European counties and threatens UK's reputation in road safety.
- Whilst the "credit crunch" and economic slowdown appear not to be impacting current public sector ITSS programmes, there is a significant reduction in traffic control work associated with new developments under Section 106 agreements.
- Local government politics are risk averse and short term, making planning decisions for new technology solutions more difficult.
- Transport generally does not have a very high place on the government's agenda as other matters take priority. Transport is left behind and ITSS with it.
- Generally our domestic market for products is small and therefore product viability frequently depends on successful exports.
- Norwich Union recently suspended its PAYD scheme owing to low uptake rates, threatening the UK's lead in Europe with this application.

# 14 Conclusions

## Global ITSS Market Size

14.1 For most of the ITSS theme areas, we have been able to access detailed market values and forecasts prepared by third party market intelligence organisations, accounting for about 70% of the market values. For the remaining ITSS theme areas, we have made reasoned estimates of the likely market values. On this basis, we conclude overall that the global ITSS market is large and growing, particularly in established regions. The market in 2005 was in the order of US$19bn and is expected to grow to $44bn by 2010 and then to $65bn by 2020.

## Key ITSS market regions

14.2 Globally the largest ITSS market is North America with 51% of the market in 2005, with the share expected to decline to 44% by 2010 and 39% by 2020. The second largest ITSS market is Asia-Pacific with 25% of the market in 2005, with the share expected to decline to 23% by 2010 and 22% by 2020. The third largest ITSS market is Europe with 16% of the market in 2005, expected to increase to 23% by 2010 and 22% by 2020. The Rest of World, including key emerging markets, had 8% of the global market in 2005, and is expected to grow to 12% by 2010 and 17% by 2020.

## Key ITSS products and services

14.3 Globally, the key current ITSS products and services are Network Management, including Road User charging, with 39% of the global market, Automotive Telematics with 24% and Freight Efficiency, including commercial telematics, with 14%. By 2010 the percentages are expected to show little change, with Network Management at 38%, Automotive Telematics at 20% and Freight Efficiency at 14%. By 2020 significant impact from mobile communications is expected, though Network Management will remain in the lead at 35%, and Communications Services and Automotive Telematics at 15% each.

14.4 Within Europe, the key ITSS products and services are currently Network Management with about half of the market, Freight Efficiency with 18% and Automotive Telematics with 14%. By 2010 the percentages are expected to change to Network Management with 51%, Public Transport and Freight Efficiency with 11% each and closely followed by Communications Services at 9%. By 2020 Network Management is expected to reduce to 45%, Freight Efficiency to 10% and Communications Services to increase to 20%.

## Key opportunities for the UK

14.5 During this study a high level assessment has been made of the UK's ITSS strengths, weaknesses, threats and opportunities. This has provided helpful insights and will guide thinking on some further investigation and examination.

14.6 Although no detailed investigation has been carried out in relation to the UK, from our existing knowledge of the UK's general ITSS capabilities across the key disciplines of infrastructure, automotive and communications, we believe that there are several areas of potential interest.

14.7 Key opportunities will depend upon the UK having a competitive position for specific products or services to the extent they will overcome local prejudice in favour of local suppliers. There are clearly areas of UK strength upon which the UK can build. Market size data for the foreign international markets will need to be qualified in the light of accessibility and attractiveness of UK offerings.

## Regulatory Reform

14.8 Whilst there are very large ITSS markets in North America, Asia-Pacific, Europe and the Rest of World, many will not be accessible to UK business for reasons of regulations, standards and national preferences. There is, perhaps, scope for investigation of these barriers under the regulatory reform remit of BERR.

# Appendices

# Appendix A: Base Product-Market Matrix

| innovITS Market Analysis: 2000 | | Base product-market matrix data: revenues in US$million | | | | | | | 2000 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Europe | | | | | |
| ITSS THEME | PRODUCTS AND SERVICE AREAS INCLUDED IN ITSS THEME | North America | Asia - Pacific | UK | Eastern Europe | Western Europe** | Total Europe | Total RoW including emerging | GLOBAL TOTALS |
| Network Management | Advanced traffic management systems, including urban and interurban hardware and systems | 1973 | 802 | 333 | 44 | 727 | 1104 | 398 | 4277 |
| | Road user charging, congestion charging and electronic toll systems, including urban and interurban | 366 | 350 | 11 | 11 | 88 | 110 | 77 | 903 |
| | ***subtotal*** | ***2339*** | ***1152*** | ***344*** | ***55*** | ***815*** | ***1214*** | ***475*** | ***5180*** |
| Road Safety | Infrastructure for road safety including vulnerable road users. | | | | | | | | |
| | Advanced driver assistance systems, including night vision systems, lane departure warning, blind spot detection, intelligent parking assist, adaptive cruise control | | | | | | | | |
| | ***subtotal*** | | | | | | | | |
| Travel and Traveller Information | Infrastructure systems, including traffic information systems and variable message signs (data included above) | | | | | | | | |
| | In-vehicle systems, including RDS-TMC and TPEG (data included below | | | | | | | | |
| | ***subtotal*** | | | | | | | | |
| Public Transport | Public Transport information systems, including ticketing, journey planning and real-time information systems for bus/rail passengers and management | 225 | 114 | 23 | 15 | 116 | 174 | 82 | 595 |
| | ***subtotal*** | 225 | 114 | 23 | 15 | 116 | 174 | 82 | 595 |
| Freight efficiency | Commercial Vehicle telematics systems including freight and fleet management systems | 329 | 132 | 17 | 9 | 61 | 87 | 181 | 729 |
| | Commercial Vehicle telematics systems including freight and fleet management services | 361 | 160 | 31 | 15 | 111 | 157 | 203 | 881 |
| | ***subtotal*** | ***690*** | ***292*** | ***48*** | ***24*** | ***172*** | ***244*** | ***384*** | ***1610*** |
| Environmental Benefits | Environmental benefits of ITSS including usage based insurance and benefits arising from ITSS listed above and below (data incl in other items) | | | | | | | | |
| | ***subtotal*** | | | | | | | | |
| Security and Crime Reduction | CCTV, ANPR, access control, enforcement, vehicle identification, eCall and incident management | 272 | 119 | 35 | 6 | 85 | 126 | 48 | 564 |
| | ***subtotal*** | ***272*** | ***119*** | ***35*** | ***6*** | ***85*** | ***126*** | ***48*** | ***564*** |
| Automotive Telematics | Telematics and infotainment - original equipment and aftermarket – hardware, and systems | 281 | 31 | 4 | 4 | 27 | 35 | 1 | 348 |
| | Telematics and infotainment - original equipment and aftermarket – services | 100 | 5 | 1 | 1 | 6 | 8 | 1 | 114 |
| | ***subtotal*** | ***381*** | ***36*** | ***5*** | ***5*** | ***33*** | ***43*** | ***2*** | ***462*** |
| Communications Services | Proportion of mobile telephone (cellphone) revenue attributable to travel and transport applications | | | | | | | | |
| | Revenue for Infrastructure telecommunications, including fixed line, WiFi, WiMax, DSRC included in application areas above | | | | | | | | |
| | ***subtotal*** | | | | | | | | |
| | **TOTALS** | ***3907*** | ***1713*** | ***455*** | ***105*** | ***1221*** | ***1801*** | ***991*** | ***8411*** |

**Note: Western Europe excludes UK

**2000 Base Product-Market Matrix**

| innovITS Market Analysis: 2005 | | Base product-market matrix data: revenues in US$million | | | | | | | 2005 |
|---|---|---|---|---|---|---|---|---|---|
| | | North America | Asia - Pacific | Europe | | | | Total RoW including emerging | GLOBAL TOTALS |
| ITSS THEME | PRODUCTS AND SERVICE AREAS INCLUDED IN ITSS THEME | | | UK | Eastern Europe | Western Europe** | Total Europe | | |
| Network Management | Advanced traffic management systems, including urban and interurban hardware and systems | 2907 | 876 | 380 | 103 | 700 | 1183 | 678 | 5644 |
| | Road user charging, congestion charging and electronic toll systems, including urban and interurban | 608 | 720 | 153 | 45 | 275 | 473 | 247 | 2048 |
| | ***subtotal*** | ***3515*** | ***1596*** | ***533*** | ***148*** | ***975*** | ***1656*** | ***925*** | ***7692*** |
| Road Safety | Infrastructure for road safety including vulnerable road users. | | | | | | | | |
| | Advanced driver assistance systems, including night vision systems, lane departure warning, blind spot detection, intelligent parking assist, adaptive cruise control | 150 | 1840 | 5 | | 41 | 46 | | 2036 |
| | ***subtotal*** | ***150*** | ***1840*** | ***5*** | | ***41*** | ***46*** | | ***2036*** |
| Travel and Traveller Information | Infrastructure systems, including traffic information systems and variable message signs (data included above) | | | | | | | | |
| | In-vehicle systems, including RDS-TMC and TPEG (data included below | | | | | | | | |
| | ***subtotal*** | | | | | | | | |
| Public Transport | Public Transport information systems, including ticketing, journey planning and real-time information systems for bus/rail passengers and management | 478 | 183 | 68 | 37 | 302 | 407 | 93 | 1161 |
| | ***subtotal*** | ***478*** | ***183*** | ***68*** | ***37*** | ***302*** | ***407*** | ***93*** | ***1161*** |
| Freight efficiency | Commercial Vehicle telematics systems including freight and fleet management systems | 531 | 230 | 41 | 21 | 144 | 206 | 280 | 1247 |
| | Commercial Vehicle telematics systems including freight and fleet management services | 583 | 252 | 73 | 37 | 256 | 366 | 315 | 1516 |
| | ***subtotal*** | ***1114*** | ***482*** | ***114*** | ***58*** | ***400*** | ***572*** | ***595*** | ***2763*** |
| Environmental Benefits | Environmental benefits of ITSS including usage based insurance and benefits arising from ITSS listed above and below (data incl in other items) | | | | | | | | |
| | ***subtotal*** | | | | | | | | |
| Security and Crime Reduction | CCTV, ANPR, access control, enforcement, vehicle identification, eCall and incident management | 732 | 196 | 62 | 19 | 127 | 208 | 94 | 1230 |
| | ***subtotal*** | ***732*** | ***196*** | ***62*** | ***19*** | ***127*** | ***208*** | ***94*** | ***1230*** |
| Automotive Telematics | Telematics and infotainment - original equipment and aftermarket – hardware, and systems | 2811 | 311 | 70 | 35 | 243 | 348 | 6 | 3476 |
| | Telematics and infotainment - original equipment and aftermarket – services | 996 | 50 | 16 | 8 | 56 | 80 | 4 | 1130 |
| | ***subtotal*** | ***3807*** | ***361*** | ***86*** | ***43*** | ***299*** | ***428*** | ***10*** | ***4606*** |
| Communications Services | Proportion of mobile telephone (cellphone) revenue attributable to travel and transport applications | | | | | | | | |
| | Revenue for Infrastructure telecommunications, including fixed line, WiFi, WiMax, DSRC included in application areas above | | | | | | | | |
| | ***subtotal*** | | | | | | | | |
| | **TOTALS** | ***9796*** | ***4658*** | ***868*** | ***305*** | ***2144*** | ***3317*** | ***1717*** | ***19488*** |

**Note: Western Europe excludes UK

**2005 Base Product-Market Matrix**

| innovITS Market Analysis: 2010 | | Base product-market matrix data: revenues in US$million | | | | | | | 2010 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Europe | | | | | |
| ITSS THEME | PRODUCTS AND SERVICE AREAS INCLUDED IN ITSS THEME | North America | Asia - Pacific | UK | Eastern Europe | Western Europe** | Total Europe | Total RoW including emerging | GLOBAL TOTALS |
| Network Management | Advanced traffic management systems, including urban and interurban hardware and systems | 4426 | 1508 | 554 | 213 | 885 | 1652 | 1423 | 9009 |
| | Road user charging, congestion charging and electronic toll systems, including urban and interurban | 2309 | 2089 | 329 | 493 | 2215 | 3037 | 519 | 7954 |
| | ***subtotal*** | ***6735*** | ***3597*** | ***883*** | ***706*** | ***3100*** | ***4689*** | ***1942*** | ***16963*** |
| Road Safety | Infrastructure for road safety including vulnerable road users. | | | | | | | | |
| | Advanced driver assistance systems, including night vision systems, lane departure warning, blind spot detection, intelligent parking assist, adaptive cruise control | 468 | 3290 | 36 | 36 | 294 | 366 | | 4124 |
| | ***subtotal*** | ***468*** | ***3290*** | ***36*** | ***36*** | ***294*** | ***366*** | | ***4124*** |
| Travel and Traveller Information | Infrastructure systems, including traffic information systems and variable message signs (data included above) | | | | | | | | |
| | In-vehicle systems, including RDS-TMC and TPEG (data included below | | | | | | | | |
| | ***subtotal*** | | | | | | | | |
| Public Transport | Public Transport information systems, including ticketing, journey planning and real-time information systems for bus/rail passengers and management | 1276 | 490 | 146 | 176 | 727 | 1049 | 261 | 3076 |
| | ***subtotal*** | ***1276*** | ***490*** | ***146*** | ***176*** | ***727*** | ***1049*** | ***261*** | ***3076*** |
| Freight efficiency | Commercial Vehicle telematics systems including freight and fleet management systems | 953 | 734 | 54 | 54 | 254 | 362 | 686 | 2735 |
| | Commercial Vehicle telematics systems including freight and fleet management services | 956 | 819 | 104 | 104 | 484 | 692 | 773 | 3240 |
| | ***subtotal*** | ***1909*** | ***1553*** | ***158*** | ***158*** | ***738*** | ***1054*** | ***1459*** | ***5975*** |
| Environmental Benefits | Environmental benefits of ITSS including usage based insurance and benefits arising from ITSS listed above and below (data incl in other items) | | | | | | | | |
| | ***subtotal*** | | | | | | | | |
| Security and Crime Reduction | CCTV, ANPR, access control, enforcement, vehicle identification, eCall and incident management | 1396 | 449 | 99 | 81 | 359 | 539 | 214 | 2597 |
| | ***subtotal*** | ***1396*** | ***449*** | ***99*** | ***81*** | ***359*** | ***539*** | ***214*** | ***2597*** |
| Automotive Telematics | Telematics and infotainment - original equipment and aftermarket – hardware, and systems | 5205 | 748 | 87 | 87 | 406 | 580 | 134 | 6667 |
| | Telematics and infotainment - original equipment and aftermarket – services | 2018 | 140 | 18 | 18 | 84 | 120 | 63 | 2341 |
| | ***subtotal*** | ***7223*** | ***888*** | ***105*** | ***105*** | ***490*** | ***700*** | ***197*** | ***9008*** |
| Communications Services | Proportion of mobile telephone (cellphone) revenue attributable to travel and transport applications | 349 | 136 | 94 | 215 | 554 | 863 | 1332 | 2680 |
| | Revenue for Infrastructure telecommunications, including fixed line, WiFi, WiMax, DSRC included in application areas above | | | | | | | | |
| | ***subtotal*** | ***349*** | ***136*** | ***94*** | ***215*** | ***554*** | ***863*** | ***1332*** | ***2680*** |
| | **TOTALS** | ***19356*** | ***10403*** | ***1521*** | ***1477*** | ***6262*** | ***9260*** | ***5405*** | ***44423*** |

**Note: Western Europe excludes UK

**2010 Base Product-Market Matrix**

| innovITS Market Analysis: 2015 | | Base product-market matrix data: revenues in US$million | | | | | | | 2015 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Europe | | | | | |
| ITSS THEME | PRODUCTS AND SERVICE AREAS INCLUDED IN ITSS THEME | North America | Asia - Pacific | UK | Eastern Europe | Western Europe** | Total Europe | Total RoW including emerging | GLOBAL TOTALS |
| Network Manage-ment | Advanced traffic management systems, including urban and interurban hardware and systems | 5208 | 1680 | 611 | 327 | 1063 | 2001 | 1521 | 10410 |
| | Road user charging, congestion charging and electronic toll systems, including urban and interurban | 2710 | 2544 | 592 | 592 | 2761 | 3945 | 623 | 9822 |
| | ***subtotal*** | ***7918*** | ***4224*** | ***1203*** | ***919*** | ***3824*** | ***5946*** | ***2144*** | ***20232*** |
| Road Safety | Infrastructure for road safety including vulnerable road users. | | | | | | | | |
| | Advanced driver assistance systems, including night vision systems, lane departure warning, blind spot detection, intelligent parking assist, adaptive cruise control | 655 | 3948 | 50 | 50 | 412 | 512 | 350 | 5465 |
| | ***subtotal*** | ***655*** | ***3948*** | ***50*** | ***50*** | ***412*** | ***512*** | ***350*** | ***5465*** |
| Travel and Traveller Information | Infrastructure systems, including traffic information systems and variable message signs (data included above) | | | | | | | | |
| | In-vehicle systems, including RDS-TMC and TPEG (data included below | | | | | | | | |
| | ***subtotal*** | | | | | | | | |
| Public Transport | Public Transport information systems, including ticketing, journey planning and real-time information systems for bus/rail passengers and management | 1180 | 526 | 186 | 162 | 803 | 1151 | 350 | 3207 |
| | ***subtotal*** | ***1180*** | ***526*** | ***186*** | ***162*** | ***803*** | ***1151*** | ***350*** | ***3207*** |
| Freight efficiency | Commercial Vehicle telematics systems including freight and fleet management systems | 1096 | 844 | 62 | 62 | 292 | 416 | 686 | 3042 |
| | Commercial Vehicle telematics systems including freight and fleet management services | 1099 | 983 | 125 | 125 | 581 | 831 | 928 | 3841 |
| | ***subtotal*** | ***2195*** | ***1827*** | ***187*** | ***187*** | ***873*** | ***1247*** | ***1614*** | ***6883*** |
| Environ-mental Benefits | Environmental benefits of ITSS including usage based insurance and benefits arising from ITSS listed above and below (data incl in other items) | | | | | | | | |
| | ***subtotal*** | | | | | | | | |
| Security and Crime Reduction | CCTV, ANPR, access control, enforcement, vehicle identification, eCall and incident management | 1865 | 617 | 157 | 123 | 520 | 800 | 281 | 3563 |
| | ***subtotal*** | ***1865*** | ***617*** | ***157*** | ***123*** | ***520*** | ***800*** | ***281*** | ***3563*** |
| Automotive Telematics | Telematics and infotainment - original equipment and aftermarket – hardware, and systems | 5205 | 748 | 87 | 87 | 406 | 580 | 134 | 6667 |
| | Telematics and infotainment - original equipment and aftermarket – services | 2421 | 168 | 22 | 22 | 100 | 144 | 63 | 2796 |
| | ***subtotal*** | ***7626*** | ***916*** | ***109*** | ***109*** | ***506*** | ***724*** | ***197*** | ***9463*** |
| Communi-cations Services | Proportion of mobile telephone (cellphone) revenue attributable to travel and transport applications | 698 | 272 | 186 | 430 | 1108 | 1724 | 2664 | 5358 |
| | Revenue for Infrastructure telecommunications, including fixed line, WiFi, WiMax, DSRC included in application areas above | | | | | | | | |
| | ***subtotal*** | ***698*** | ***272*** | ***186*** | ***430*** | ***1108*** | ***1724*** | ***2664*** | ***5358*** |
| | **TOTALS** | ***22137*** | ***12330*** | ***2078*** | ***1980*** | ***8046*** | ***12104*** | ***7600*** | ***54171*** |

**Note: Western Europe excludes UK

**2015 Base Product-Market Matrix**

| innovITS Market Analysis: 2020 | | Base product-market matrix data: revenues in US$million | | | | | | | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Europe | | | | | |
| ITSS THEME | PRODUCTS AND SERVICE AREAS INCLUDED IN ITSS THEME | North America | Asia - Pacific | UK | Eastern Europe | Western Europe** | Total Europe | Total RoW including emerging | GLOBAL TOTALS |
| Network Management | Advanced traffic management systems, including urban and interurban hardware and systems | 5729 | 1848 | 612 | 450 | 1079 | 2141 | 1673 | 11391 |
| | Road user charging, congestion charging and electronic toll systems, including urban and interurban | 3252 | 3052 | 473 | 710 | 3550 | 4733 | 747 | 11784 |
| | ***subtotal*** | ***8981*** | ***4900*** | ***1085*** | ***1160*** | ***4629*** | ***6874*** | ***2420*** | ***23175*** |
| Road Safety | Infrastructure for road safety including vulnerable road users. | | | | | | | | |
| | Advanced driver assistance systems, including night vision systems, lane departure warning, blind spot detection, intelligent parking assist, adaptive cruise control | 917 | 4737 | 70 | 70 | 412 | 552 | 490 | 6696 |
| | ***subtotal*** | ***917*** | ***4737*** | ***70*** | ***70*** | ***412*** | ***552*** | ***490*** | ***6696*** |
| Travel and Traveller Information | Infrastructure systems, including traffic information systems and variable message signs (data included above) | | | | | | | | |
| | In-vehicle systems, including RDS-TMC and TPEG (data included below | | | | | | | | |
| | ***subtotal*** | | | | | | | | |
| Public Transport | Public Transport information systems, including ticketing, journey planning and real-time information systems for bus/rail passengers and management | 1321 | 507 | 172 | 190 | 893 | 1255 | 330 | 3413 |
| | ***subtotal*** | ***1321*** | ***507*** | ***172*** | ***190*** | ***893*** | ***1255*** | ***330*** | ***3413*** |
| Freight efficiency | Commercial Vehicle telematics systems including freight and fleet management systems | 1205 | 928 | 68 | 68 | 322 | 458 | 755 | 3346 |
| | Commercial Vehicle telematics systems including freight and fleet management services | 1209 | 1081 | 137 | 137 | 639 | 913 | 1021 | 4224 |
| | ***subtotal*** | ***2414*** | ***2009*** | ***205*** | ***205*** | ***961*** | ***1371*** | ***1776*** | ***7570*** |
| Environmental Benefits | Environmental benefits of ITSS including usage based insurance and benefits arising from ITSS listed above and below (data incl in other items) | | | | | | | | |
| | ***subtotal*** | | | | | | | | |
| Security and Crime Reduction | CCTV, ANPR, access control, enforcement, vehicle identification, eCall and incident management | 2564 | 878 | 180 | 191 | 773 | 1144 | 398 | 4983 |
| | ***subtotal*** | ***2564*** | ***878*** | ***180*** | ***191*** | ***773*** | ***1144*** | ***398*** | ***4983*** |
| Automotive Telematics | Telematics and infotainment - original equipment and aftermarket – hardware, and systems | 5205 | 748 | 87 | 87 | 406 | 580 | 161 | 6694 |
| | Telematics and infotainment - original equipment and aftermarket – services | 2905 | 202 | 26 | 26 | 120 | 172 | 75 | 3354 |
| | ***subtotal*** | ***8110*** | ***950*** | ***113*** | ***113*** | ***526*** | ***752*** | ***236*** | ***10048*** |
| Communications Services | Proportion of mobile telephone (cellphone) revenue attributable to travel and transport applications | 1047 | 408 | 279 | 860 | 1662 | 2801 | 5328 | 9584 |
| | Revenue for Infrastructure telecommunications, including fixed line, WiFi, WiMax, DSRC included in application areas above | | | | | | | | |
| | ***subtotal*** | ***1047*** | ***408*** | ***279*** | ***860*** | ***1662*** | ***2801*** | ***5328*** | ***9584*** |
| | **TOTALS** | ***25354*** | ***14389*** | ***2104*** | ***2789*** | ***9856*** | ***14749*** | ***10978*** | ***65469*** |

**Note: Western Europe excludes UK

**2020 Base Product-Market Matrix**

# Appendix B: Abbreviations

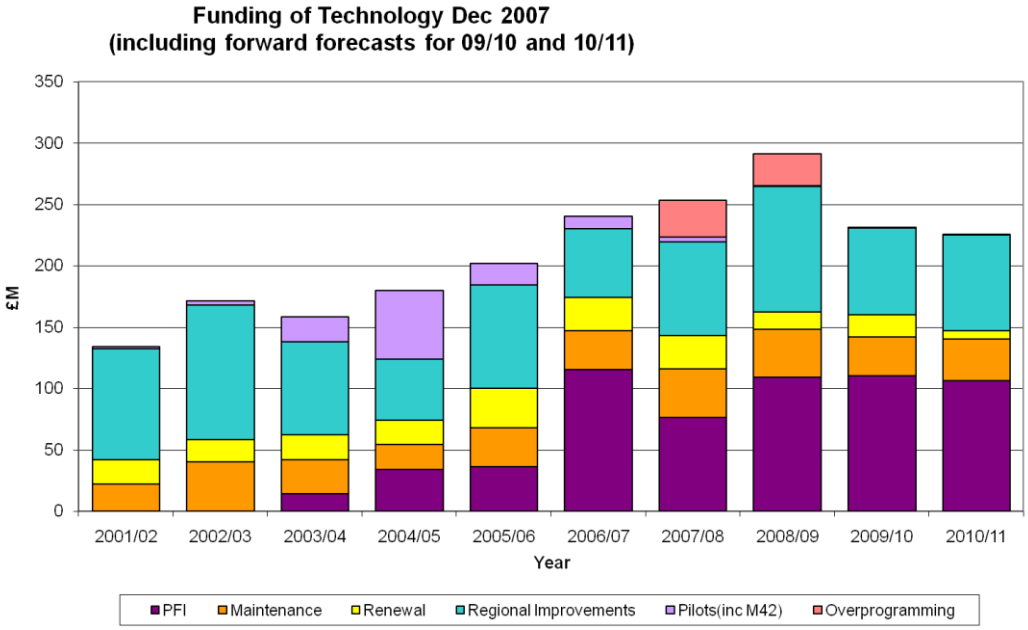
## List of Abbreviations

| | |
|---|---|
| ACPO | Association of Chief Police Officers |
| ANPR | Automatic Number Plate Recognition |
| ATMS | Advanced Traffic Management Systems |
| AVL | Automated Vehicle Location |
| BSI | British Standards Institute |
| CAGR | Compound Annual Growth Rate |
| CANBUS | Controlled Area Network |
| CCTV | Closed Circuit Television |
| CfIT | Commission for Integrated Transport |
| CNIL | Commission Nationale de L'informatique et des Libertes |
| CTT | Congestion and Travel Time |
| CVHS | Co-operative Vehicle Highway Systems |
| CVO | Commercial Vehicle Operations |
| DfT | Department for Transport |
| DBERR | Department for Business, Enterprise and Regulatory Reform |
| DSRC | Dedicated Short Range Communications |
| DVLA | Driver and Vehicle Licensing Agency |
| EC | European Commission |
| EIB | European Investment Bank |
| ERTICO | European public-private sector membership organisation for ITS |
| ETC | Electronic Toll Collection |
| ETR | Express Toll Route |
| EU | European Union |
| Galileo | European contribution to the Global Navigation Satellite System. |
| GNSS | Global Navigation Satellite System |
| GPRS | Global Package Radio Service |
| GPS | Global Positioning System |
| GSM | Global System for Mobile |
| HA | Highways Agency |
| HAIL | Highways Agency Information Line |
| HMI | Human Machine Interface |
| IBEC | International Benefits and Evaluation Committee |
| InnovITS | UK Centre for Excellence in transport telematics and technology for sustainable mobility |
| IST | Information Society Technologies |
| ITS | Intelligent Transport Systems |
| ITS America | American public-private sector membership organisation for ITS |
| ITS Japan | Japanese public-private sector membership organisation for ITS |
| ITSSG | International ITS Standards Steering Group |
| ITS UK | UK public-private sector membership organisation for ITS |
| MIRA | Motor Industry Research Association |
| NTCC | National Traffic Control Centre |
| OBU | On Board Unit |
| PAYD | Pay As You Drive |
| PAYP | Pay As You Pollute |
| PHYD | Pay How You Drive |
| PIARC | World Road Association |
| PKI | Parking Information |
| PSA | Public Service Agreement |
| PTIS | Public Transport Information |
| RCC | Regional Control Centres |
| RDS | Radio Data System |
| RDS-TMC | Radio Data Service – Traffic Message Channel |
| RTIG | Real-Time Information Group |
| RTM | Road Traffic Messages |
| RUC | Road User Charging |
| RVD | Remote Vehicle Diagnostics |
| SCOOT | Split Cycle Offset Optimisation Technique |
| SLA | Service Level Agreement |

| | |
|---|---|
| SMMT | The Society of Motor Manufacturers and Traders Ltd |
| SMS | Short Message Service |
| SVT | Stolen Vehicle Tracking |
| TEC | Traffic Event Compact |
| TfL | Transport for London |
| TIH | Travel Information Highway |
| TMC | Traffic Message Channel |
| TPEG | Transport Protocol Experts Group |
| UBI | Usage Based Insurance |
| UDG | UTMC Development Group |
| UTMC | Urban Traffic Management and Control |
| VII | Vehicle Infrastructure Integration |
| VIF | Vehicle Information Framework |
| VPS | Vehicle Positioning Systems |
| VOSA | Vehicle and Operator Services Agency |
| WP29 | Working Party 29, the automotive focus of the UNECE |

# Appendix C: HA Technology Programme

The Highways Agency has a major programme of technology implementation as indicated in the following chart which shows the funding of technology from 2001/02 to 2010/11.

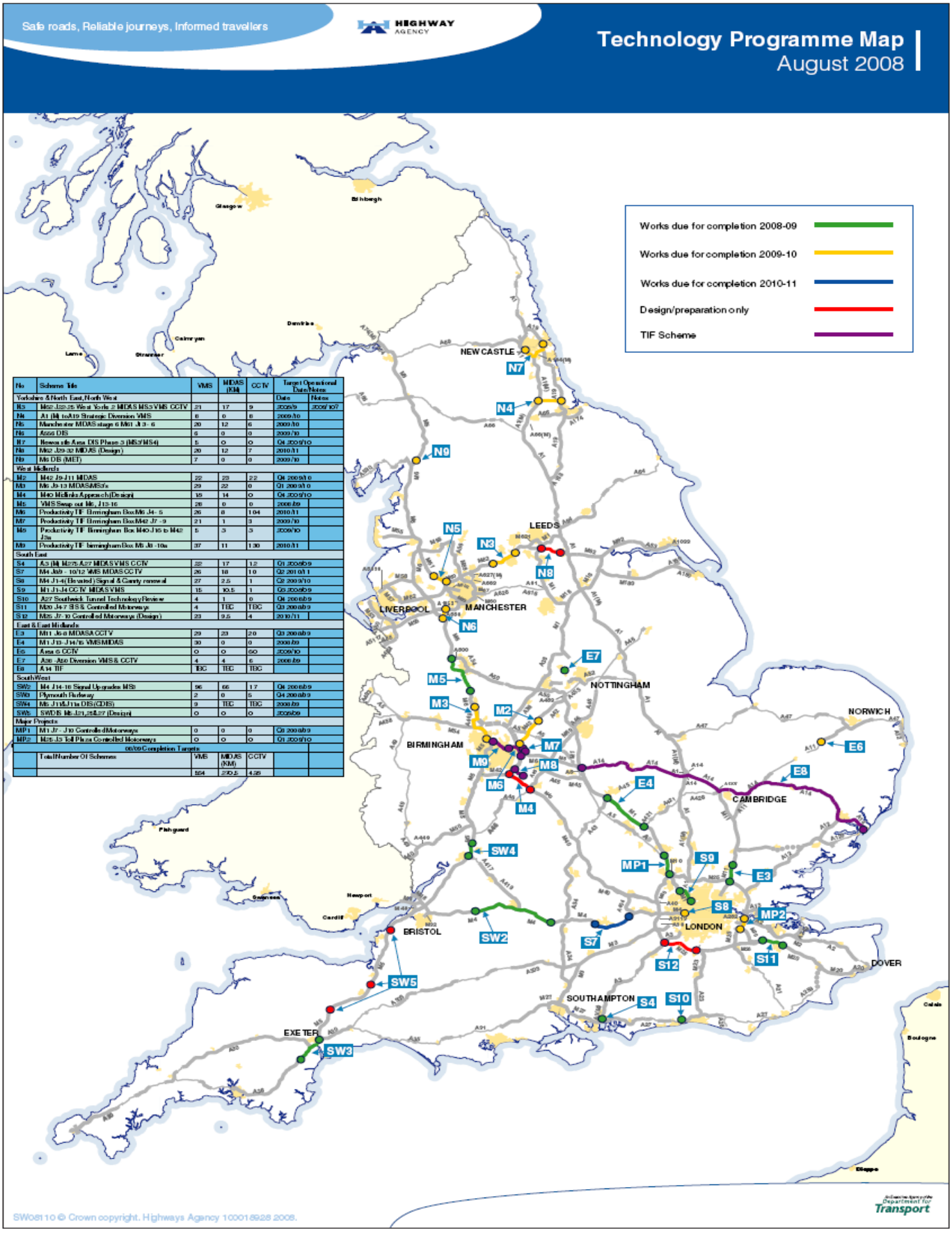



This shows technology spend by a number of different categories including capital improvements (mostly regional MIDAS, CCTV, VMS schemes and includes schemes such as Ramp Metering), PFI (NRTS and NTCC costs), Pilots (includes ATM M42 scheme), Maintenance and Renewals (includes some smaller schemes). More details of the HA schemes are given in the table below and the map on the next page.

These figures include for all traffic management and civil works associated with the technology. So for example, a MIDAS scheme cost will include the budget for traffic management, and a VMS scheme will include budget for civil works, e.g. foundations and cantilevers. Many of the HA's technology schemes comprise a combination of MIDAS, VMS and CCTV so there is no readily available breakdown of spend per equipment type. For the purpose of the analysis in this ITSS global market study we have taken a view on the traffic management and civil works content in arriving at the UK market size for Network Management.

Additionally, the Department for Transport recently announced a significant investment package to improve and make better use of England's motorways involving innovative plans to tackle congestion on our busiest motorways and give drivers greater choice over their journeys. The investment in Managed Motorways will fund a mix of techniques to get the most out of the existing network, such as opening the hard shoulder to traffic, taking forward the Advanced Motorway Signalling and Traffic Management Feasibility Study which identified almost 500 lane miles of motorway with the potential for hard shoulder running.

| No | Scheme Title | VMS | MIDAS (KM) | CCTV | Target Operational Date/Notes | |
|---|---|---|---|---|---|---|
| Yorkshire & North East, North West | | | | | Date | Notes |
| N3 | M62 J22-25 West Yorks 2 MIDAS MS3 VMS CCTV | 21 | 17 | 9 | 2008/9 | 2009/10? |
| N4 | A1 (M) toA19 Strategic Diversion VMS | 8 | 0 | 8 | 2009/10 | |
| N5 | Manchester MIDAS stage 6 M61 J13 - 6 | 20 | 12 | 6 | 2009/10 | |
| N6 | A556 DIS | 6 | 0 | 0 | 2009/10 | |
| N7 | Newcastle Area DIS Phase 3 (MS3/MS4) | 5 | 0 | 0 | Q4 2009/10 | |
| N8 | M62 J29-32 MIDAS (Design) | 20 | 12 | 7 | 2010/11 | |
| N9 | M6 DIS (MET) | 7 | 0 | 0 | 2009/10 | |
| West Midlands | | | | | | |
| M2 | M42 J9-J11 MIDAS | 22 | 23 | 22 | Q4 2009/10 | |
| M3 | M6 J9-13 MIDAS/MS3's | 29 | 22 | 0 | Q1 2009/10 | |
| M4 | M40 Midlinks Approach (Design) | 18 | 14 | 0 | Q4 2009/10 | |
| M5 | VMS Swap out M6, J13-16 | 28 | 0 | 0 | 2008/09 | |
| M6 | Productivity TIF Birmingham Box M6 J4 - 5 | 26 | 8 | 104 | 2010/11 | |
| M7 | Productivity TIF Birmingham Box M42 J7 - 9 | 21 | 1 | 3 | 2009/10 | |
| M8 | Productivity TIF Birmingham Box M40 J16 to M42 J3a | 5 | 3 | 3 | 2009/10 | |
| M9 | Productivity TIF birmingham Box M6 J8 -10a | 37 | 11 | 130 | 2010/11 | |
| South East | | | | | | |
| S4 | A3 (M) M275 A27 MIDAS VMS CCTV | 22 | 17 | 12 | Q1 2008/09 | |
| S7 | M4 J8/9 - 10/12 VMS MIDAS CCTV | 26 | 18 | 10 | Q2 2010/11 | |
| S8 | M4 J1-4 (Elevated) Signal & Gantry renewal | 27 | 2.5 | 1 | Q2 2009/10 | |
| S9 | M1 J1-J4 CCTV MIDAS VMS | 15 | 10.5 | 1 | Q3 2008/09 | |
| S10 | A27 Southwick Tunnel Technology Review | 4 | 1 | 0 | Q4 2008/09 | |
| S11 | M20 J4-7 SIS & Controlled Motorways | 4 | TBC | TBC | Q3 2008/09 | |
| S12 | M25 J7-10 Controlled Motorways (Design) | 23 | 9.5 | 4 | 2010/11 | |
| East & East Midlands | | | | | | |
| E3 | M11 J6-8 MIDASA CCTV | 29 | 23 | 20 | Q3 2008/09 | |
| E4 | M1 J13- J14/15 VMS MIDAS | 30 | 0 | 0 | 2008/09 | |
| E6 | Area 6 CCTV | 0 | 0 | 60 | 2009/10 | |
| E7 | A38 -A50 Diversion VMS & CCTV | 4 | 4 | 6 | 2008/09 | |
| E8 | A14 TIF | TBC | TBC | TBC | | |
| South West | | | | | | |
| SW2 | M4 J14-18 Signal Upgrades MS3 | 96 | 66 | 17 | Q4 2008/09 | |
| SW3 | Plymouth Parkway | 2 | 0 | 5 | Q4 2008/09 | |
| SW4 | M5 J11&J11a DIS (GDIS) | 9 | TBC | TBC | 2008/09 | |
| SW5 | SWDIS M5 J21,25&27 (Design) | 0 | 0 | 0 | 2008/09 | |
| Major Projects | | | | | | |
| MP1 | M1 J7 - J10 Controlled Motorways | 0 | 0 | 0 | Q3 2008/09 | |
| MP2 | M25 J3 Toll Plaza Controlled Motorways | 0 | 0 | 0 | Q1 2009/10 | |
| 08/09 Completion Targets | | | | | | |
| | Total Number Of Schemes | VMS | MIDAS (KM) | CCTV | | |
| | | 564 | 270.5 | 428 | | |



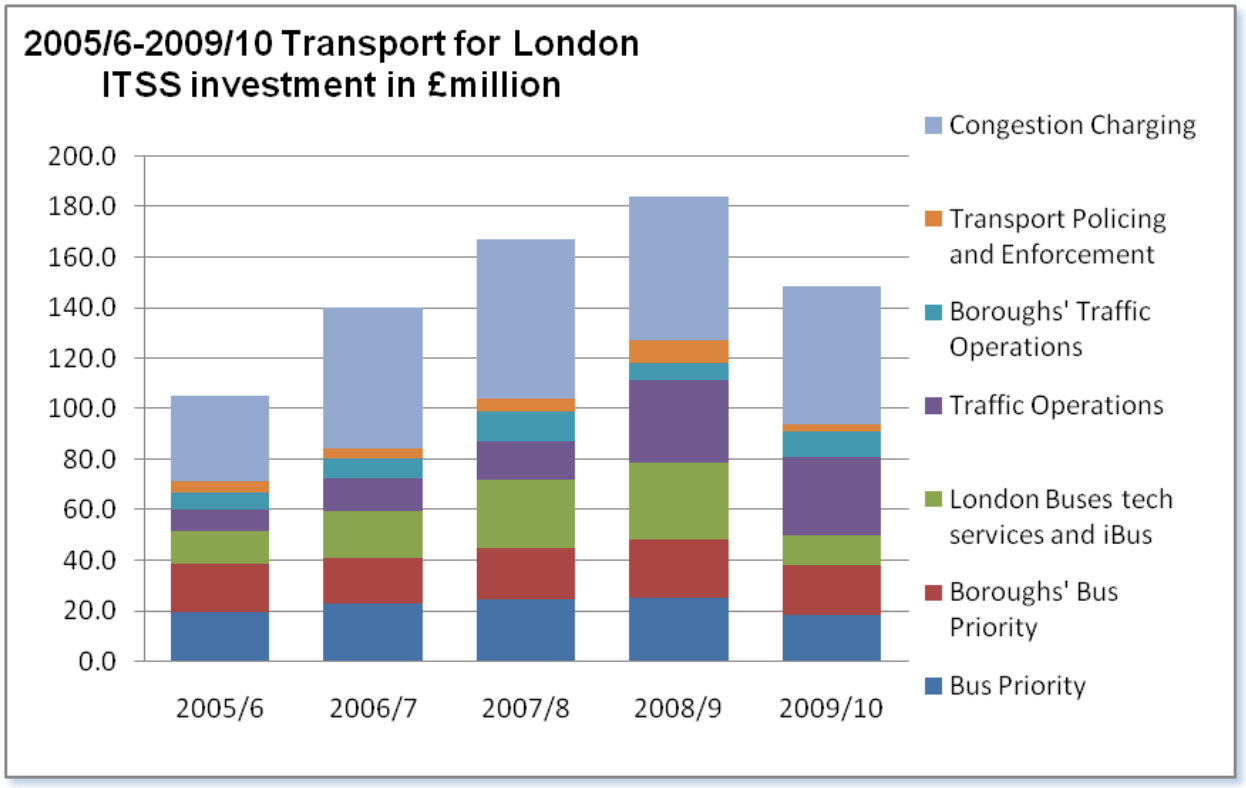

| No | Scheme Title | VMS | MIDAS (KM) | CCTV | Target Operational Date/Notes | |
|---|---|---|---|---|---|---|
| Yorkshire & North East, North West | | | | | Date | Notes |
| N3 | M62 J28-25 West Yorks 2 MIDAS MS3 VMS CCTV | 21 | 17 | 9 | 2008/9 | 2009/10? |
| N4 | A1 (M) to A19 Strategic Diversion VMS | 6 | 0 | 6 | 2009/10 | |
| N5 | Manchester MIDAS stage 6 M60 J3 - 6 | 20 | 12 | 6 | 2009/10 | |
| N6 | A556 DIS | 6 | 0 | 0 | 2009/10 | |
| N7 | Newcastle Area DIS Phase 3 (MS2/MS4) | 5 | 0 | 0 | Q4 2009/10 | |
| N8 | M62 J29-32 MIDAS (Design) | 20 | 12 | 7 | 2010/11 | |
| N9 | M6 DIS (MET) | 7 | 0 | 0 | 2009/10 | |
| West Midlands | | | | | | |
| M2 | M42 J9-J11 MIDAS | 22 | 23 | 22 | Q4 2009/10 | |
| M3 | M6 J9-13 MIDAS/MS4's | 29 | 22 | 0 | Q1 2009/10 | |
| M4 | M40 Midlinks Approach (Design) | 18 | 14 | 0 | Q4 2009/10 | |
| M5 | VMS Swap out M6_J13-16 | 28 | 0 | 0 | 2008/09 | |
| M6 | Productivity TIF Birmingham Box M6 J4 - 5 | 26 | 8 | 104 | 2010/11 | |
| M7 | Productivity TIF Birmingham Box M42 J7 - 9 | 21 | 1 | 3 | 2009/10 | |
| M8 | Productivity TIF Birmingham Box M40 J15 to M42 J3a | 5 | 3 | 3 | 2009/10 | |
| M9 | Productivity TIF birmingham Box M6 J9 -10a | 37 | 11 | 130 | 2010/11 | |
| South East | | | | | | |
| S4 | A3 (M) M275 A27 MIDAS VMS CCTV | 22 | 17 | 12 | Q1 2008/09 | |
| S7 | M4 J9 - 10/12 VMS MIDAS CCTV | 26 | 18 | 10 | Q2 2011/11 | |
| S8 | M4 J1-4 (Elevated) Signal & Gantry renewal | 27 | 2.5 | 1 | Q2 2009/10 | |
| S9 | M1 J1-J4 CCTV MIDAS VMS | 15 | 10.5 | 1 | Q3 2008/09 | |
| S10 | A27 Southwick Tunnel Technology Review | 4 | 1 | 0 | Q4 2008/09 | |
| S11 | M20 J4-7 SIS & Controlled Motorways | 4 | TBC | TBC | Q3 2008/09 | |
| S12 | M25 J7-10 Controlled Motorways (Design) | 23 | 9.5 | 4 | 2010/11 | |
| East & East Midlands | | | | | | |
| E3 | M11 J6-9 MIDAS/CCTV | 29 | 23 | 20 | Q3 2008/09 | |
| E4 | M1 J10-J14/16 VMS MIDAS | 30 | 0 | 0 | 2008/09 | |
| E5 | Area 6 CCTV | 0 | 0 | 60 | 2009/10 | |
| E7 | A38 -A50 Diversion VMS & CCTV | 4 | 4 | 6 | 2008/09 | |
| E8 | A14 TIF | TBC | TEC | TBC | | |
| South West | | | | | | |
| SW2 | M4 J14-16 Signal Upgrades MS3 | 96 | 66 | 17 | Q4 2008/09 | |
| SW3 | Plymouth Parkway | 2 | 0 | 5 | Q4 2008/09 | |
| SW4 | M5 J11&J13a DIS (CDIS) | 9 | TEC | TBC | 2008/09 | |
| SW5 | SWDIS M5 J21,25&27 (Design) | 0 | 0 | 0 | 2009/09 | |
| Major Projects | | | | | | |
| MP1 | M1 J7 - J10 Controlled Motorways | 0 | 0 | 0 | Q3 2008/09 | |
| MP2 | M25 J3 Toll Plaza Controlled Motorways | 0 | 0 | 0 | Q1 2009/10 | |
| 08/09 Completion Targets | | | | | | |
| | Total Number Of Schemes | VMS | MIDAS (KM) | CCTV | | |
| | | 554 | 270.5 | 426 | | |

# Appendix D: Transport for London

The information in this Appendix has been taken from the Transport for London Investment Programme 2008 published in December 2007.

Transport for London (TfL) is a major purchaser of Intelligent Transport Systems and Services in line with the Mayor's Transport Strategy. The key ITSS themes and programmes include: bus priority, technical services and iBus, traffic operations, transport policing and enforcement, and congestion charging.

The investment profile in £million for each of these themes for 2005/06 to 2009/10 is given in the chart below. Further details of each theme follow the chart.




## Bus priority

Bus priority measures on London's roads have protected services from increases in traffic congestion and made journeys more reliable. Without bus priority, passengers would experience longer journey times and a less reliable and attractive service, and operating costs would increase.

Bus priority reduces the cost of accommodating growth in passenger numbers and facilitates the introduction of new services and new buses to meet the population increases predicted in TfL's Transport 2025 (T2025) and the London Plan.

Bus priority measures consist of bus lanes, some with a contra flow, facilities for buses only (e.g. prohibited turns for other traffic), signal schemes and other traffic management and engineering measures along busy bus routes. The Selective Vehicle Detection (SVD) programme introduces priority traffic signalled junctions that reduce delay to buses, while having little adverse effect on other traffic.

London's buses travel through more than 3,000 signals and the SVD programme has provided benefit by giving priority to buses at almost 50 per cent of these junctions by installing a loop and a beacon-based bus priority. An accelerated programme will continue over the plan period by adopting new Global Positioning System (GPS) based iBus technology. The programme is designed to integrate with the iBus programme and will be installed on the bus fleet and at traffic signals between 2007/08 and 2010/11.

A number of new initiatives have been included in the programme, including third generation bus priority (3GBP). Following the development of the London Bus Initiative and route 38 pilot, the 3GBP programme has been adopted to reflect a network corridor management approach to bus priority focused on high-density bus routes

### Technical services and iBus

Technical Services Group (TSG) provides innovative, reliable and best-value technical solutions and services aimed at enhancing passengers' experience, bus operators' service management capabilities and TfL's business overall. TSG operates the Band III bus radio, AVL networks and Countdown. The key requirements of these systems are to provide emergency 'code red' systems at CentreComm, RTPI at 2,000 bus stops across the bus network and service control facilities for bus operators at 90 garages.

AVL is used for performance monitoring and historic journey time analysis to support bus network planning and the optimisation of route schedules. The AVL system also supports bus lane enforcement cameras and SVD at junctions.

### New technology development (iBus/Countdown)

London Buses' fleet of more than 8,000 buses is to receive a new radio and bus monitoring system. It will harness satellite-based and short-range, high-speed data technology to help operators provide a better regulated and more efficient service.

The central system and equipment on the buses will be completely replaced, resulting in improved radio coverage and reliable AVL to support better service reliability and meet current and future business needs. iBus will provide additional and enhanced interfaces, making data more readily accessible.

Geographic Information System (GIS) mapping will be used for 'code red' calls, on-bus low bridge alarms and digitisation of bus lane enforcement cameras, and will support a range of future applications such as on-bus CCTV in real time. The system is an enabler for new telematics options such as a virtual 'Countdown on a phone' interface and new Countdown sign technology (Countdown II).

Audio and visual next-stop information will be provided on all buses. The new location technology will allow for enhanced bus priority schemes to operate at junctions.

Research has shown that the on-bus 'nextstop' signs and audio announcements, as well as the range of information that they will present, will provide extensive benefits to all passengers, especially disabled people.

Countdown II is an enhancement and replacement programme that will utilise new sign technology advancements available in the current market. The programme will replace the current 2,000 obsolete on-street RTPI signs and roll out a total of up to 4,000 signs.

### Traffic operations

The Directorate of Traffic Operations (DTO) is charged with 'keeping London moving'. This is achieved through the optimisation of London's traffic signals and road network performance and includes mitigating, minimising and managing congestion. The London Traffic Control Centre (LTCC) monitors London's roads 24/7. It also coordinates planned events and incident responses in collaboration with London Buses and the Metropolitan Police.

The directorate has the responsibility for the design, installation and commissioning of all traffic signals schemes on the TLRN and BPRN in the Greater London area (as the traffic authority). Among other responsibilities are the design, development and deployment of equipment, including CCTV and variable message signs and the provision of real-time information to journey planning and modal choice.

The purpose of the Investment is to:

- Improve the provision of real-time traffic information to the LTCC and stakeholders. This will be achieved through the expansion of the proportion of the network covered by data sources such

as split-cycle offset optimisation technique (SCOOT), automatic number plate recognition, CCTV cameras and the development of supporting IT solutions

- Design, develop, modify, install and maintain in a state of good repair, traffic signals, CCTV, network monitoring control and information systems
- Continue development of technological solutions to support traffic management and operations in the future
- Support the additional demands on TfL to both monitor and react in real time to the needs of the 2012 Olympic Family transport
- Continue to manage traffic flow in London dynamically and in real time

### Transport policing and enforcement

The Transport Policing and Enforcement Directorate (TPED) is responsible for delivering transport policing and enforcement services across TfL operational businesses.

TfL's Investment Programme supports the work of TPED through developing the enforcement infrastructure and installing a further 75 CCTV cameras per year from 2006/07 through to 2010/11. Including existing units, this will deliver an enforcement network of around 650 CCTV cameras. The Investment Programme will also deliver a digital traffic enforcement system (DTES) across CCTV, bus-mounted and fixed-camera networks, information management infrastructure for the London-wide Removal Service and the Maintenance Enforcement and Traffic Regulation Order System. This programme will continue until 2010. Ongoing enforcement infrastructure maintenance and renewal, to maintain a state of good repair, is also incorporated.

### Congestion Charging

The Congestion Charge division is responsible for: Operating and improving the existing charging scheme; rolling out the western extension; designing, consulting on and managing the implementation of the proposed London Low Emission Zone (LEZ); carrying out trials into new technology; and progressing the re-let of existing contracts.

The London Congestion Charging Zone has been extended westwards to cover most of the Royal Borough of Kensington and Chelsea, and Westminster south of Harrow Road. The extended zone went live on 19 February 2007. New assets include enforcement cameras and number plate reader equipment, and the IT equipment and databases required to operate the extended scheme, as well as new signage.

The investment programme also supports a series of technology trials of road user charging equipment. The evaluation of new technology is aimed at reducing scheme operating costs, improving vehicle detection rates and allowing for increased charging flexibility. It will also enable better informed decisions to be made about possible ways forward for road user charging in London over the foreseeable future.

The LEZ seeks to deter the most polluting vehicles from driving within Greater London. HGVs, buses, coaches, heavier light goods vehicles (LGVs) and minibuses are required to meet certain emission standards. Operators whose vehicles do not meet the emission standards would need to: Fit pollution abatement equipment; replace their vehicles with newer, cleaner models; and reallocate their fleet so that only compliant vehicles run into London, or pay a substantial daily charge. The first stage of the scheme went live in early 2008.

The Congestion Charging Re-let programme includes activities to establish new contracts for the operation of the extended zone. The programme also includes the replacement of the enforcement cameras and number plate readers in the existing zone and the design, testing and delivery of new IT systems to operate the scheme. The plan includes the provision of automatic vehicle detection technology, dedicated short-range communication (DSRC), or 'tag and beacon', across the Congestion Charging network to facilitate the introduction of more flexible charging.