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CALIFORNIA PATH PROGRAM
INSTITUTE OF TRANSPORTATION STUDIES
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Observations on European Advanced Traveler Information and Traffic Management Systems

Youngbin Yim, Jean-Luc Ygnace

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**Observations on European
Advanced Traveler Information
and Traffic Management Systems**

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Transports Et Leur Securite-Lesco

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PREFACE

This report contains information on the DRIVE program in Europe. It is intended to give an overview of the current efforts in ATIS and ATMS research and development by the European Community. This is the final report of the PATH program for the California Department of Transportation under MOU72.

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1.1. Background

The major issues associated with traffic congestion problems in Europe seem to be, as in most developed countries, the combination of a growing number of automobiles and a shrinkage of public funds for freeway construction. In the EC countries there are 120 million cars and car ownership has been growing at the rate of 4% a year. Consequently, traffic on international highways has grown at least 5% a year in recent years and freight traffic alone on interurban freeways in 1990 grew by 10% above the level of the previous year. The recent growth in the European economy and changes in the economic structure of commercial firms and industries (i.e., just-in-time delivery and flexible manufacturing) are expected to generate additional demand for inter- and intraurban freeways.

The cost of transportation is increasing relative to other household expenditures with each household spending, on average, 10% of its income for transportation. There has also been an increase in the marginal cost of transportation per output of the gross national product (GNP). In recent years, a 1% growth in GNP generated 1.5% growth in passenger traffic and 3% growth in freight transportation. It is expected that the growing economy of the European countries, coupled with severely limited highway investment funds will eventually generate a greater demand for surface transportation facilities. (The growth of the European economy in recent years has been about 2.5% per annum.) The cost of congestion in the EC countries is presently estimated at 500 billion European Currency Units (ECU) a year which accounts for 15% of the total transportation cost. As traffic increased, accidents also went up, with 1980s statistics showing more than 50,000 fatal accidents and 1,700,000 injuries a year for that decade.

Considering the scarcity of land, the limited resources, and the environmental impacts of new road construction, the EC's decision was to better utilize the existing road network with advanced information and telecommunications technologies. For several years, the EC countries have been aggressively promoting research and development of intelligent vehicle and highway systems called Advanced Transport Telematics (ATT).

To support the R&D effort of ATT, the European Parliament and the Council of Ministers formally adopted in 1988, a three year community research program, DRIVE, to be carried out between 1988 and 1991. The purpose of the DRIVE program was to increase the efficiency of the existing road capacity by means of applying ATT technologies for the improvement of safety and environmental quality. The initial phase of the DRIVE program was devoted to the exploitation and development of technologies and was completed in December 1991. The subsequent phase,

DRIVE II, began in January 1992 and is to be carried out over a three year period, ending in 1994. This phase of the work is devoted primarily to technology verification, assessment, and integration through field trials and demonstration projects. The third phase of the DRIVE program will be devoted to the full scale commercialization of those technologies if the potential benefits prove themselves to be realistic.

Currently it is assumed that the more cars equipped with in-vehicle communication devices, the more benefits there will be and, thus, the demand for ATT services will soon exceed the sales of the ATT system itself. This assumption is based primarily on the projected market demand of the ATT systems in Europe, which is that by 2010, 90% of the 190 million European vehicles will be equipped with processor, communication, and interface devices for inter-active driver information, navigation and safety systems. By the year 2020, there will be a market for ATT equipped vehicles of 50 billion ECUs with 10 to 15 billion ECUs of ATT infrastructure equipment work (Commission of the European Communities, 1992). As demand increases, the European market will be fully integrated in the ATT systems financing and information services, including a system integration in national and regional administrations, auto industries, insurance companies, radio stations, and telecommunications networks. In the near future, perhaps within 5 years, the European Community is expected to compete with Japan and the U.S. in the world market for commercialized ATT products. By then the commercialized European in-vehicle devices will be more market driven; with the products being desired mostly by drivers, operators, and infrastructure owners.

In Japan, 200,000 cars are already equipped with autonomous navigation systems. As seen from Europe, Japan is expected to compete for the ATT solutions in the world market; their technology is believed to be already well ahead of the U.S. Therefore, according to European researchers, the technological competition in the world market, at least in the near term, will be more likely with Japanese than with American products.

In Japan, advanced driver information systems are near deployment (Ervin, 1991). By 1995, the major cities in Japan will provide a continuous radio broadcast of travel time and other traffic information in most urban areas. The in-vehicle devices, ranging from a few hundred to thousands of dollars, depending on the capabilities of the system, will be commercially available for traffic information and vehicle navigation services, Collision warning and other active safety innovations are also expected to be marketed widely in Japan. By the year 2000, a basic level of advanced traveler information systems will be in place throughout Japan and head way control and

automatic collision avoidance products will be commercially available.

The European ATT deployment schedule was originally in line with that of the Japanese, with the placement of the core ATMS infrastructure in 1995. This schedule is now moved to the late 1990s. The primary reason for the delay is that the diversity of culture, language, and infrastructure conditions in Europe creates complexity in system integration. One challenge of the European system is reaching an agreement among the EC countries in establishing a common framework that is compatible and interoperational throughout Europe. While the two-way communication systems are agreed to be beneficial for the future ATT systems, the debate continues over the choice of technology for the communications infrastructure. It is not yet clear whether that infrastructure should be a new, dedicated, beacon-based system, or a cellular radio system (Catling, 1992). The other reason for the delay is the uncertainty associated with the database requirements to produce accurate digital maps for reliable vehicle navigation and route guidance information. In the DRIVE II program, directives for the standardized ATT systems are actively being sought through collaborative research projects and development of commercial products. It is anticipated that during the second half of the 1990s, new European cars will be equipped with in-vehicle navigation systems linked to a centralized dynamic traffic information database (Kimber, 1992).

1.2. The European Challenge

As mentioned earlier, the major challenge of the European Community is the establishment of functional specifications, European standards, and a compatible network for all services in an “open” system. The functional specifications in Europe require flexibility in the integration of existing systems and in the implementation of new systems at various stages of technology development in different environments. In the specifications, the different situations at technical and institutional levels need to be considered, particularly where local, regional, and national authorities are responsible for the infrastructure and decide the investment and deployment strategies. Workable protocols are also needed for encouraging fair competition and for managing the risks of investment. Investors need to comply with a consistent set of concepts for engineering, verification, and implementation of the ATT technologies. Many separate hardware and software initiations in different countries are being developed, (e.g., TRAFFICmaster and TravelPilot), and these systems need to be integrated with the current and future systems.

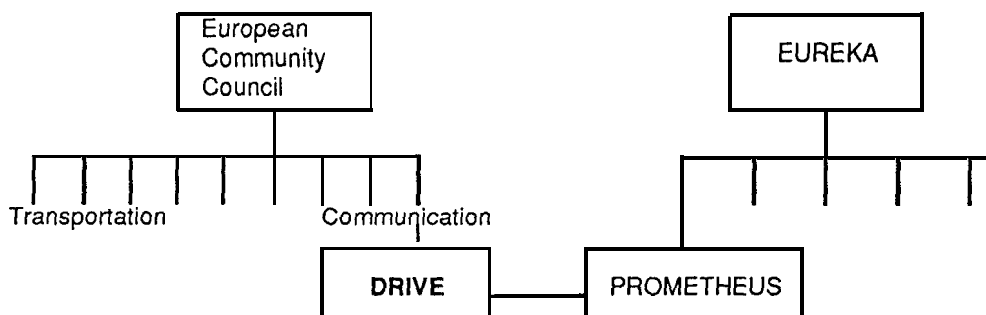
The DRIVE program is therefore aimed at the development of the European ATT which can be

built on a common European road environment through a collaborative effort among the EC countries, while bringing order to the diversity of the parallel development in ATIS and ATMS technologies. The major issues involved in the system specifications seem to fall in the following three areas: 1) the standardization for system integration; 2) the road network and geometric configuration; 3) the communication and information technologies.

1.3. Other Research Programs

Within the framework of EUREKA (European REsearch Coordination Agency), there is a cooperative research program known as PROMETHEUS, (PROgraM for a European Traffic with Highest Efficiency and Unprecedented Safety). Both programs share similar objectives, to support drivers by optimizing road utilization through the application of the latest information and telecommunications technologies, but the research focuses are quite different. The research interest of PROMETHEUS is in development of vehicle communication and safety systems while DRIVE is focused on the community issues related to traveler behavior, standardization, and technology deployment. The current research subjects in PROMETHEUS include conflict zone monitoring, vision enhancement, collision avoidance, cooperative driving, and autonomous intelligent cruise control. PROMETHEUS is complementary to DRIVE and there has been a close coordination between the two programs (Figure 1.1). Since 1986, European automobile manufacturers and their suppliers, the electronic industry, and a large number of research institutes have been participating in the PROMETHEUS program. A greater number of private firms participates in PROMETHEUS than in the DRIVE program.

Figure 1.1. Relationships between DRIVE and PROMETHEUS



2. DRIVE PROGRAM

Since the inception of the DRIVE program in 1988, there seems to have been a major shift in the perception of the European IVHS technologies. DRIVE I projects have shown the potential benefits of ATMS technologies; thus, there is a growing optimism that ATMS can be a primary road management solution to future traffic problems. Some of the commercialized traffic information devices are already deployed and more devices are expected to be on the market within a few years. To minimize redundancies and incompatibilities in product research and development, local and federal government authorities are actively engaged in the development of standards and specifications for advanced information infrastructure systems. The DRIVE program is now dedicated to verification and application of the ATT technologies. The following section describes the evolution of the DRIVE program over the past four years.

2.1. Drive I Projects

The DRIVE I program was undertaken over a three year period between 1988 and 1991. The R&D efforts of DRIVE I (Figure 2.1) were devoted primarily to technology exploitation in the Road Transport Informatics (RTI). There were four areas of research interest: 1) general approach and modelling to develop suitable tools to simulate and evaluate the effects of the Road Transport Informatics on users and society (15 projects); 2) behavioral aspects and traffic safety study road safety through RTI and to define functional specifications and requirements for the relevant RTI systems (14 projects); 3) traffic control studies to deal with traffic management problems, data acquisition, automatic detection of incidents, artificial intelligence, expert systems, and computer vision (22 projects); 4) the system engineering and consensus formation office (SECFO) to reach a consensus within Europe on the basic characteristics of the future Integrated Road Telematics Environment (IRTE); 5) services, telecommunications and database concerning the telecommunications and information flow (20 projects). These projects also studied the source of information and the use of information, including positioning systems, digital maps and driver information systems.

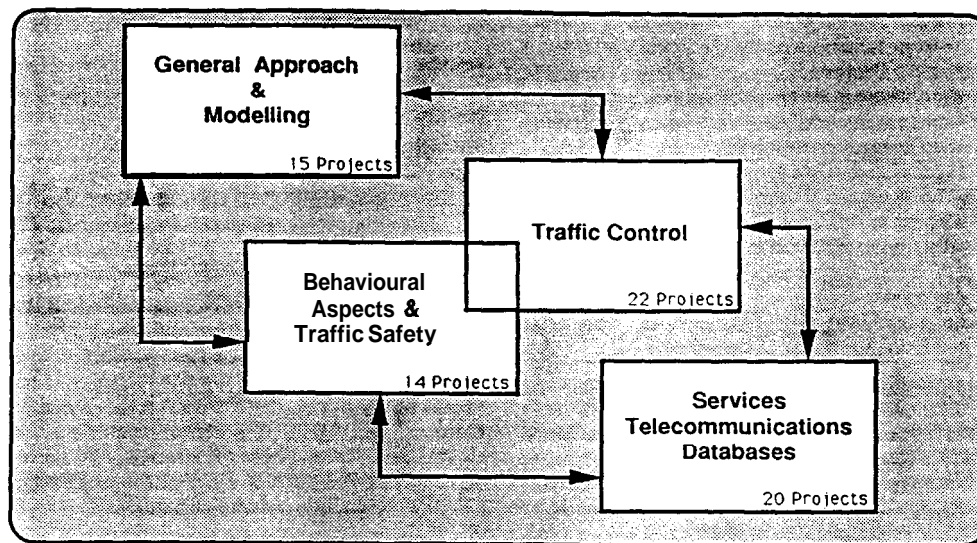
The five research subjects are: a) public transportation for more efficient use of the existing system and for attracting ridership; b) freight transportation for integrated freight and commercial fleet management and the associated functional characteristics of an RTI; c) digital maps and data

base specifications for traffic related attributes; d) information and broadcasting systems dealing with traffic information gathering and dissemination and the study of the use of electronic cards for portable travel and transport information systems; e) communication technologies for direct communications media (enabling technology) and indirect communication media (a form of public communication service) and for the development of an overall communication architecture and for RTI network concepts.

The DRIVE I projects were conducted by 71 consortia, primarily from the research and development sector of private and government organizations, and from industries and service producers. On the average, there were five to six partners in each consortium. DRIVE I was focused on the R&D work of different ATIS and ATMS technologies and on the identification of the best choice of the systems and implementation strategies from economic and technical perspectives.

Figure 2.1. Drive I Project Groups

(source: Commission of the European Communities,1992)



2.2. Results of the DRIVE I program

The most important contribution of the DRIVE I program was the consensus reached on the basic features of the future IRTE. A task force, SECFO, was also established for reaching consensus among the EC countries on the various levels of technology choices and implementation. The DRIVE I program made the European Community aware of available choices among alternative technologies for implementation, identified research areas in need of further development and evaluation of the RTI technologies, and defined the user interactions required in the early stages of the ATMS technology development and implementation.

The major achievements of the DRIVE I projects are the agreements reached among the EC countries on the standardization of the automatic debiting for toll systems, road pricing, and parking fees, the development of a master plan for Pan European trip planning and the level of air pollution reduction using telematics in urban areas. From the DRIVE I program, more than 350 technical papers were published in the following research areas (Appendix 1).

Traffic safety: algorithms for street safety at pedestrian crossings.

Traffic control: road condition and weather monitoring; video surveillance and image processing for automatic incident detection; a knowledge-based system prototype for traffic management and control in urban areas; algorithms and strategies for traffic control; data exchange between traffic control centers and integration of route guidance into traffic control systems.

Telecommunications: the technical feasibility of cellular mobile radio for a dynamic route guidance system (SOCRATES); a computer aided information and management system for the operation of an urban bus fleet and passenger information; a digital map for pilot projects.

In addition, various implementation strategies were developed. The DRIVE I program 1) defined priorities of ATT technology application, 2) arrived at a consensus for a European master-plan identifying the technologies to be tested and the corridors and cities to implement them, 3) recommended an inclusion of the Transport Telematic Network as an integral part of the Trans European Networks to the European Parliament and Council, and 4) created a Pan European non-profit organization (ERTICO) to promote the implementation of promising results of the ATT technologies.

2.3. Standardization and Protocols

The European ATT requires common specifications to permit economies of scale and to ensure compatibility between different countries. The specifications cover vehicle to roadside

communications and communications between national and international operators. DRIVE I established a technical committee to oversee and develop ATT standards and protocols. Because of the strong interest in the development of a common theme and in the establishment of a road environment on which the infrastructure of ATT can be built, nearly one half of the DRIVE I projects were devoted to research on the European specifications and formal standardization. The specifications developed under the DRIVE I program are as follows: RDS/TMC (Radio Data System and Traffic Message Channel defined by the European Broadcasting Union) for radio traffic message channel protocol; TARDIS for functional specifications for automatic debiting; GSM (Groupe Special Mobile - digital Pan European cellular system planned for the early 1990s) for the structure of a cellular radio network for transport application; DNT (DRIVE Normalized Transmission) for the concept of a bearer independent communication and interface architecture for telematics applications in road transportation; GDF for the concept and structure of geographical databases; SMARTCARDS for the standardization of the automatic debiting of moving vehicles; GIDS for the specification for an MMI interface for an electronic co-driver; VMS for the application and use of Variable Message Signs.

As a result of the increasing interest in Transport Telematics in DRIVE I and PROMETHEUS and other programs, the DRIVE II program is directed to setting standards and developing protocols for the following technologies: automatic fee collection and access control; smart cards; traffic data dictionary and exchange; geographic location referencing; traffic and travel information; man-machine interface; hazardous goods monitoring; public transport data models and transmission equipment; automatic ticketing; communication architecture and protocols; interfaces between traffic control services; integrated road transport environment architecture; freight and fleet management systems; extension of RDS/TMC protocol to urban areas and other information services; individual route guidance; parking management.

3. DRIVE II PROGRAM

In 1991, the European Parliament and the Council of Ministers authorized an extension of the DRIVE program for an additional three years to test and validate those information and telecommunications technologies that showed potential benefits for road transportation. The DRIVE II program continues within the framework of the ATT Technology development and application. The DRIVE II program is devoted to seven areas of research interest in ATT: 1) demand management; 2) travel and traffic information systems; 3) integrated urban traffic management systems; 4) integrated inter-urban traffic management systems; 5) driver assistance and cooperative driving; 6) freight and fleet management; and 7) public transport management. There are 56 projects in the program and 512 partners are involved in the project for various phases of the program. The DRIVE II program is set for a three year effort requiring 20,250 man months, almost twice as many man months as the DRIVE I program (12,000 man months).

3.1. Goals and Research Framework

The goals of the DRIVE II program are: 1) to establish a framework for the European ATT technologies through validation of those showing potential benefits; and 2) to establish common functional specifications and to promote standards. Because of the experimental nature of the DRIVE II program, a greater number of partners is involved in the program than was in DRIVE I; these are local, regional, national authorities and private industries, including telecommunications, automobile and service companies, as well as universities and research institutes.

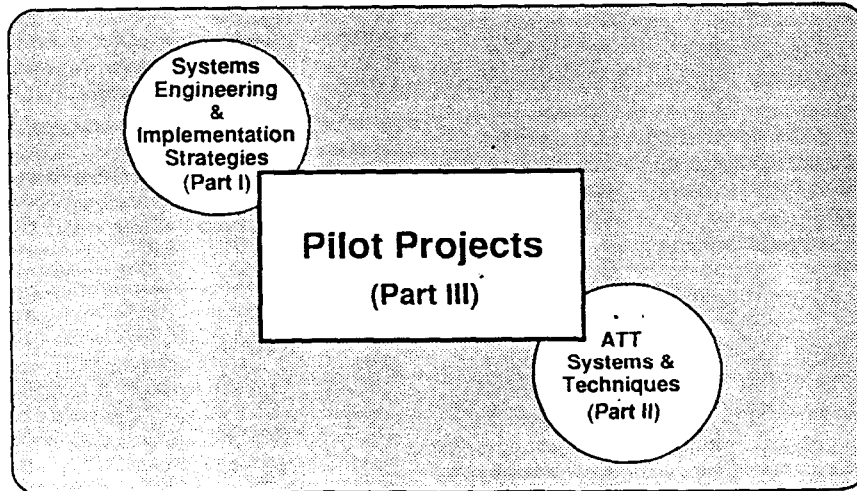
Within each area of the seven research interests, the projects are divided into three basic research activities: systems engineering and implementation strategies, ATT systems and techniques, and pilot projects.

1) Systems engineering and implementation strategies (21 projects)

The key activities are to specify the necessary technical requirements, to oversee the core projects, to evaluate the economic and social impacts of the selected technologies, and to develop a consensus on draft standards (Figure 3.1).

Figure 3.1. Interrelated Activities of the ATT Research Program

(source: Commission of the European Communities)



2) ATT systems and techniques (5 projects)

This research area deals with the management and control of road transportation, including hardware and software development. The research activities are primarily in the assessment of public policy needs in safety regulations in order to provide guidelines to producers and suppliers.

3) Pilot projects (30 projects)

These projects are concerned with the verification of ATT technology applications. They address traffic safety, system efficiency, and environmental consequences. The technical viability and performance of integrated ATT technologies and their appropriateness and applicability in the different European countries are experimented within field trials. Projects include the use of a core of infrastructure and administrative services to establish functional specifications for traffic control on freeways via telecommunications supplemented by ATT services.

3.2. DRIVE II Projects

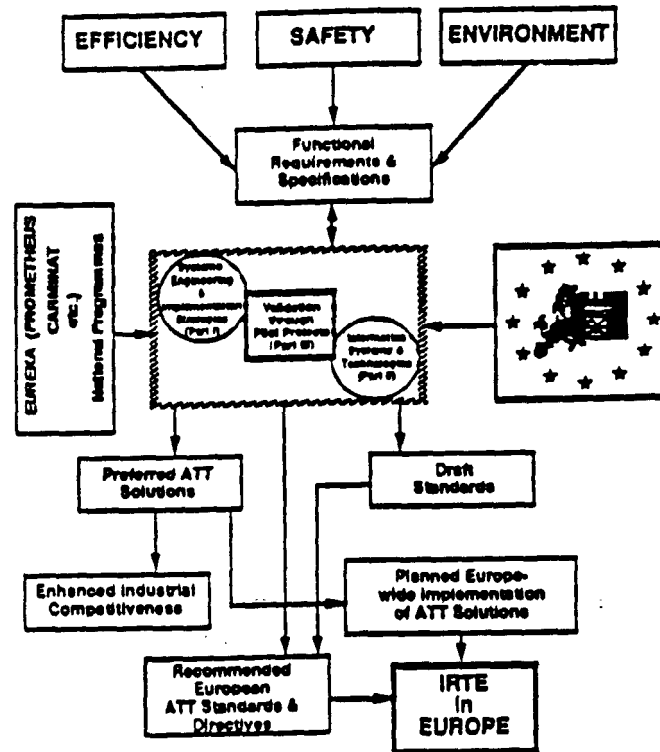
In the DRIVE II program, more than 70% of the program resources are devoted to experimental studies of technology application in cities and inter-urban corridors, for passenger and freight transportation (Appendices 2 and 3). The program index is in Appendix 4. The participating organizations are listed in Appendix 5, and a list of contact persons and telephone numbers is shown in Appendix 5. The seven areas of interest, in more detail, are as follows (Figures 3.2 and 3.3):

Figure 3.2. Research Activities related to ‘Areas of Major Operational Interest’
(source: Commission of the European Communities, 1992)

RESEARCH ACTIVITIES (Chapters of Workplan)		AREAS OF MAJOR OPERATIONAL INTEREST						
I. Systems Engineering and Implementation Strategies								
I.1	Functional Specifications and Systems Definition	●	●	●	●	●	●	●
I.2	Implementation Aspects	●	●	●	●	●	●	●
I.3	User Demand Evaluation and Modelling	●	●	●	●	●	●	●
II. Advanced Road Transport Telematics Systems and Technologies								
II.1	Information Management, Communication Architectures and Technologies	●	●	●	●	●	●	●
II.2	Development of Transport Management and Traffic Control techniques and systems	●	●	●	●			
II.3	Advanced Systems for Road Safety			●	●	●		
II.4	Freight Transport		●				●	
II.5	Public Transport		●					●
III. Validation through Pilot Projects								
III.1	Demand Management Systems	●		●				
III.2	Travel and Traffic Information Systems	●	●	●	●	●	●	●
III.3	Urban Traffic Management Systems	●	●	●				
III.4	Interurban Traffic Management Systems		●		●			
III.5	Driver Assistance and Cooperative Driving Systems				●	●	●	
III.6	Freight & Fleet Management Systems						●	
III.7	Public Transport Systems	●	●	●				●

Figure 3.3. Progress Towards the Integrated Road Transport Environment

(source: Commission of the European Communities, 1992)



1. **Demand management** (14 projects)

The projects in this category are concerned with the use of technology in assisting urban authorities and the managers of interurban transport to achieve a balance between traveler demand and the capacity of the road and rail network. Six projects are devoted to technology validation and implementation strategies for controlling the use of road space, access control and the provision and pricing of parking. The projects are aimed at testing the strategies of direct pricing for the use of the road via automatic tolling/debiting systems, including effective measures for policing and enforcement, and the use of multi-payment systems assisting the access to public transport .

CASH (Coordination of Activities for Standardization of Hades) is an effort to establish common functional specification for automatic debiting systems by reaching consensus between European operators and manufactures.

ADEPT (Automatic Debiting and Electronic Payment for Transport) is a system which will be built on a 5.8 GHz secure microwave communications link combined with a multipurpose smart card providing for all the payment needs. Four separate field trials will be conducted in Gothenburg, Lisbon, Thessaloniki, and Trondheim to demonstrate the on-street parking management and debiting method of nonstop tolling. Two sites are dedicated to multilane applications for testing enforcement strategies and congestion metering. An in-vehicle monitoring device will be used for the diagnosis of congestion levels and automatic debiting when certain levels of congestion are reached.

ADS (Automatic Debiting System) is aimed at an improvement of the traffic flow in the freeway network through European countries by the application of automatic debiting systems. The concept of multilane nonstop payment and multimodal information exchange for advanced booking will be tested through field trials in Italy near the Mont Blanc tunnel and the harbor of Brindisi.

GAUDI (Generalized and Advanced Urban Debiting Innovation) will launch a joint approach among five cities (Barcelona, Bologna, Dublin, Marseille, Trondheim and Rome) to define the scope of the experiments and to appraise multiservice urban debiting, road pricing, public transport ticketing, parking debiting and zone access systems.

BATT (Behavior and ATT) will evaluate changes in travel behavior resulting from ATT based on before and after comparisons of travel patterns. The experiment will use stated preference techniques, various forms of attitude analysis incorporating both revealed and stated preference data, simulation tools, classic econometric models, longitudinal surveys and analysis, and multicriteria analytic techniques.

MARTA (Monitoring Attitude toward Road Traffic Automation) will concentrate on the impacts of ATT on inter-urban and intra-European flows of passenger automobiles in coordination with the study in freight transportation where modal shares will also be affected by ATT. Techniques used are qualitative assessments of RTI/ATT options and its impact consisting of in-depth interviews of individuals or groups with the help of ad hoc instrument motivation guides, and oriented tests.

2. Travel and traffic information

11 projects addressing issues relating to the collection, processing and distribution of travel and traffic information for pretrip planning at home, in the office and in the course of a journey, whether as drivers of vehicles, public transport passengers or as fleet operators. Services such as traveler information, trip planning, route guidance and tourist information in a multi-modal environment are tested in an actual operating condition. These projects also address organizational and social issues concerning the provision of information and the response of users.

PROMISE (PROMETHEUS CED 10 Mobile and Portable Information Systems in Europe) will develop a multi-modal traveler information system incorporating the DNT concept for interconnection with an open system architecture using portable terminals. It investigates the potential benefits of two way communications devices utilizing the GSM and modern paging systems.

SOCRATES/KERNEL (System of Cellular Radio for Traffic Efficiency and Safety) is a pilot project to test the cellular radio system for the increasing efficiency of road capacity and safety. It analyzes and develops operational issues including the necessary liaison with standardization bodies, GSM (the European cellular radio system) coordination for technical developments, and the establishment of the DRIVE Normalized Transmission (DNT) program. Its aim is to prepare a standardized Pan European traffic information and communication system for the cellular radio technology.

ICAR (Integrated Confined Area RTI communication systems) will develop methods to extend the potential service of the GSM for vehicles inside confined areas, such as tunnels. The project will evaluate performance of leaky feeders and mode converters for a GSM retransmission in confined areas and will investigate the main benefits of using GSM for the SOCRATES (cellular radio service) type services. A tunnel in Belgium is the testbed project for this purpose.

EAVES (Evaluation and Assessment of Variable European Sign Systems) will provide a qualitative and quantitative assessment of VMS and integrated VMS/RDS-TMC systems on an European scale with special attention to the benefits for driver and fleet operators. The study will design and monitor the experiments to evaluate the benefits of these systems in different DRIVE II pilot projects.

INTERCHANGE will establish an European traveler information network (ET-NET) for real time exchange of ATT data between national traffic/travel information centers among the participating nations.

ATT-ALERT (Advice and Problem Location for European Road Traffic) will standardize the current communications protocol dealing with digital audio broadcasting (DAB), AM data systems (AMD), and digital radio communication systems (DRC), to enhance its capabilities in providing a comprehensive driver information service. Its aim is to develop essential protocols needed for the ATT implementation in addition to the existing RDS-TMC protocols and to pursue standardization at international level. This study will provide a consistent framework for the application of the ATT protocols to other media or bearers.

LLAMD (Euro-Project - London, Lyon, Amsterdam, Munich, and Dublin) is a pilot project among the five cities to develop a general theme of advanced travel and traffic information systems. Emphasis will be given to systems architecture for the integration of information relating to urban and interurban traffic and the interaction between route guidance and traffic management for parking, park and ride, urban public transport, and cross city freight movement.

GEMINI (Generation of Messages in the new Integrated Road Transport Environment) is a demonstration project to develop an integrated system for driver information. It focuses on the Radio Data System Traffic Message Channel (RDS-TMC) and Variable Message Sign networks. The trial sites are in Italy, France with possible additional sites in Spain.

ACCEPT (Alert Concerted Cooperation in European Pilots of TMC) will also test the RDS-TMC system in Germany and France. The Dutch Rhine Corridor has been chosen for the experimental test on the main corridor. The RDS-TMC system on this corridor will be interconnected through a cross-border traffic information transmission to the Ile de France project in the region of Paris. The Ile de France project is the test bed for the comparison and for the experimentation of the compatibility of the in-vehicle TMC terminals with the German system.

EDRM2 (European Digital Road Map2) will test the digital map database for a defined set of pilot applications within the traffic control and traffic management systems linked with real time traffic

information and other related events. The purpose of the study is to upgrade the GDF standards by including the dynamic data requirements for European countries.

CITIES (Cooperation for Integrated Traffic Management and Information Exchange Systems) develops and evaluates ATT systems dealing with dissemination and broadcast of traffic and route guidance information for traffic control and demand management through pilot projects in Paris, Brussels, and Gothenburg. The study will compare the effectiveness of one type of travel and traffic information services with other types.

3. Integrated urban traffic management

8 projects under this category of research are aimed at an improvement of transport systems through the integration of current systems in cities. The studies will focus on traffic network control, route guidance, travel and traffic information, parking management, emergency management, and environmental control. Traffic prediction tools and flow estimations will be integrated in signal control as part of the knowledge-based techniques for urban corridor control in the pilot projects.

ASTRA (Assistance Service for Travel and Traffic) investigates the feasibility of a dynamic interactive-integrated system to provide travel and traffic information services, including parking reservations and route guidance for drivers, dynamic scheduling for transit operators, and transit connection and shuttle bus services for transit patrons.

VRU-TOO (Vulnerable Road User Traffic Observation and Optimization) will identify behavior of pedestrians in an IVHS environment and will establish a set of basic rules for safe and unsafe interactions between pedestrians and vehicles. This project will test the advanced detector systems to improve conditions for pedestrians at signalized interactions and pedestrian crossings. It will take place in the urban areas of northern and southern Europe.

PRIMAVERA (Priority Management for Vehicle Efficiency, Environmental and Road Safety on Arterials) will develop integrated strategies for managing queues while giving priorities to public transit in an IVHS environment. The strategies will be dynamic traffic control measures using real time data and will be coordinated with the existing UTC and surveillance systems. The study will

evaluate the strategies from the efficiency, environmental, and safety points of view on main freeways and the intervening residential arterials. The strategies will be tested through field trials in two cities, Leeds and Turin.

EUROCOR (European Urban Corridor Control) is a project to test the traffic control and management model already developed for the integrated urban networks and infrastructure requirements for various levels of traffic using variable message signs. These modelling tools will be tested in mixed urban and interurban situations beyond the feeder network to allow a greater control of traffic flow by the use of variable message signs.

OUARTET (Quadrilateral Advanced Research on Telematics for Environment and Transport) will verify the benefit of integrating and coordinating RTI/ATT services by testing the concept in four cities; Athens (GR) for environmental control, Birmingham (UK) for public transit management and information system, Stuttgart (D) for dynamic route guidance and emergency call systems, and Torino (I) for the IRTE Architecture for public transit using the input from the studies done in other cities.

LIAISON BERLIN (Linking Autonomous and Integrated Systems for On-line Network and Demand Management in Berlin) is a feasibility study of the development and installation of a demand management system for selected areas of the CBD in Berlin. This project is to test the Integrated Network and Information Management (INIM) system covering the CBD priority radial arterial and the freeway ring around Berlin.

KITS (Knowledge-based and Intelligent Traffic Control Systems) will consolidate and enhance the prototype KLB system and conduct extensive experiments in four European countries including both urban and interurban test sites. The demonstration sites are at Cologne (D), Trondheim (N), Genoa (I) and Madrid(E). The project will test the application of real time traffic control systems suited for the combination of unstable and heuristic knowledge.

SCOPE (Application of ATT in Southampton, Cologne and Piraeus) develops and tests the broader application of ATT in three European cities, Southampton (UK), Cologne (D), Piraeus (GR) in the area of ATIS, the strategic information systems, public transit, and urban traffic management and control.

4. Integrated interurban traffic management

12 pilot projects address traffic control and driver information systems on freeways and parallel roads. They deal with automatic incident detection including techniques of image processing and comparative evaluation with other means of data collection. These projects will test traffic data interchange between control centers in neighboring countries to set Pan European specifications. The universal roadside processor for traffic, weather and road conditions, data collection and transmission will be validated. Weigh-in-motion and automatic toll collection systems will be incorporated into an integrated traffic monitoring system. Prediction of traffic flows and their incorporation into traffic control for route guidance via one way and two way communication systems will be carried out; these include the use of variable message signs.

INVAD II (Evaluation of the INVAID System in Motorway and Urban Pilot Projects) deals with the application of image processing and computer vision techniques for automatic incident detection. In DRIVE II, the feasibility of detecting incidents is being tested at the systemwide level using vision related and loop detector based data on freeways and on an urban arterial network.

HERMES (High Efficiency Roads with Rerouting Methods and Traffic Signal Control) is aimed at increased traffic safety and operational efficiency using knowledge-based information through the application of control strategies based on on-line O and D information.

EUROTRIANGLE is a feasibility study for integrated traffic control and information systems on the corridor connecting three European regions, Flanders and Wallonia in Belgium and Northrhine-Westphalia in Germany. The techniques being tested are image processing, incident handling, and interchange of information between regional control centers.

DYNA (a DYAmic traffic model for real time Application) will test an operationalized dynamic traffic model for real time traffic information. The model will provide short term forecasts of traffic flows and travel time information to traffic operators.

PORTICO (PORTugese Road Traffic Innovations on a Corridor) will test surveillance capabilities for hazardous goods vehicles using driver information and early warning systems, including incident detection and integrated automatic debiting with overload detection systems (weigh in motion). Several experimental studies are planned on the Portugese corridor.

MELYSSA (MEditerranean - Lyon-Stuttgart Site for ATT) consists of several field experimental studies planned to test the ATT technologies for the improvement of road efficiency, safety, and environmental quality on the motorway between Stuttgart and Lyon. The experiments will focus on the application of the ATT technologies explored in DRIVE I for real time traffic and route guidance information to drivers by interconnecting European traffic control centers for both urban and interurban roadway networks. The project team will construct both a static and dynamic data base traffic model to forecast traffic conditions by using video image processing and electronic data interchange systems. The information dissemination techniques to be tested are dynamic variable message signs, RDS/TMC for driver information, cellular radio systems, videotex, radio telephone and public information terminals.

OUO VADIS (QUeue Obviation by VARIable Direction Information Signs) will investigate the traffic control strategies of VMSs and compare alternative strategies using the simulation technique to predict driver response to VMS.

ARTIS (Advanced Road Transport Informatics in Spain) is a pilot study on the Junquera-Seville corridor aimed at the development of a strategic plan by the Spanish Government to establish a national and international network for travel and traffic information, knowledge based intelligent traffic control, automatic incident detection using artificial vision techniques, VMSs using RDS/TMC and dangerous goods control systems.

GERDIEN (General European Road Data and Information Exchange Network) will develop an information network for road traffic data collection and exchange between the European Community countries. The study will identify the required infrastructure for dynamic traffic management in the inter-urban parts of the Integrated Road Transport Environment (IRTE). The key component of this study will develop a network which will be flexible for the integration of the Advanced Road Transport Telematics for all levels of technology application. The study is carried out by partners from Netherlands, England, and Germany.

ROSES (ROad Safety Enhancement System) focuses on the implementation of a fully integrated traffic, road condition, and weather monitoring and control system to improve traffic safety and winter season road maintenance using integrated roadside and vehicle based monitoring and

information systems. The techniques being used for this study are simulation and indoor testing in a controlled environment using research vehicles and drivers in Netherlands and Wales.

PLEIADES (Paris-London corridor Evaluation of Integrated ATT and DRIVE Experimental Systems) will demonstrate an integrated driver information and network management system on the Paris-London corridor. The test site is the main corridor between England and France and is an important gateway to other European countries. The project will identify the preferred system, define infrastructure constraints for system implementation, and outline detailed plans and a timeline for system design and deployment strategies.

RHAPIT (Rhein/Main Area Project for Integrated Traffic Management) will test the cellular radio technology (SOCRATES) for implementation of a dynamic route guidance system. The concept of SOCRATES will be tested with 650 loops and 100 equipped vehicles for collecting and disseminating floating-car and dynamic traffic data in Frankfurt. This project is a first time effort to apply a full scale GSM standard radio telephone system to demonstrate the use of cellular technologies for automatic incident detection, integration of information on traffic flow from the dynamic route guidance system, congestion prevention and rerouting strategies using the existing variable message signs.

5. Driver assistance and cooperative driving

10 projects will test the prototypes of on-site in-vehicle and integrated monitoring and enforcement systems and the feasibility of an in-vehicle recorder, in driver information and assistance for the presentation and scheduling of driver information. The aim of this research is to develop a system for assisting the driver and to communicate information between vehicles, focusing on man-machine interaction techniques for improving the effectiveness of the systems. The research will focus on the development of tools for design specification and evaluation of man-machine interfaces including examination of the needs of elderly and disabled drivers and the corresponding specifications.

HOPES (Horizontal Project for the Evaluation of Safety) will develop a basic framework for prospective and retrospective safety analysis and investigate the effects of ATT on road safety.

ARIADNE (Application of a Real time Intelligent Aid for Driving and Navigation Enhancement) focuses on the intelligent driver support system including a collision avoidance radar sensor and processor.

EMMIS (Evaluation of Man Machine Interface by Simulation techniques) is aimed at an improvement of driver interfaces on onboard information systems and to validate evaluation tools for assessing driver performances.

SAMOVAR (Safety assessment Monitoring on Vehicle with Automatic Recording) will determine the feasibility of an in-vehicle device for recording traffic accident and driver behavior by assessing the potential impact of different recording devices.

HYRDIE (Harmonization of ATT Roadside and Driver Information in Europe) focuses on the standardization of man-machine interface for the ATT technologies based on the analysis of the in-vehicle presentation techniques. The presentation techniques evaluated include safety, clarity, audible, and visual means of presentation, harmonization of text and symbols and compatibility between in-vehicle and external information. The study will establish guidelines and standards for in-vehicle presentation. The primary participants for this study are INRETS in France and the Transport Research Laboratory in England.

DETER (Detection, Enforcement, and Tutoring for Error Reduction) will develop and test on-site, in-vehicle, and integrated monitoring and enforcement systems through simulation and field trials. The user acceptance of the systems is being tested by field experiments and on-site tutoring.

TESCO (TEST on Cooperative Driving) will test the cooperative driving on highways with intelligent cruise control and intelligent maneuver control. The experimental work will be done with 10 vehicles covering 800,000 km over a six months period.

COMIS (COmmunication using Millimeter wave Systems) will test the cooperative driving and intelligent cruise control using a 60-64 GHz Millimeter wave Monolithic Integrated Circuit transceiver over the duration of the DRIVE II program (three years).

EDDIT (Elderly and Disabled Drivers' Information Telematics) deals with the problems of drivers suffering from reduction in perception and cognition for driving. The study attempts to develop ways of assisting these drivers using ATT services if the ATT technology proves to be advantageous to the drivers.

TELAID (TELEmatic Applications for the Integration of Drivers with special needs) will identify requirements of handicapped drivers for the ATT technology application and propose guidelines and standards for equipment design based on the results of surveys and field demonstrations.

6. Freight and fleet management

5 projects focus on freight and logistic management systems to enable intermodal operations. These pilot projects deal with infrastructure requirements in technical specifications for freight management systems and in standardization for freight operators.

COMBICOM is aimed at the development and the installation of a road/rail information system for communication of all operational information among operators, including shippers, haulers, freight forwarders, customs, and consignees. The test sites are the corridors connecting Munchen-Kufstein-Brenner-Verona.

FRAME emphasizes freight management on the control and monitoring of hazardous goods shipments both on land and sea. The experimental sites are channel crossings, the Welsh corridor and a remote terminal operation between Netherlands and Greece.

CITRA (System for the control of dangerous goods transport in international alpine corridors) is an international Alpine pilot project through Germany, Austria and Italy and proposes an integrated monitoring and control system to optimize hazardous and dangerous goods transportation.

METAFORA will evaluate mobile data communication activities on eleven different pilot tests between North-West Europe and Greece.

IFMS will create an open system architecture for computer aided and integrated functional specification and implementation strategies. The system will be validated through pilot projects in

controlled logistics on a Pan European scale, including urban and interurban transport operations. Based on this experiment, the research team will recommend functional specifications and standardization for Pan European implementation strategies.

7. Public transport management

3 projects will develop, implement and test an integral vehicle scheduling and control system for advanced public transit technologies applied to interurban and rural situations. The main focus of the study is to develop functional standardization of public transit for European countries. These projects will assess the possibilities in integrating urban networks with user information in vehicles and at transit stops using RDS and interactive street terminals with an intelligent interface. There will be demand responsive services in the demonstration projects that give active priority to public transit and emergency services. For the study of the integration of public transit into an urban area traffic control system, twelve different urban sites will be tested.

PHOEBUS is an integral vehicle scheduling and control system covering all the functions required for urban, interurban and rural public transport applications within integrated urban networks. There will be a full scale demonstration project in Brussels to test user information inside the vehicles and at stops using RDS radio broadcasting; it will develop algorithms to create networks with variable route and variable schedule lines for a demand responsive bus system.

EUROBUS is an experimental project to test an advanced computer for passenger information in public transport with a common transport data base and a geographic information system for transit schedules and road networks.

PROMT will develop and test the methods for giving active priority to buses, trams and emergency vehicles in urban traffic control systems. There will be field tests in three European cities with real time adaptive urban traffic control systems; SCOOT in London, UTOPIA in Turin, and SOCRATES in Gothenburg.

3.3. Other projects

Independent from the projects included in the general plan of the DRIVE II program, there are a number of technology research and development projects underway, mostly in England, France, and Germany among local and regional authorities and private companies.

ROMANSE is a test bed project to experiment with the multi-modal transportation systems in Southampton, England (Tarrant and Turner, 1992). The project was initiated by the Hampshire county Council and is funded by the DRIVE program, but is not a part of the ongoing DRIVE II general program. The aim of this project is to establish a comprehensive, real time, multi-modal information center which can collect, evaluate, coordinate and disseminate both real time and forecasted information on networks and service requirements for travelers by automobile, bus, train, ferry, and plane. ROMANSE is an integrated traffic control and traveler information system with public transport and geographic information. During 1993-94, this integrated multi-modal transit information system will be tested and field studies will be carried out for system evaluation. The ROMANSE project was initiated to encourage transit ride, park and ride, and park and share (carpooling) through bus priority schemes, passenger information systems, and vehicle monitoring and management systems.

The Siemens' Euro-Scout central computer will be used with appropriate models to provide route recommendations. As a part of the pilot project, the routing algorithms already developed will be tested and evaluated for their effectiveness. Subject travelers will be provided with strategic trip planning and tactical enroute information services through various dissemination tools including radio broadcast, (RDS-TMC and local radio, other broadcast (teletext, cable TV, videotext), variable message signs (advisory route advice, parking guidance and special needs such as bridge closures) and passenger information (onboard buses, trains and ferries at terminals).

Using Geographic Information Systems (GIS), the database will be created for operational and strategic information in the TTI center. It will collect all data in static situations with the measures to cope with the dynamic data such as changes in parking regulations by time of day or infrequent changes in traffic regulations. It will also store historical information relating to traffic and accident statistics, and weather environmental and road condition data.

4. EUROPEAN IN-VEHICLE INFORMATION SYSTEMS

Four in-vehicle information systems currently being investigated in Europe are RDS/TMC, TRAFFICmaster, Euro-Scout, and SOCRATES. These systems have demonstrated the technical feasibilities to this date, although they are at different stages of development and application. RDS/TMC is currently in use in Germany. TRAFFICmaster, the first commercialized dynamic in-vehicle information system, is already being deployed in England and is planned for expansion in other European countries and in the US. Euro-Scout is a beacon-based dynamic route guidance system. The feasibility of the beacon-based system has been demonstrated in Berlin previously and more recently in London. A full scale demonstration of SOCRATES is currently underway in three European cities.

4.1. RDS-TMC

RDS/TMC (Radio Data System/Traffic Message Channel) is a system for disseminating traffic information by means of the designated sideband of existing FM radio broadcasts. To establish European TMC (Traffic Message Channel) standards, RDS is currently being tested on 14 trial sites with the consultation of the European Broadcasting Union and the European Conference of Ministers of Transport. This system is more suitable for radio traffic information services than paging or cellular systems, because its two-way communication capability does not allow a full scale onboard navigation system for dynamic route guidance information services. The field trial projects for RDS/TMS include the Rhine-Corridor in Germany connected to Ile de France in the Paris region for in-vehicle TMC terminal for comparison and compatibility tests. As it stands, this technology is most likely the one to be implemented in the immediate future.

4.2. TRAFFICmaster

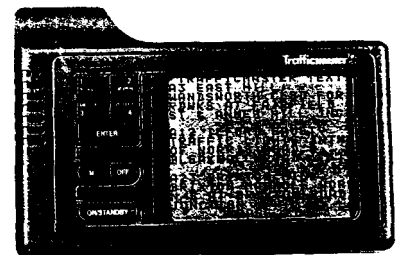
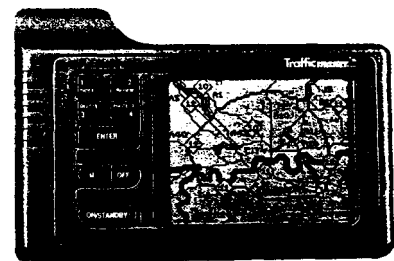
TRAFFICmaster is a transportable in-vehicle device for dynamic traffic information services. It automatically alerts drivers with up-to-the minute traffic information on freeway congestion (Mat-tell, 1992). The system developed by General Logistics PLC in England, entirely with private investment, has been commercially available for approximately two years. The service currently offers traffic information on major freeways in London in addition to personal paging. Since its commercial introduction, more than 10,000 customers have subscribed at a fee of approximately

\$50-60 a month for the traffic information and an additional \$15 fee for personal paging. Within the next six months, the services will be expanded to the major urban freeways in Birmingham and the connecting freeways to London. The technical feasibility of the system for traffic management on an urban network is currently being tested in Southampton.

In the London region, two hundred infrared twin beam detectors are mounted side by side on overhead bridges to record vehicle speed in each direction, from which the degree of congestion is determined at a given time. The speed information is reported to the centralized control center, where the average vehicle speed is computed every 3 minutes with a speed up-date every minute. The speed information is displayed on a 5" x 6" LCD (Liquid Crystal Display) monitor. The TRAFFICmaster is 12" wide x 6" high and mounted on the dashboard. It uses the existing radio communication system available for paging; the paging system is found to be more economical than cellular radio or satellites. This device is very similar to the California device called WAY TO GO, at least in concept, and the device called SEREL by Renault in France. The SEREL project has been abandoned because of the potentially high subscription cost.

TRAFFICmaster is a simple and low cost device which performs very well for collecting and disseminating traffic information. Here we have an interesting situation where a private company, without public subsidy, developed devices for traffic management and control systems. In a few months, TRAFFICmaster plans to have an AVL capability via satellites.

Figure 4.1. TRAFFICmaster Unit



4.3. Euro-Scout

Euro-Scout is a beacon-based dynamic route guidance system developed by Siemens. Its original model, ALI-SCOUT, was tested in the LISB trial in Berlin from 1987 to 1990, and is still in limited use. ALI-SCOUT equipment was also tested for the London Autoguide Demonstration Scheme. Using the most current traffic information and short-term traffic predictions, the system calculates optimal routes throughout a network for an individual traveler. The road information relevant to the surrounding area is downloaded to each beacon, and when the equipped vehicles pass the beacons, they receive the best route for their destinations via an infrared link. The communications link is a two-way system so that the beacon also receives data from equipped vehicles on current traffic conditions. The received information can then be sent to the control center for monitoring the quality of traffic information throughout the network. Euro-Scout is a more sophisticated in-vehicle unit than the systems mentioned earlier. Its current system also has the ability to provide public transit and parking availability information to the driver of an equipped vehicle.

4.4. SOCRATES

SOCRATES is an alternative approach to Euro-Scout using cellular radio channels for traffic information. It was the largest project in the DRIVE I program and has fully demonstrated the technical feasibility of the concept. The SOCRATES plan is to use specific frequencies from the Pan European GSM digital cellular radio system, which will replace the existing analog system during the 1990s. The system broadcasts the data to all equipped vehicles via cellular radio in an individual cell. A multiple-access protocol will allow the traffic condition data to be transmitted back to the control center from equipped vehicles. SOCRATES can support autonomous navigation systems, such as CARIN and TRAVELPILOT, by providing traffic and dynamic route guidance information.

In DRIVE II, three pilot projects will test the full scale implementation of the SOCRATES concept in London, Gothenburg and the south Hessen region around Frankfurt. Forty companies are actively working on the development of SOCRATES for route guidance projects. The current thinking is that a digital communications system linked to vehicles will be financially justified on the basis of route guidance and driver information services. This suggests a number of other possibilities such as fleet management; traffic monitoring through emergency calls; and transit, parking, and park-and-ride information; most of which are currently under investigation.

4.5. ATIS Application

It is generally agreed that ATT cannot offer solutions to the congestion problems via dynamic route guidance or advanced traffic control. Many government authorities in Europe, at least, in professional circles, are increasingly convinced that demand needs to be managed through other means, such as public transit and parking information. Although there is a strong conviction that advanced transit information service has had little impact on transit ridership, solutions are still sought for the provision of better information on public transit and on parking facilities to encourage transit services such as park and ride. A number of pilot projects in DRIVE II are actively investigating the possibility of providing information about alternative modes of travel to automobiles. However, these studies do not seem to include traveler behavior, i.e., to what extent does information technology encourage transit ridership.

The most probable application of advanced two-way communication systems in the immediate term is for fleet operation and management. Fleet operation can greatly benefit from the ATT systems by being able to locate vehicles immediately in real time. Combining Euro-Scout and SOCRATES together as an onboard vehicle location system with two-way communication offers the AVL capability. The traffic information and dynamic route guidance information provided through SOCRATES would also help increase productivity in fleet operations. The early market for the advanced in-vehicle systems is likely to be concentrated on the fleet sector.

Traffic control is another area of cellular application. The operational efficiency of an urban network, particularly as it approaches saturation, is critical, depending on the techniques used for controlling the traffic signals. The SCOOT traffic-responsive traffic control system developed at the Transport Research Laboratory is claimed to be the most advanced system in the world. The SCOOT system takes input from traffic sensors, then determines delays and queue lengths to adjust traffic signal settings in real time. Systems such as SCOOT can potentially benefit from ATT by getting more detailed real time data. The APPLE project in London is currently investigating the benefits of SOCRATES for SCOOT. There has been a cooperative effort in the test of SOCRATES from the cellular industries because the traveler information is viewed as value added service.

5. SUMMARY AND CONCLUSIONS

This report contains information on European ATIS/ATMS technologies to date. The material is a broad overview of European research efforts in IVHS technologies, based primarily on observations made during a three month period from September through December 1992. The report covers the subjects based on what is available in the recent literature and the information gathered through personal interviews, conferences, and site visits.

As in the U.S. and Japan, the major thrust of the European automation interest seems to be in the application of ATIS and ATMS technologies. No explicit research interest in highway automation appeared in the recent literature or in conference proceedings. However, human factors research on the interface between drivers and automobiles in an IVHS environment is well underway and much of the ergonomics research for in-vehicle information systems for the DRIVE II program is being done by French and German researchers (in France, mostly at INRETS). In the DRIVE II program, over 20 projects out of 57 total address engineering psychology and physiology for human safety and for emergency warning systems. The European expert opinion, however, is that Japan is far ahead of Europe in ergonomics.

Most information presented in this report is about the DRIVE II program, mainly because this project is the single largest effort publicly funded in Europe. Nine countries are collaborating to solve traffic problems by means of ATIS/ATMS technologies in some 40 major urban areas. The DRIVE II program began on January 1, 1992, and is scheduled to run until the end of 1994. The main objective of DRIVE II is to validate the results from the DRIVE I projects through field trials or pilot projects. The DRIVE II program has a strong emphasis on the integration of ATT technology applications within the pilot projects. There are currently 56 projects in the program and about 20 are major field trials. The five largest urban field trials, known as Euro-Projects, were all developed from an initiative known as POLIS; there are some 30 major European cities participating in this effort. A number of other pilot projects concerned with interurban transportation management are developed from an initiative known as CORRIDOR, a parallel initiative of POLIS. Dynamic route guidance systems will be installed in three of the Euro-Projects and a major field trial called STORM is being implemented in Stuttgart to evaluate the concept of a dual-mode route guidance system. In Amsterdam, the city authorities are planning to install Euro-Scout beacons with specific emphasis on providing parking, park-and-ride, and public transit

information to drivers as a demand management strategy. There is an interest in integrating EURO-Scout and SOCRATES in a single control center. Another Euro-Scout system is planned in Munich to test the concept by integrating the system with other ATT applications and particularly with a planned centralized traffic information pool.

5.1. State of the European Technologies

Concerning Geographic Information Systems (GIS), as yet there is no standardized map database or protocols for the European Community. The project called EDRMC hopes to establish basic protocols and common European standards for geographic data files in data acquisition, modelling, and exchange of geographic data among the EC countries.

The traffic data collection techniques used in European cities are mostly rely on loop detectors, video cameras, and infrared detectors. The Ile de France project, using the SIRIUS system, is perhaps the most extensive undertaking of infrastructure development with loop detectors in Europe. The French SIRIUS system, a major component of the CITIES project in DRIVE II, is considered to be the most advanced and comprehensive traffic management system using variable message signs in Europe. An extensive system of loop detectors is being installed in Amsterdam for traffic control and management through variable message signs. In London, the primary means of gathering real time traffic and road information is through infrared detectors installed by a private company with private investment funds to provide a real time traffic information service called TRAFFICmaster. The city will eventually be equipped with loop detectors and video cameras. The cellular radio technology for the collection of real time data is neither being tested nor is it on the near term research agenda.

As to data dissemination methods, several techniques are being investigated, including in-vehicle devices such as RDS-TMC, paging, beacon-based, and cellular radio. But there seems to be a number of projects concerned with the standardization of roadside dissemination techniques, such as the installation and location of variable message signs. There are several field trial projects underway, including those in Paris, London, and Amsterdam. One of the research interests in the VMS application is to identify how messages displayed on the roadside can be transferred into vehicles as input to navigation computers or repeated to the driver through internal displays or other media.

Road pricing is another area of active research in Europe. This concept is more feasible in Europe than in the U.S. because private toll roads are widely accepted in Europe and there are extensive networks of toll roads, especially in France and Italy. In Spain, more toll roads are planned to be built to serve the entire network. Although toll roads are mostly interurban, road pricing is viewed as an effective means of demand management. Several demonstration projects are studying the effectiveness of electronic toll methods.

In general, implementation of ATMS/ATIS technologies in Europe seems to be somewhat ahead of the U.S. schedule, at least in the experimental stages of technology validation and system standardization. As shown in the DRIVE II program, the majority of the demonstration projects address the advanced information systems for multi-modal purposes. Although there have apparently been some delays in the progression of full scale ATMS implementation, the first phase is most likely to be in freight transportation. In two years, the extensive experimental work will be completed under the DRIVE II program and the experience gained from these pilot projects will establish the common basis for implementation of the European ATMS infrastructure.

It appears, however, that the current approach to IVHS research in Europe is still technology driven; a considerable amount of market research has yet to be carried out. There also seems to be no explicit research interest in the benefit assessment of IVHS technologies. The major research activities have been carried out based on the assumption that the economic and social benefits are proportional to the number of equipped vehicles.

5.2. Lessons of the DRIVE Program

The overall impression of the European IVHS program is that their research emphasis is on the practical application of IVHS technologies as compared to the theoretical approach seen in California. Real time traveler information services are already provided in some European cities. Several traveler response studies are currently underway, including evaluation projects in Paris, Amsterdam, and London. What can be learned from the DRIVE program? Elements of the DRIVE program which are in the advanced stages of technology application are as follows:

1) Institutional aspect

a) Standardization

There is a cooperative effort to establish standards for a Pan European interoperable ATMIS

system. Its purpose is to encourage industries to work with prototype protocols and standards so that overall economies of scale in production and services can be achieved. The effort is also directed towards industry to create a Europe-wide market for ATIS equipment manufacturing. Some standards and protocols have already been developed for communication technologies.

b) Marketing

Two objectives of the ATT marketing plan are to aggressively promote ATMIS in local communities through public education and to foster the competitiveness of European industry in the international market. The EC countries are currently defining an European position in the world market.

c) Collaboration among cities for field demonstration

Over twenty major cities are collaborating on field trial studies for technology validation. Large scale testbed projects are already underway to assess the travel behavior of motorists using variable message signs and cellular telephones. In-vehicle navigation devices are scheduled to be tested in 1994. Each urban area will test different technologies to avoid redundancies in technology demonstration.

d) Common approach to evaluation of pilot projects

To provide a common frame of reference for evaluation of the field trial studies, the EC countries are developing a single approach with a common methodology that can be applied to all pilot projects. The "Kernel" project is responsible for developing evaluation methodologies. A task force was formed to address the methodological concerns.

e) Private sector initiatives and public support

There have been private sector initiatives to solve urban traffic problems without public financing. As an example, TRAFFICmaster is developed solely with private funding. The English Ministry of Transportation is now helping the company through market research to expand and promote their products in the international market.

f) Research focus

The European ATMIS research focuses on technology application and validation of promising

technologies. Based on the initial stage of technology exploitation, promising technologies were selected and the research focus is now on these selected technologies.

g) Cooperation among research programs

The DRIVE and PROMETHEUS programs are cooperatively working toward a common goal and the DRIVE II workplan established collaboration with PROMETHEUS. Many researchers involved in DRIVE also participate in the PROMETHEUS program. Representatives of PROMETHEUS regularly attend meetings on the DRIVE program.

2) Technology transfer

a) Congestion pricing

To develop demand management strategies, congestion pricing and automated toll collection are being tested in Goteborg (Sw), Thessaloniki (Gr), Trondheim (Nor), Lisbon (P), and Cambridge (UK). The European trend increasingly favors the "user fee" approach where users directly pay the cost of facilities in the form of tolls. Feasibility studies of variable congestion-pricing for roads and parking facilities are currently underway. Automated toll collection is already in operation in many parts of Europe.

b) Expert systems

"Expert systems" here refers to the software technologies to solve traffic problems by way of specifying a set of rules based on knowledge. In Europe, such techniques are believed to be well suited for traffic control and management. SIRIUS uses an expert system that currently handles all stages of traffic management and information systems for the Paris region. KITS is in the process of developing a knowledge-based traffic control model for various applications, including: inference and completion of traffic data from sensors, analysis and diagnosis of traffic conditions, qualitative prediction of traffic behavior, and management of control actions.

c) Communications technologies

Four types of communications technologies for in-vehicle information systems have already been demonstrated for their technical feasibility. Large scale test projects are currently underway for RDS/TMS, paging, cellular, and beacon systems. These technologies have already been demonstrated as feasible means of providing multi-modal traveler information data to drivers.

d) Human factors research

Human factors research is focused mostly on the interface between the driver and in-vehicle and roadside traveler information systems. Research concerns are mostly with the placement of onboard display units in relation to driver position, voice interaction, and the display of messages in relation to the driver's ability to comprehend the messages (Vernet, 1992). The ergonomics research in Europe is far more extensive than it is in the U.S.

e) System integration

Whether they function as service providers or as control/management centers, most European cities have traffic operations centers. Each system usually has its own management structure and protocols for communication and develops its own database and employs its own computer language. The QUARTET project has as its goal the integration of these individual systems by applying the basic principles of open-architecture with common database and access rules. There has also been an effort to integrate existing technologies rather than to develop new technologies.

f) ATIS in public transportation

As in California, European cities are actively promoting transit ridership through the use of traveler information systems. The main goal is to encourage a modal shift from private automobiles to buses and trams by informing people about travel conditions and travel options. A full scale implementation program is underway in Cologne, Southampton, and Piraeus (the SCOPE Cities).

Advanced traveler information systems have demonstrated the important role they have in mode shift from single occupancy vehicle to transit. The transit information system deals with passenger information, pre trip information terminals, variable direction and information signs, and driver information services. Real time travel information can be received at home or at the work place, on the street and at operator-controlled terminals. The onboard route guidance system displays details of the routes that the bus follows and the odometer shows information on how far the bus has traveled. As the bus passes infrared beacons along the route, the computer information is updated with the exact location of the bus. This system provides real time information on the bus schedule via arrival time at each bus stop. At the stop, a three line text displays the route number, destination, and estimated arrival times of the next three buses.

5.3. Opportunities for Collaboration

A number of opportunities exist between EC countries and California for collaboration in IVHS research and development.

a) Development of software in traffic control systems

Although the traffic problems in European cities are not similar to those in U.S. cities, there has been similar interest in developing traffic control and management systems. Freeway control systems in the U.S. are more developed than in France or other European countries because of the highway expansion program in the 1950s. In Europe, private toll roads were encouraged to meet transportation demand. Almost all new highways in recent years have been built by private entrepreneurs. Only a few years ago, European cities began thinking about solving traffic problems without building additional highways. The current research interest in traffic management is similar to the U.S.

England is much more active in urban traffic-control software research. A French researcher developed a traffic light simulator called OPEC at a university; this later became a commercial product. This is one of the highly advanced traffic engineering simulators, yet there is a concern about how well the product will do in the market. It is thought that technology transfer is not an issue; the question is whether or not people are willing to use products driven by technology. Traditional freeway control systems would not be able to provide reliable results in incident detection both in urban and rural freeway conditions. A collaboration effort is currently underway between Virginia Tech and French Academics and industry to develop software called VELEC for freeway traffic management. Standard hardware will be used for this software. INRETS is participating in this collaboration.

b) Exchange of research findings

A number of demonstration projects are underway in Europe in various areas of research, including traveler behavior, market research, system architecture, and technology integration. The U.S. research interests are similar to the European. It would be beneficial if the work in both regions could be compared to learn about the similarities and differences in these research findings.

c) Joint manufacturing of ATIS components

Joint manufacturing opportunities for IVHS products exist. Project California is attempting to

identify opportunities to collaborate with industries in Europe in order to create jobs in California. Similarly, the UK and France are attempting to export services and ATIS devices to the U.S. Recently Trafficmaster entered into a contract with Westinghouse to set up hardware systems, provide training, and market their products in the midwestern parts of the U.S.

5.4. Suggested Approach

Given that the nature of traffic problems in the U.S. is different from the ones in Europe, the question is what should PATH emphasize in light of DRIVE?

a) Clear objectives for technology deployment

In general, the DRIVE program does not seem to have clear objectives for technology implementation. In-vehicle communication technologies for European standards are largely in debate.

b) Market driven approach

Even though researchers and administrators emphasize the importance of the market driven approach, very little work is performed in market research for ATIS products. Much of the R&D efforts are still based on the technology driven approach.

c) Regulatory requirements

Federal and local governments have imposed increasingly stringent requirements for obtaining permits to operate ATIS services. The goal is to regulate IVHS products for compatibility and interoperability of the system. More stringent regulations make it increasingly difficult for the private sector to obtain permits to provide services and distribute products.


Suggestions for the future R&D efforts in California are: a) to develop clear objectives for technology selection and deployment, b) to develop ATIS products based on market demand through extensive market survey efforts, c) to encourage collaboration between the public and private sectors for standardization and product development as seen in the TravInfo project, and d) to provide flexible permit procedures for industry to freely participate in the market within the basic guidelines of industry practice and regulations.

Appendices

Appendix 1

Achievements of DRIVE I

(source: Commission of European Communities, 1992)

Project	Main deliverable	Impact
V1001 BARTOC: Integrated Public Transport WCS	Specification of requirements and standards for recommended  for public transport Vehicle Scheduling and Control System	Improvement of efficiency and reliability of VSCSs integrating fare collection, passenger information, priority, etc. with emphasis on on-line functions e.g. schedule adherence and control.
V1002 SMILER : Short Range Microwave Links: Present and Future	Recommendations for European standards concerning short range road to vehicle communication links.	Comparative evaluation of the already developed microwave technologies in the 2.5 GHz, 6.6 GHz and 9.9 GHz bands for short range communications between road and vehicles. Comparison of these technologies with other comparative links, like cable systems, infrared links and microwaves in the millimetric spectrum (60 GHz) on the basis of their performances, their cost, their reliability and cost of installation. Investigation of the feasibility of a unified link able to fulfill the requirements of road to vehicle and vehicle to vehicle communications. Synthesis of the potentialities of microwaves for RTI implementations.
V1003 VAMOS : Requirements and System Specification for Dynamic Traffic Messages	White book of recommendations for the use of dynamic traffic messages	Demonstration of the use and the utility of dynamic traffic messages to provide information to the driver. Set of recommendations for providing information by variable message signs.
V1004 DREAM: Feasibility Study for Monitoring Driver Status	Report about the feasibility of monitoring driver's status. System recommendations.	Demonstration of the necessity for, and the feasibility of, a multiple sensor monitoring device.
V1005 PREDICT : Pollution reduction by information and control techniques	Methods for pollution monitoring. Development of alternative RTI-based control strategies.	Development of a scheme to reduce environmental pollution in Central Business Districts through traffic operation and control measures.
V1006 DRIVAGE : Factors in Elderly People's Driving Abilities	Report about elderly driver's reaction to RTI innovations; implications for driver and road-user safety, and for road and equipment design.	Basis input for RTI system developers, so that any specific needs of elderly people's can be taken into account.

THE ACHIEVEMENTS OF DRIVE I

Project	Main deliverable	Impact
V1007 SOCRATES : System of Cellular Radio for Traffic Efficiency and Safety	Recommendations for specifications of 'An RTI System Based on Cellular Radio'.	<p>Demonstrate the feasibility of dynamic route navigation systems based on cellular radio.</p> <p>Demonstrate that the proposed communication links can also provide applications such as hazard warning, emergency calls, automatic vehicle location, road pricing, hotel/parking status, etc.</p> <p>Suggest how the technology developed for cellular radio could be best used, in simplified equipment, for DRIVE purposes.</p>
V1008 Strategies for Integrated Demand Management	Setting up and evaluation of various strategies for integrated demand management systems in congested urban areas of Europe and the resulting optimum system architecture with the use of RTI technologies	Better control of congestion in urban areas with the use of RTI technologies for optimum traffic restraint policies in congested European cities.
V1009 Vehicle location systems using satellites	Study report on economic and operational advantages of using satellites for vehicle location.	Deliverables suitable for use as a preliminary decision-base for further research work into low cost satellite systems. However, the research was completed during 1989 and is therefore of limited value.
V1010 PANDORA : Prototyping a navigation database of road network attributes	Methodology for network data extraction from digital map. Field trials following development and upgrade of CDF standard. Contribution to standardisation and property right issues.	Demonstrate the practical use of the G D P data transfer format for the production of navigation databases. Assessment of the operational issues dated with the maintenance of a navigation database and additional services.
V1011 CAR-GOES : Integration of Dynamic Route Guidance and Traffic Control	Strategies and system specifications for an integrated system running together route guidance and traffic control techniques	Demonstration of the achievable benefits for different levels of integration of route guidance system in traffic control centres, together with other services
V1013 CERACS : Comparative Evaluation of the Different Radiating Cables and Systems Technologies	Report describing the place of the cable systems in an RTI organisation as well as the advantages and inconveniences of these systems compared with their concurrent*.	Production of a methodology permitting an easy prediction of the performances of radiating cables on whatever particular site.

THE ACHIEVEMENTS OF DRIVE I

Project	Main deliverable	Impact
V1014 IMAURO Integrated model for the analysis of urban mode optimisation	Construction of dynamic traffic test model including data acquisition and data base system	Availability of model to test RTI applications in small urban areas such as distance warnings, overtaking aids, etc
V1015 CLAIRE : Artificial Intelligence Based Systems for Traffic Control	Knowledge Based System Prototypes for Urban Traffic Control	Demonstration of the applicability of solutions provided by artificial intelligence to solve traffic control problems in urban areas.
V1016 INFOSAFE An Information System for Road User Safety and Traffic Performance	Prototype of an INFOSAFE Expert System	The framework of the information flow to the driver, will allow traffic managers to increase safety on traffic performance.
V1017 BERTIE: Changes in Driver Behaviour due to the Introduction of RTI Systems	Report on the strategy for information presentation, and description of behaviour changes due to the introduction of RTI systems.	Quantification and evaluation of the behavioural changes of RTI systems in terms of safety and usability as a basis input for evaluation and modelling activities.
V1018 TARDIS The Total Traffic Management Environment	IRTE functional requirements, recommendations for standardization	Guidance to maximize the potential for integration between different RTI applications. Common specifications for automatic debiting systems and for the integration of mad pricing with automatic toll collection. Contribution to the process of defining a specification for the application layers of the two-way vehicle-to-roadside communication link, fundamental to the establishment of the IRTE. Identification and structuring of the possible applications to be included in the standardization process. Development of a traffic data flow simulation model (TARSIM).
V1019 CASSIOPE Computer-Aided System for Scheduling, Information and Operation of Public Transport in Europe	Specification of requirements and demonstration of a second generation computer aided system for scheduling and control of urban public transport systems.	Improvement of efficiency and reliability of VSCS's with emphasis on off-line function. e.g. timetable planning, vehicle and driver scheduling etc... -Assess benefits of new generation integrated VSCS

THE ACHIEVEMENTS OF DRIVE I

Project	Main deliverable	Impact
V1020 Tidal Flow Systems	Development and demonstration of tidal flow systems in Lisboa and Barcelona, recommendations for implementation and operation	Demonstration of the efficiency of tidal flow systems to increase the capacity of the existing road infrastructure
V1021 Task force "European Digital Road Map"	Proposal for a European standardisation procedure, Detailed report on logistical problems of data manufacturing, map database, and traffic management. Benchmark test and analysis report	Technical framework for the production of a common roadmap and a proposal for a European standard (CDF2.0)
V1022 Realisation of a Real Time Urban Traffic Control System	Specification of a traffic control system for one or several intersections and for the central unit equipment	Demonstration of the industrialisation need of Prodyn algorithm
V1023 EUROTOPP A new, integrated RTI oriented transport planning process	Software and manual of tools to aid traffic forecasting and planning during and following the introduction of RTI systems	Provision of updated tool and models to enable accurate planning following RTI introduction
V1024 Driver Information System	Handbook on the strategies for and architecture of information systems. System specifications and recommendations	Integration of existing systems into one Europe-wide system
V1025 EURONETT Evaluating user reaction on new European transport technologies	A suite of sub-models including activity patterns, travel choice and psychological models and an umbrella model for long term forecasts	Researched and proven models incorporating RTI effects on user behaviour
V1026 INVAID Integration of computer vision techniques for automatic incident detection	Prototype of an incident detection system and field trial	Improving road safety and road transport efficiency by improved traffic monitoring using computer vision techniques
V1027 EUROFRET A European system for international road freight transport operation	Review of existing systems, preferred strategy and recommended organisational structure for users	Proven and researched strategies for future implementation, with critical functions specified and investigated; considering major issues on environment, road taxation, etc.
V1028 TUNICS Tunnel integrated control system	Recommendations for the architecture of an integrated tunnel control system and recommendations for field trials	Demonstration of the possibilities of RTI for improving tunnel transport safety and efficiency

THE ACHIEVEMENTS OF DRIVE I

Project	Main deliverable	Impact
V1029 Standards for RDS-TMC throughout Europa	Guidelines for location coding and message sets. Software development for message generation and evaluation of decoding methods. Draft proposed pre-tender to RDS-TMC specifications.	Progress towards standardisation and improved application for road transport
V1030 PAMELA Microwave Communications for Traffic Monitoring and Pricing	Delivery and testing of a microwave link prototype for automatic two-way data-communication between vehicles and the roadside.	Demonstration of the potential of a microwave link for identification, monitoring, control and pricing of traffic.
V1031 An Intelligent Traffic System for Vulnerable Road User	Computer model of behavior of pedestrians and cyclists	Creation of a set of tools for traffic management to enhance the safety and mobility of vulnerable road user.
V1032 STRADA - Standardisation of traffic data transmission and management	Specification of a European Integrated Traffic Data Transmission and Management System.	Important milestone in the standardisation of the dictionary as well as the transmission and management system to be used when exchanging traffic data between traffic data producers and consumers. Reduced equipment costs due to standardization. Easy access to traffic information stored anywhere in Europe.
V1033 AUTOPOLIS Automatic Policing Information System	Recommendations for the development of on-rite and in-vehicle prototypes	Determination of the technical potential of, and requirements for, automatic policing systems that will be able to warn the driver and prevent illegal behaviour.
V1034 RIMES : Road Information and management EURO system	Synthesis report on state of the art. Definition of data elements for road data bases. Recommendations for RDB technology	Strengthen the needs of the road authorities and identification of necessary interfaces with navigation database; recommendations for standards
V1035 CHRISTIANE : Motorway traffic flow monitoring and control	Prototypes of linear and network motorway control and field experiments	Definition of automatic control techniques for the control of motorway network
V1036 EVA : Evaluation process for road transport informatics criteria, methods. test production	Evaluation framework, sensitivity studies and results on test reproduction of reference candidates	Guarantee that all evaluation work is carried out using the same criteria, allowing results to be compared like for like.

THE ACHIEVEMENTS OF DRIVE I

Project	Main deliverable	Impact
V1037 STAMMI Definition of Standards for In-Vehicle Men Machine Interface	Draft ● tendvdr for in-vehicle man machine interface	Harmonisation o f e rgonomic standards e nd guidelines f o r in-vehide MMI in Europe and development of a criteria checklist for the design of in-car information ● systems.
V1038 DACAR -Data Acquisition and Communication techniques end their Assessment for Road transport.	Report on the assessment of basic data acquisition and communication techniques for use in RTI systems.	Provides recommendations o n the applicability e nd suitability o f the most promising data acquisition and commuaicrtioa techniques for RTI applications.
V1039 ATTAIN : Survey of Potential Applications of Artificial Intelligence to Solving Traffic Engineering Problem	Report on potential use of AI techniques for traffic engineering	Improvement and guidance for the exploitation of artificial intelligence tchniqu to traffic ● nginearinc.
V1040 Safety Scenario - Identification of Hazards	Utilisation of different models to predict the common European hazard situations in which RTI techniques are likely to have their maximum effect in reducing traffic accidents in Europe.	Identification of some RTI devices that can have a favourable impact on common-types o f accidents i n European Countries
V1041 CIDS Generic Intelligent Driver Support System	Report □■ ● pecification and development of the CIDS prototype	Design, prototype development and standards recommendations for a class of intelligent co-driver systems.
V1042 ITHACA In-depth Accident Data Collection and Analysis	European Proforma for collection of data for in-depth accident ● ◆■ □□ end studies. Prototype expert system for in-depth accident data analysis.	Traffic controllers will use this multi-stage accident documentation process for future developments in traffic safety.

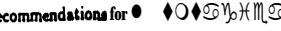
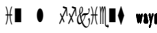
THE ACHIEVEMENTS OF DRIVE I

Project	Main deliverable	Impact
<p>V1043 CIDER - DRIVE Integrated Telecommunications</p>	<p>Drive communications system architecture handbook.</p> <p>Model for dimensioning and optimizing the telecommunications and information processing infrastructures.</p>	<p>Establishment of capabilities of existing and planned public mobile communication systems for DRIVE applications.</p> <p>Proposals for further development of telecommunications network structures and standards necessary to support the evolving IRTE.</p> <p>Proposal on error correction schemes.</p> <p>Recommendations for extra-urban signalling and communications systems.</p> <p>Preliminary recommendations on optimum methods and systems for dealing with information flow in an IRTE in a cost-effective manner via the concept of the Drive Normalised Transmission (DNT).</p>
<p>V1044 FLEET Freight and logistics efforts for European traffic</p>	<p>Fleet management requirements specifications and outlook for system design, implementation scenario and proposed standards. Demonstration project and specifications</p>	<p>Widely acceptance of proposed functional specifications for freight and fleet management system interfaces to external services (customs, traffic information, etc.)</p>
<p>V1045 PARCMAN Parking Management, Control and Information Systems</p>	<p>Specifications of parking information networks, standard framework for parking control, specification and design of the information system and a demonstration prototype based on real-time information and selection of strategies</p>	<p>Demonstration of more efficient parking management systems (2nd generation of parking systems)</p>
<p>V1046 FRIDA Framework for integrated dynamic analysis of travel and traffic</p>	<p>Modelling framework with evaluation criteria and guidelines for optimal use, including results of sensitivity tests of modelling framework</p>	<p>Behaviour model for travel and driven to test RTI based policies</p>
<p>V1047 ODIN Origin-destination information versus traffic control</p>	<p>Urban and extra-urban dynamic algorithms to achieve and use origin/destination information</p>	<p>Better adaptation of traffic control to main traffic streams</p>
<p>V1048 DOMINC Advanced control strategies and methods for motorway RTI systems of the future</p>	<p>Comprehensive analysis of the problems related to feasibility and introduction of convoy driving</p>	<p>Study of the feasibility of introducing co-operative driving</p>
<p>V 1049 Field trials</p>	<p>Manual of recommendations and specifications concerning field trials for RTI services</p>	<p>Basis for the pilot project stage of relevant DRIVE (and future) projects</p>

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Project	Main deliverable	Impact
V1050 DRACO Driver and Accident Coordinated Observer	In vehicle 'black box' accident recorder	To provide data to assist in the reconstruction of road traffic accidents
V1051 DRIVE SAFELY : Procedure for Safety Submission for RTI Systems	Draft pre-standard for software and hardware development for RTI systems	A support to standard definition activities that will be required for computer hardware and software components for use in road transport systems.
V1052 ICARUS Interurban control and road utilisation simulation	Reports on finalisation of models, completion of micro-simulation and estimates of RTI effects	Recommendations on analysis of the connection between RTI systems and speed, flow and capacity on interurban roads
V1053 MODEM : Modelling of emission and consumption in urban areas	A model of exhaust noise emissions and fuel consumptions, and a set of driving cycles in urban areas	Mathematical models proven by practical testing showing the effects of enhanced traffic control systems on vehicles' exhaust and noise emissions.
V1054 ASTERIX : System and scenario simulation for testing RTI systems	Development of an integrated traffic simulation system for testing RTI systems at different levels in large urban areas complete with user manual	New software to estimate the quantitative effects of the impact of introduction of RTI systems
V1055 AI Techniques for Traffic Control	Implemented and tested KBS prototype for traffic data collection, data analysis and interpretation, traffic prediction and traffic control.	Applicability and effectiveness of the use of artificial intelligence techniques applied to traffic control problems.
V1056 MONICA System integration for incident-congestion detection and traffic monitoring	Strategies for urban and extra-urban strategies for automatic incident detection, software for one system based on UTC sensors	Improved traffic safety and road transport efficiency by improved traffic monitoring
V1057 SECFO Systems engineering and consensus formation office	IRTE Policy objectives, application scenarios, communication architecture, RTI, standardization issues, IRTE strategy assessment and IRTE implementation plan.	Integration of systems and standards throughout DRIVE, and development of IRTE Policy objectives, and a long term implementation plan.
V1058 CROW Conditions of road and weather	System architecture and improved data acquisition and forecasting techniques for an integrated road condition and weather monitoring system.	Better risk assessment under bad weather conditions. Faster response to (expected) emergency conditions. Higher reliability in road condition assessment. Identification of critical spots along the road under bad weather conditions in relationship with traffic circumstances. Defining the best sensor location. More effective salt spraying.

THE ACHIEVEMENTS OF DRIVE I

Project	Main deliverable	Impact
V1059 SPECTRUM Strategies for preventing road traffic congestion	Recommendations for  for prevention of road traffic congestion. Field trial on a section of German Motorway applying a new method for congestion prevention developed in Italy	Applicability of strategies for preventing traffic congestion in urban areas and on motorways
V1060 SMART Electronic cards for travel and transport	Specification of the most promising application of smart cards	Use of new smart cards possibilities to improve exchange between users and their transport means
V1061 PUSSICATS: Improvement of Pedestrian Safety and Comfort at Traffic Light	Pedestrian detectors, algorithms, recommendations on traffic control strategies	Development of new sensors for pedestrians for traffic control systems.
V1062 Multi-layered Safety Objectives	Analysis of factors causing accidents, development of models, and formulation of multi-layered safety objectives	Identification of situations where RTI interventions can improve road safety 
V1063 VIC : Vehicular Integrated Communications	Investigation into protocol suitability for vehicle to vehicle communications with recommendations on the most suitable.	Assessment of the relative constraints of vehicle to vehicle communications when compared to those of vehicle to infrastructure communications.
V1064 UROP Universal Roadside Processor	Open reference architecture for a multipurpose roadside system in an integrated RTI infrastructure.	The architecture contributes to the overall modelling of the DRIVE IRTE. It can serve as a hardware and software independent reference description for the implementation of modular roadside systems and for the definition of national standards for roadside systems for chosen infrastructures.
V1065 SIRIUS Sociopolitical Implications on RTI Implementation and Use Strategies	Identification of sensitivities which positively or negatively affect the RTI implementation process and to identify the socio-political impacts of RTI adoption. Recommendations of optimal ways of introducing and phasing RTI policies given socio-political impacts.	Optimization of the RTI implementation process in Europe referring to positive and negative effects and side effects given intentions and interests of the different actors involved. Suggestions for strategies will take into account prevailing social and political conditions.
V1066 PULSAR Parking Urban Loading Unloading Standards and Rules	Development of a model to predict demand and supply of on-street parking in urban areas, taking into account the problems of loading and unloading operations. Recommendations and guidelines for technical and legal modifications	Solutions and recommendation* for avoiding congestion from parking and loading/unloading vehicles in urban areas

THE ACHIEVEMENTS OF DRIVE I

Project	Main deliverable	Impact
V1067 IMPACT - Implementation Aspects concerning Planning and Legislation	Proposal for international planning procedures for • implementation and identification of needs for changes in legislation to assure an • effective development and Europe-wide introduction and functioning of RTI •	Contribution to the necessary development of common standards for RTI systems, functions and components. Contribution to the necessary coordination and changes in laws and regulations for implementation of RTI • systems in Europe.
V1068 CHRISTINE Characteristics and Requirements of Information Systems based on Traffic Data in an Integrated Network Environment	Recommendations on the traffic data exchange between traffic information and control centres.	Contribution to a more effective interchange of data among traffic control and information centres resulting eventually in a better traffic information service to the travellers and drivers.
V1069 Car Pooling System Management	Development and demonstration of car pooling systems in a metropolitan area and in rural areas	Identification of gaps and • shortcomings of present procedures, and use of RTI techniques to realize car pooling system management
V1070 PARIS Project for the economic Assessment of Road transport and traffic Information Systems.	Recommendations on the choice of RTI technologies.	Quantitative (using econometric modelling) and qualitative assessment of the matrix of RTI related industry, will contribute to understand the effects of technical decisions on European industry competitiveness.
V1072 FIORE: Funding and Investment Objective for RTI in Europe.	Assessment of RTI systems financial performance.	Market assessment and financial scenarios to address potential investors • source.
V1073 EUROTRIP European Trip Planning System	Development of a prototype and field test of a Trip Planning System	Trip Planning facilities to be used by various groups and actors in the transport field

Appendix 2

Core Activities in DRIVE II

(source: Commission of European Communities, 1992)

THE CORE ACTIVITIES IN DRIVE II

Key: • AREA ADDRESSED + PRINCIPAL AREA	PROJECT AREAS							PROJECT TYPES						
	DEMAND MANAGEMENT (1)	TRAVEL & TRAFFIC INFO. (2)	INT. URBAN TRAFFIC MGT. (3)	INT. INT URBAN TRAFFIC MGT. (4)	DRIVER ASSISTANCE (5)	FREIGHT & FLEET MGT. (6)	PUBLIC TRANSP. MGT. (7)	PILOT PROJECTS	FEASIBILITY STUDY ONLY	SUPPORTING R&D	KERNEL PROJECTS	PROGRAMME MGT.		
V2001 ASTRA	•	•	• +				•		*					
V2002 HOPE5	•	•	•	•	• +	•	•				*			
V2003 COMBICOM						• +		*						
V2004 ARIADNE		•			• +					*				
V2005 VRU-TOO			• +		•					*				
V2006 EMMIS		•			• +					*				
V2007 SAMOVAR					• +	•			*					
V2008 HARDIE		•			• +						*			
V2009 DETER					• +					*				
V2010 TESCO					• +			*		*				
V2011 COMIS					• +					*				
V2012 PROMISE	•	• +	•	•	• +	•					*			
V2013 SOCRATES KERNEL	•	• +	•	•	•	•					*			
V2014 ICAR		• +								*				
V2015 INVAID II			•	• +				*						
V2016 PRIMAVERA	•		• +	•				*						
V2017 EUROCOR	•		• +	•				*						
V2018 QUARTET	•	•	• +			•		*						
V2019 HERMES			•	• +						*				
V2020 EAVES	•	• +									*			
V2021 INTERCHANGE		• +				•					*			
V2022 EUROTRIANGLE		•		• +	•				*					
V2023 PHOEBUS		•				• +		*		*				
V2024 CASH	• +							*			*			
V2025 EUROBUS		•				• +		*		*				
V2026 ADEPT	• +							*						
V2027 GAUDI	• +					•		*						
V2028 ATT-ALERT		• +									*			
V2029 BATT	• +	•	•								*			
V2030 MARTA	• +			•							*			
V2031 EDDIT		•			• +					*				
V2032 TELAID		•			• +					*				
V2033 LLAMD	•	• +	•		•	•		*						
V2034 FRAME						• +		*						
V2035 LIAISON BERLIN	•	•	• +						*					
V2036 DYNA	•	•	•	• +	•			*		*				
V2037 PORTICO		•		• +	•			*						
V2038 GEMINI		• +			•			*						
V2039 KITS			• +	•					*					
V2040 MELYSSA		•		• +	•	•		*						
V2041 CITRA		•				• +		*						
V2042 QUO VADIS	•			• +				*						
V2043 ARTIS		•	•	• +	•			*						
V2044 GERDIEN				• +				*						
V2045 ROSES		•		• +	•			*						
V2046 ACCEPT		• +			•			*						
V2047 PLEIADES	•	•		• +	•	•		*						
V2048 METAFORA		•				• +		*						
V2049 PROMPT			•			• +			*					
V2050 SCOPE		•	• +		•	•		*						
V2051 IFMS		•				• +		*						
V2052 EDRM 2		• +	•	•							*			
V2053 ADS	• +	•	•					*						
V2054 CITIES	•	• +	•		•	•		*						
V2055 RHAPIT		•		• +	•	•		*						
V2056 CORD	•	•	•	•	•	•						*		

DRIVE II Projects' Areas of interest

DRIVE 1992

THE CORE ACTIVITIES IN DRIVE II

Project		Key Activities
NUMBER	ACRONYM	
V2029	BATT	Behavioural aspects of telematics services in Transport for assessment purposes
V2002	HOPES	Providing framework and guidelines for safety assessment and integrating safety evaluation results from pilot projects. The safety areas covered are: Traffic Safety and Man-Machine Interaction
V2008	HARDIE	Proposing recommendations for the presentation of information to drivers and establishing the feasibility of guidelines and standards to be adopted for in-vehicle presentation
V2013	SOCRATES KERNEL	The coordination of the SOCRATES projects and the development of their parallel/horizontal tasks will be undertaken by the KERNEL. A main task will be to prove the functionality of the systems (Route Guidance et al) over different cellular sites and media, although optimally the system will be implemented on the GSM for pan-European use. (See also SOCRATES pilot projects).
V2020	EAVES	Providing and applying the methodologies for qualitative, quantitative and economic assessments to improve the effectiveness of VMS.
V2024	CASH	The aim of CASH is to promote, within DRIVE, cooperation between users of automatic debiting systems resulting in a common functional specification document to be used as an input to CEN for standardisation and also the basis for competitive industrial developments.
V2021	INTERCHANGE	Providing specifications based on DNT concept for real time travel information exchange network between involved national information centres.
V205 1	EDRM 2	Expertise in geographical reference data production using GDF 2.0
V2028	ATT-ALERT	Promote and standardize the current protocol in order to enhance its capabilities in providing a comprehensive driver information service.
V2012	PROMISE	The main objective of the project is to develop a multi-modal traveller information system, incorporating the DNT concept for interconnection with an open system architecture, for these portable terminals. They will also investigate the potential of implementing two way communications utilising the GSM and/or modern paging systems.

Table 2: Kernel Projects

Appendix 3

Pilot Projects in DRIVE II

(source: Commission of European Communities, 1992)

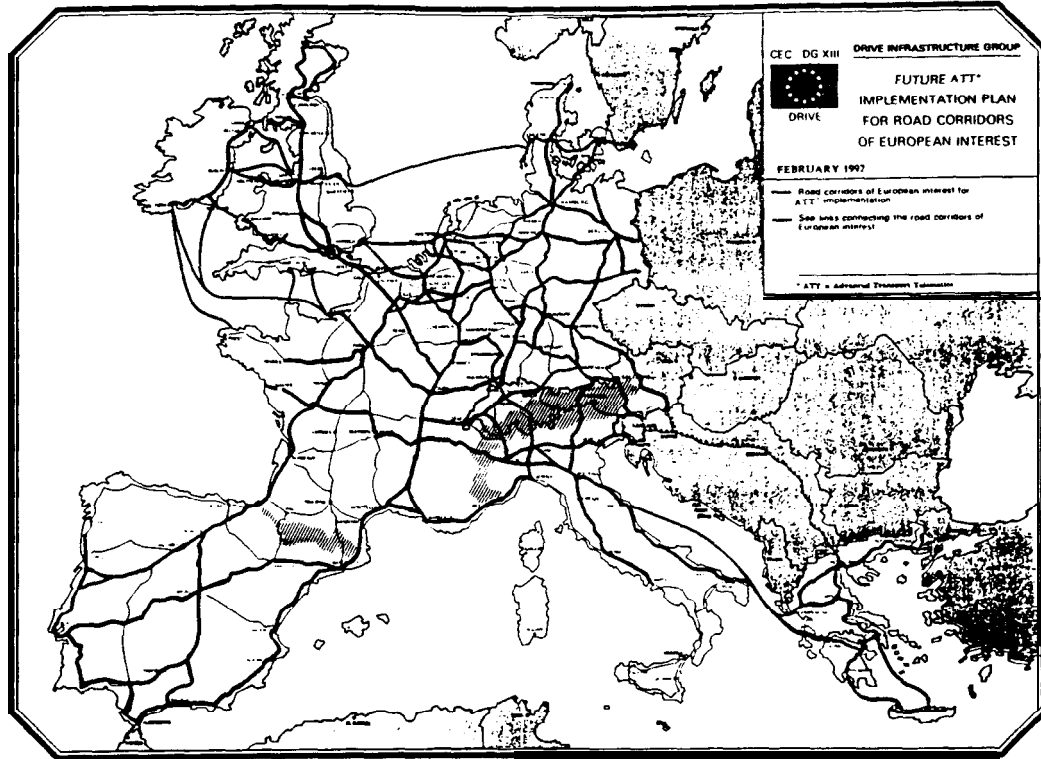


Figure 3: Future ATT Implementation plan for Road Corridors of European Interest

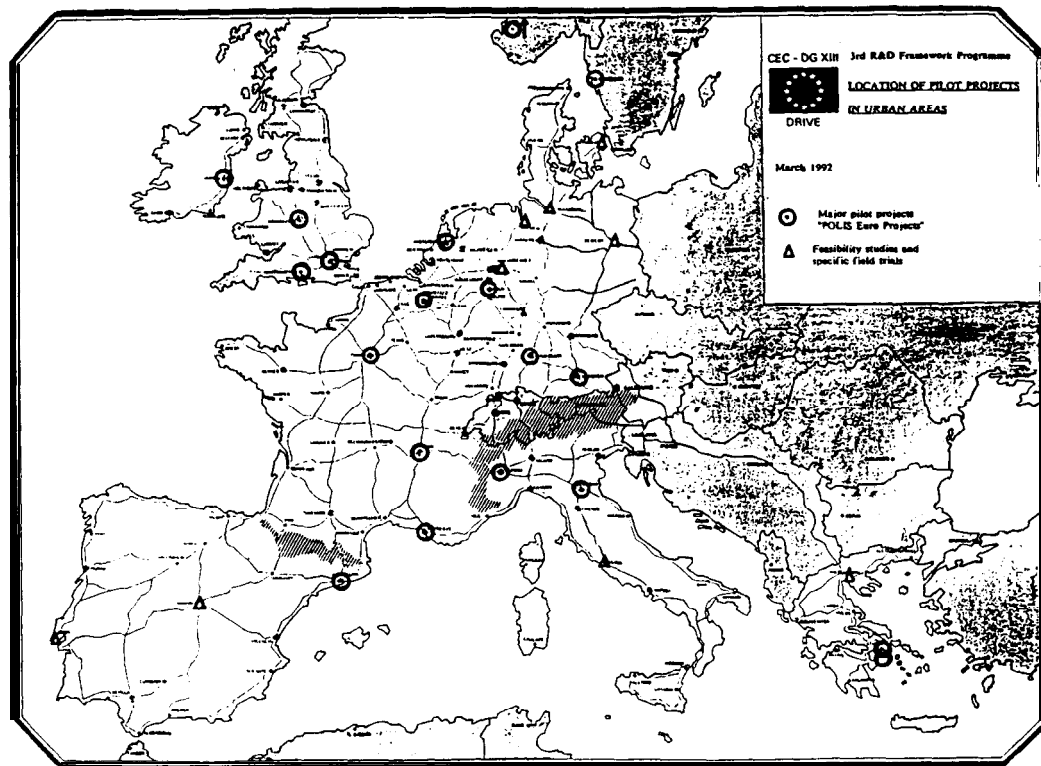


Figure 11: Pilot Projects in Cities

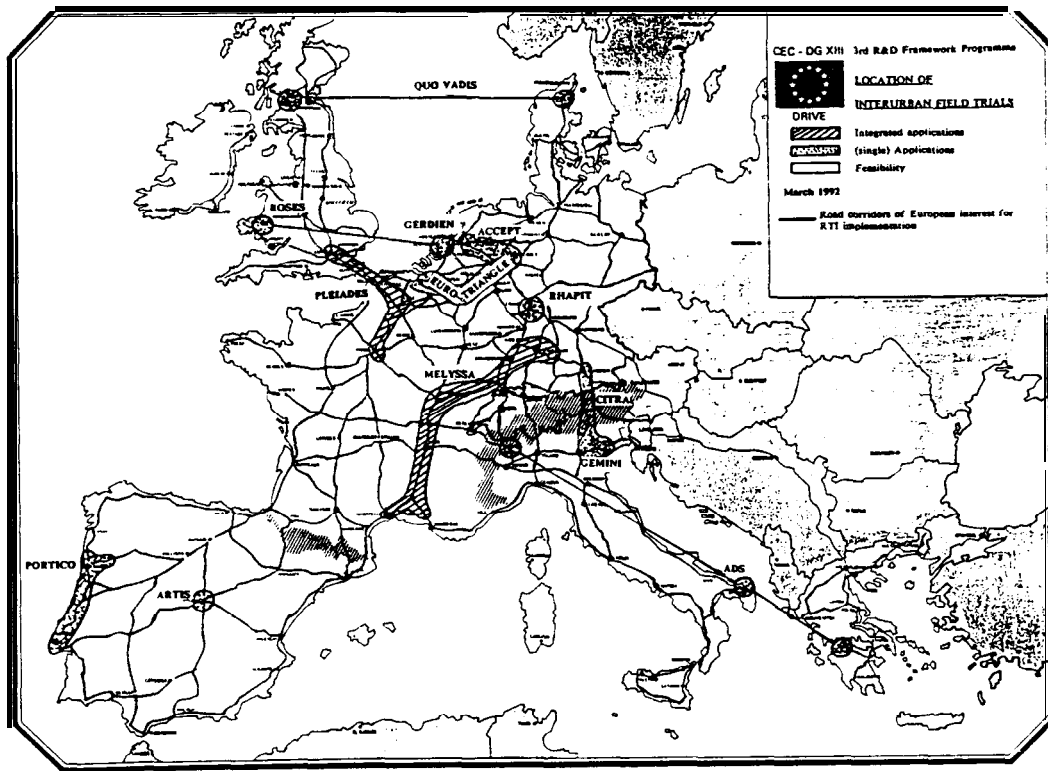


Figure 15: Pilot Projects on Motorways

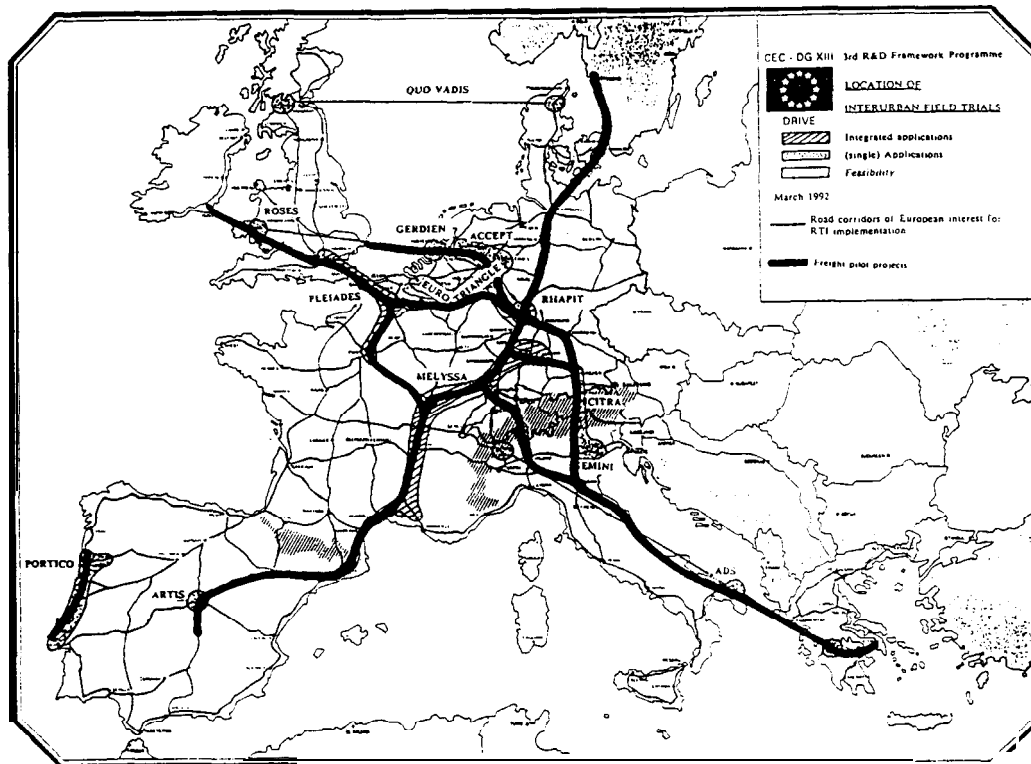


Figure 18: Pilot Projects and Freight Transport Operation

Appendix 4

DRIVE II Program Index - by major operational interest

(source: Commission of European Communities, 1992)

AREA 1 - Demand Management

V2024 CASH - Coordination Of Activities For Standardization Of Hades

Kernel project - Standardisation activity to establish common functional specifications for automatic debiting systems.

V2026 ADEPT - Automatic Debiting And Electronic Payment For Transport

Pilot project - with tests on four sites to demonstrate different aspects of demand management using microwave communication and a special purpose smart-card.

V2027 GAUDI - Generalized And Advanced Urban Debiting Innovation

Pilot Project - to determine the effect on traffic flow on motorways of automatic debiting systems.

V2029 BATT - Behaviour And A.T.T.

Kernel project - to determine the changes brought about in driver behaviour due to the introduction of ATT.

V2036 MARTA - Monitoring Attitudes towards Road Traffic Automation

Supporting Research & Development project - to assess the response of users of the inter-urban network to the introduction of ATT services and technologies and to estimate the prospective market in relation to the predicted growth in traffic.

V2053 ADS - Automatic Debiting Systems

Pilot project - to improve traffic flow on motorways through the use of automatic debiting systems.

AREA 2 - Travel and Traffic Information

V2012 PROMISE - Prometheus CED10 - Mobile And Portable Information Systems In Europe

Kernel project - to produce a multi-modal traveller information system incorporating the DNT.

V2013 SOCRATES-KERNEL - System Of Cellular Radio for Traffic Efficiency And Safety (Kernel)

Kernel project - to demonstrate the functionality of systems using cellular radio.

V2014 ICAR - Integrated Confined Area RTI Communication System

Supporting Research & Development project - to extend GSM usage to confined areas such as tunnels using leaky feeder cables.

V2020 EAVES - Evaluation And Assessment Of European Sign Systems

Kernel project - to look at several aspects of the integration of variable message signs and RDS/TMC

V2021 INTERCHANGE - INTERCHANGE

Kernel project - to establish a network for real time exchange of ATT information between national travel/traffic information centres.

V2028 ATT-ALERT - Advanced Transport Telematics - Advice and Problem Location for European Road Traffic

Kernel project - Standardisation activity to complete and standardise the current draft RDS/TMC ALERT C protocol.

V2033 LLAMD - London, Lyon, Amsterdam, Munich and Dublin

Pilot Project - travel & traffic information, urban & interurban; guidance; freight and accident analysis.

V2038 GEMINI - Generation Of Messages In The New Integrated Road Transport Environment

Pilot project - to develop an integrated driver information system using RDS/TMC and VMS.

V2046 ACCEPT - Alert Concerted Cooperation In European Pilots For TMC

Pilot Project - to test RDS/TMC as an effective tool for traffic information and control.

V2052 EDRM 2 - European Digital Road Map 2

Kernel project - to provide the first steps towards the availability of digital map data for applications requiring it.

V2054 CITIES - Cooperation For Integrated Traffic Management And Information Exchange Systems

Pilot project - to compare the effectiveness and operation of a number of different information systems.

AREA 3 - Integrated Urban Traffic Management

V2001 ASTRA - Integrated System Of Assistance Services For Travel And Traffic

Feasibility study - interactive integrated travel and traffic assistance service for public and private transport.

THE AREAS OF MAJOR OPERATIONAL INTEREST

V2005 VRU-TOO - Vulnerable Road User Traffic Observation And Optimization

Supporting Research & Development/Pilot Project - behavioural pedestrian-vehicle interaction rules and the piloting of advanced pedestrian detector systems

V2016 PRIMAVERA - Priority Management For Vehicle Efficiency, Environment And Road Safety On Arterials

Supporting Research & development project - dynamic queue management with priority to buses in the context of traffic calming,

V2017 EUROCOR - European Urban Corridor Control

Pilot project - extends DRIVE I CHRISTIANE (V1035) model to corridor control.

V2018 QUARTET -Advanced Research on Telematics for Environment And Transport

Pilot Project - IRTE Architectures tested; DRIVE II projects part of a more comprehensive project. In DRIVE II four cities concentrating on 5 aspects of traffic control in the IRTE.

V2035 LIAISON BERLIN - Linking Autonomous And Integrated Systems For On-line Network And Demand Management In Berlin

Feasibility study - looking at the development and installation of a demand management system in the framework of an Integrated Network and Information Management System

V2039 KITS - Knowledge-based And Intelligent Systems For Traffic Control

Supporting Research & Development project - prototype knowledge-based system consolidation enhancement and demonstration at four sites.

V2050 SCOPE - Applications OfATT In Southampton, Cologne And Piraeus

Pilot Project - integrated pilot tests in three cities of information and traffic control related elements if the IRTE.

AREA 4 - Integrated Interurban Traffic Management

V2015 INVAID II - Evaluation Of The Invaid System In Motorway And Urban Pilot Projects

Pilot Project -verification of DRIVE I INVAID project output.

V2019 HERMES - High Efficiency Roads With Rerouting Methods And Traffic Signal Control

Supporting Research & Development project - to enhance traffic control strategies using on-line origin/destination information and automatic incident detection.

V2022 EURO-TRIANGLE - Pilot Application Of Advanced Traffic Management In Flanders (B), Walloon (B), Northrhine-Westphalia (D)

Feasibility study - to assess the benefits of image processing, incident handling and interconnection of regional control centres.

V2036 DYNA -A Dynamic Traffic Model For Real-time Applications

Supporting Research & Development project - to produce a dynamic traffic model for real time applications.

V2037 PORTICO -Portugese Road Traffic Innovations On A Corridor

Pilot project - to survey hazardous goods vehicles, driver information and early warning systems.

V2040 MELYSSA - Mediterranean-Lyon-Stuttgart Site For ATT

Pilot project - to interconnect traffic control centres, test route guidance systems, improve uaffic information and establish an integrated network management.

V2042 QUO VADIS - Queue Obviation By Variable Direction & Information Signs

Pilot project - to investigate a range of modelling approaches and VMS control strategies.

V2043 ARTIS - Advanced RTI In Spain

Pilot project - on travel and traffic information, knowledge base intelligent traffic control, automatic incident detection with cameras, VMS operated via RDS/TMC and dangerous goods control.

V2044 GERDIEN - General European Road Data & Information Exchange Network

Pilot project - devise a coherent network for road traffic data collection and exchange.

V2045 ROSES - Road Safety Enhancement System

Pilot project - will continue and validate the research undertaken in the CROW project (DRIVE I, V1058) in the field of weather and road condition monitoring and forecasting.

THE AREAS OF MAJOR OPERATIONAL INTEREST

V2047 PLEIADES - Paris - London Corridor

Pilot project - to demonstrate an integrated driver information and network management system in the Paris-London corridor.

V2055 RHAPIT- -Rhine/Main Area Project For Integrating Traffic Management

Pilot project - deals mainly with a Dynamic Route Guidance system based on SOCRATES and an interface with the public transport in the urban area of Frankfurt.

AREA 5 - Driver Assistance & Cooperative Driving

V2002 HOPES - Horizontal Project For The Evaluation Of Safety

Kernel project - to provide a framework for safety assessment and to integrate safety evaluation results from the different DRIVE projects.

V2004 ARIADNE - Application of a Real-Time Intelligent Aid for Driving and Navigation Enhancement

Supporting Research & Development project - to build on work of DRIVE I GIDS - to provide a support system for the driver under a wide range of circumstances.

V2006 EMMIS - Evaluation Of Man Machine Interface By Simulation Techniques

Supporting Research & Development project - to develop evaluation tools for man machine interfaces.

V2007 SAMOVAR - Safety Assessment Monitoring On-vehicle With Automatic Recording

Feasibility study - investigates an in-vehicle safety assessment monitoring and automatic recording device

V2008 HARDIE - Harmonisation Of ATT Roadside And Driver Information In Europe

Kernel project - to build on the work in DRIVE I on standards for man-machine interaction.

V2009 DETER - Detection, Enforcement & Tutoring For Error Reduction

Supporting Research & Development project - leading to an in vehicle driver monitoring and legal enforcement system.

V2010 TESCO - Test On Cooperative Driving

Supporting Research & Development project/Pilot project - to test the cooperative driving functions already developed in PROMETHEUS and DRIVE I.

V2011 COMIS - Communication Using Millimetre Wave Systems

Supporting Research & Development project - to produce **60-64 GHz** transceiver for use in cooperative driving and intelligent cruise **control**.

V2031 EDDIT - Elderly And Disabled Drivers Information Tekmatics

Supporting Research and Development - studies requirements of **ATT** systems for elderly and disabled driver information

V2032 TELAID - Telematic Applications for the Integration of Drivers with special needs

Supporting Research and Development project - studies telematics applications for car devices for drivers with special needs

AREA 6 - Freight & Fleet Management

V2003 COMBICOM - Combined Transport Communication Systems

Pilot project - to monitor the status of combined traffic units (swap bodies or containers).

V2034 FRAME - Freight Management In Europe

Pilot project - to control and monitor hazardous goods shipment.

V2041 CITRA - System For The Control Of Dangerous Goods Transport In International Alpine Corridors

Pilot project - to optimise hazardous goods transport from an international point of view.

V2048 METAFORA - A Major Testing Of Actual Freight Operations Using RTI On An Axis

Pilot project - to test in a realistic environment mobile data communications and electronic data interchange.

V2051 IFMS - Integrated Freight Logistics Fleet & Vehicle Management System

Pilot project - to implement an open systems architecture for computer aided and integrated transport (OSA-CAIT)

AREA 7 - Public Transport Management

V2023 PHOEBUS - Project For Harmonizing Operations On The European Bus

Supporting Research & Development project - demonstration of a simple VSCS system based on DRIVE I-BARTOC - development of a VSCS for urban, inter-urban and rural P.T. networks - demand responsive

THE AREAS OF MAJOR OPERATIONAL INTEREST

systems - passenger information at stops and inside the vehicle.

V2025 EUROBUS - Data modelling (Transmodel) and passenger information (Popins) for public transport

Supporting Research & Development project - passenger information, and development of a universal data model for public transport operators.

V2049 PROMPT - Priority And Informatics In Public Transport

Supporting Research & Development project - Integration of P.T. in UTC and priority for P.T. vehicles.

Programme Management

V2056 CORD - Coordination Of Research and Development

Supports strategic management, particularly responsibility in coordination and organisation of Topic Groups.

Appendix 5

DRIVE II Program Participating Organizations

(source: Commission of European Communities, 1992)

This section lists the participations in DRIVE by Member State of the EC

B - BELGIUM

Adm. de l'Equipelement et des Deplacements (V2054*)

Belgische Radio Televisie Nederlandstalig (V2054)

Cerco (V2052)

Devlonics Control (V2022)

Ertico (V2056*)

IBM Belgium (V2048)

Interactive Learning Services (V2034)

ISSEP (V2014)

Macq Electronique (V2054)

Min. Wallon De l'Equ. et Transport (V2022, V2047)

Ministerie Vlaamse Gemeenschap (V2015, V2022)

Radio Television Belge Langue Francaise (V2054)

Regie des Telegraphes et des Telephones (V2054)

Siemens Belgium (V2023)

Soc. Des Transports Intercommunale Bruxelles (V2054)

Telindus Networks (V2015)

Tracer (V2015, V2022*)

Transurb Consult (V2023)

U.I.T.P. (V2023)

Universite Libre de Bruxelles (V2036)

Vigitec (V2015)

VVM De Lijn (V2023)

Teleways (V205 1)

Transport Mondia (V2048)

D - GERMANY

AEG Kabel Aktiengesellschaft (V2014)

ANT - Nachrichtentechnik (V2022)

AVE Verkehrs und Informationstech. (V2041, V2044)

BMV STV 12 (V2046)

BMW (V2006, V2036)

Bundesanstalt fur Strassenwesen (V2046)

City of Cologne (V2050*)

Daimler Benz (V2013, V2018, V2040, V2051*, V2052)

Daimler Benz Dasa Telefunken Systemt. (V2040)

Dambach - Werke (V2038, V2050)

Debis Systemhaus (V2051)

Dekra (V2011)

Dornier (V2044, V2051, V2040)

DST Deutsche Systemtechnik (V2001)

Forschungszentrum Informatik Karlsruhe (V2039)

Fraunhofer Institut Iitb (V2006)

Fraunhofer Gesellschaft (V2032)

Freistaat Bayern (2033)

Gewiss Laboratories (V2032)

GPC-Gerhard Ploss Consulting (V2019)

Heusch Boesefeldt (V2019, V2022, V2039, V2046, V2050)

Hoffmann & Leichter Consultants (V2035)

IBM Deutschland (V2012)

Ingenieurbuero Karajan (V2040)

Ingenieurgruppe I W - Aachen (V2001*)

Innenministerium NRW/ZPD (V2046)

Institut fur Arbeitswiss. & Tech/Management (V2032)

Institute For Communications (V2011)

Institut fur Stadtbauwesen Aachen (V2001)

IVU (V2035)

Keller (V2018, V2040)

Koelner Verkehrsbetriebe (V2050)

Kombiverkehr (V2003)

Kombiwaggon-projekt (V2003)

Krone (V2020)

Landeshauptstadt Stuttgart (V2018)

Landschaftsverband Rheinland (V2022)

Landschaftsverband Westfalen-Lippe (V2022)

MAN Technologie (V2007, P0251)

MAN-Nutzfahrzeuge (V2033, V2051)

Mentz Datenverarbeitung (V2033)

Mercedes-Benz (V205 1)

Min. F. Stadtentw. Und Verkehr N.W. (V2022)

DRIVE 1992

PARTICIPATING ORGANIZATIONS

Motorola (V2052)
Muenchener Verkehrs und Tarifverbund (V2033)
Oberste Baubehoerde Bayer Min. D. Innern (V2041)
Philips (V2028, V2046, V2052)
Pietzsch Automatisierung (V2041, V2037)
Porsche (V2045)
Prognos (V2012)
Robert Bosch (V2013, V2018, V2028, V2033, V2038, V2040, V2046*, V2052*, V2054)
Schenker Rhenus (V2051)
Senatsverwaltung F. Verkehr U. Betriebe (V2035*)
Siemens (V2018, V2019, V2033, V2040, V2041, V2050)
Signalbau Hueber (V2033)
SNV Studiengesellschaft Nahverkehr (V2025, V2035)
Steierwald Schoenharting & Partner (V2012, V2018, V2020, V2033, V2041)
Storm-Buero (V2018)
Straessle Information System, Essen (V2050)
Studienges. fur den kombinierten Verkehr (V2003)
Stuttgarter Strassenbahnen (V2025)
Sueddeutscher Rundfunk (V2018, V2040)
Technical University of Aachen (V2011, V2044)
Technische Universitaet Hamburg-Harburg (V2010, V2019)
Technische Universitaet Muenchen (V2002, V2015, V2017, V2019, V2033, V2042)
Telefunken Systemtechnik (V2011*)
TFK&VTI Transportforschung (V2026, V2051)
TÜV Bayern (V2008)
TÜV Rheinland (V2002, V2006)
Universitaet Karlsruhe/ IFV (V2050)
Universitaet Stuttgart IAT (2032)
Verkehrsministerium Baden-Wuerttemberg (V2018, V2040)
Verkehrsverbund Rhein-Ruhr (V2022)
Verkehrsverbund Stuttgart (V2018)
Volkswagen (V2012)
Weiss Electronic (2022)

DRIVE 1992

DK - DENMARK

Carl Bro Group (V2001)
Danish Road Institute (V2021, V2042)
Danish Traffic Information Centre (V2021)
EB Trafiksystemer (V2001)
Helsingor Municipality (V2001)
HT - Copenhagen City And Regional Transport (V2001)
Maersk (V2034)

E-SPAIN

Aq uila (V2034)
Barcelona Tecnologia (V2027*)
CAE/CTF (V2027)
Consortio de Transportes de Madrid (V2023, V2025)
Construcciones Y Contratas (V2043)
Diseno Ingenieria Sistemas Electronicos (V2038, V2043)
Electronic Traffic (V2015, V2043)
Ena Trafico (V2025)
Entitat Metropolitana del Transport (V2027)
Lisitt-universitat de Valencia (V2015, V2040, V2043)
On Campus Technology (V2015*, V2040, V2043)
Reial Automobil Club de Catalunya (V2027)
Saintrasa (V2043)
Sice (V2043)
Sistemas Y Tratimiento de Informacion (V2034)
Telia (V2013)
Universidad Politecnica de Madrid (V2008, V2039, V2043)
Universidad Politecnica de Cataluña (V2013, V2027, V2043)
Urban Systems Management (V2027)
UTE OCT-Telling (V2043*)

F - FRANCE

Advanced Research Partners (V2013)
Alcatel Cable (V2014)
C.G.F.T.E. (V2025)
CCETT (V2028)

Centre de Recherche de Toulouse (V2033)
 Cete de Bordeaux (V2040)
 Cete de l'Est (V2040, V2045)
 Cete de Lyon (V2033, V2040*)
Cete Mediterranee (V2025*, V2027, V2040)
 Communaute Urbaine de Lyon (V2033)
 Compagnie des Signaux et Equipments Electroniques (v2026)
 Compagnie Generale d'Automatisme (V2023*, V2033, V2054))
 Compagnie Generale Des Eaux (V2054)
 Dept. des Sciences de l'Environment (V2009)
 DDE du Rhone (V2033)
 Eurocim (V2040)
 France Telecom (V2040)
 French Motorway and Tunnel Companies (V2040)
 Gencom (V2040)
 Global **Logistique** Conseil (V2051)
 GTM Entrepose (V2033)
 I N R E T S (V2002, V2003, V2008, V2014*, V2015, V2017, V2023, V2031, V2040, V2042, V2043, V2047, V2054)
 Intralude (V2054)
 Isis (V2015, V2020, V2040, V2042)
 Laboratoire d'automatique & d'Analyse des Systemes (V2009)
 Laboratoires d'Electronique Philips (V2013)
 Matra - MS21 (V2010)
 Melte (V2040, V2047)
 Meteo France (V2040)
 Peugeot (V2010, V2054)
 Philips (V2046)
 Regie Autonome des Transports Parisiens (V2023)
 Regie des Transports de Marseille (V2027, V2025)
 Renault (V2010, V2031, V2040, V2046, V2047, V2052, V2054)
Sagem (V2046, V2052)
 Sanef (V2047)
 Secap (V2024)

PARTICIPATING ORGANIZATIONS

Securite et Signalisation (V2018)
 Sema Group (V2013, V2047, V2054)
 Sermo Electronique (V2040)
 Service Interdep. Exploitation Routiere (V2020, V2046, V2038, V2054)
 SES (V2050)
Sodit (V2033)
Societe Mixte Des Transports Rhone Et Lyon (V2033)
 Srilog (V2017)
 Steria (V2042)
Syndicat des Transports Parisiens (V2054)
 Telediffusion de France (V2023, V2040, V2046, V2054)
 Thomson Composants Microondes (V2011)
 Transexpert (V2025, V2040, V2043)
 Univ. Sciences et Techniques de Lille (V2014)
 Urba 2000 (V2054)
 Velec (V2015)
Ville de Paris (V2017, V2054)
GR - GREECE
 Almatrans (V2048)
 Aristotele's University of Thessaloniki (V2025, V2026, V2032*)
 Athens Development Office (V2023)
 Athens Urban Transport (V2018)
 Communications & Management Systems Unit (V2017)
Costas Abacoumkin & Associates (V2018)
 Ecotechnici (V2018)
 Era tosthenes (V2050)
 Gamma Institute Greece (V2050)
 Greek Highway Fund (V2026)
 Helgeco (V2032)
Hellen Consult (2053)
 Hellenic Telecommunications Organisa tion (V2048)
 Hitec Modern and Computer Applications Technology (V2050)
 Impetus Consultants (V2007, V2034, V2043)
 Intelltech (V2048)

DRIVE 1992

PARTICIPATING ORGANIZATIONS

Intracom (V2018, V2026, V2050)
Intrasoft (V2018, V2050)
Makios Transports (V2048)
Ministry of Mercantile Marine (V2048)
Ministry of Public Works (V2048, V2053)
Mobility International Hellas (V2032)
Municipality of Athens (V2018)
Municipality of Piraeus (V2050)
National Technical University of Athens (V2018, V2026)
Org. Astikon Synkinonion Thessaloniki (V2025)
Pan-Drive (V2018)
Planet (V2018, V2048)
Port of Piraeus Authority (V2050)
TRADEMCO (V2026, 2048*)
Transport Envir'nt Develop'nt Systems (V2005, V2018, V2029*)
TRUTh, Transport Research Unit of Thessaloniki (V2015, 2017*, V2048)

I-ITALY
Alcatel Face (V2027)
Associazione **Porti Italiani** (V2048)
ATC Bologna (V2027)
Automa, Sistemi di Automazione Industriale (V2039*, V2043)
Autostrada (V2011, V2053*)
Autostrade **Brescia-Padova** (V2038)
Autostrada **del Brennero** (V2041)
Autostrada **Trafo** Monte Bianco (V2053)
Autostrade **Venezia-Padova** (V2038)
Autovie Venete (V2038)
Cemat (V2003)
Centro Ricerche Fiat (V2006*)
Centro **Studi** Sui Sistemi di Trasporto (V2002, V2006, V2010*, V2019, V2036, V2038, V2051)
Citta' di Roma
Citta' di **Torino** (V2016, V2018)
Consorzio **5T** (V2018*)

Consorzio Trasporti Torinesi (V2049)
Eco Consult - Roma (V2041)
Elasis (V2010, V2036)
Elettronica Santerno (V2027)
Enea (V2053)
Finmar (V2053)
Fondazione G. Marconi
Guidosimplex (V2032)
Istituto di Analisi dei Sistemi & Informatica (V2039)
Italtel Telesis (V2041*)
Iveco Fiat (V2051)
Marconi (V2027)
Mizar Automazione (V2010, V2016, V2020, V2033, V2038, V2049)
Radiotelevisione **Italiana** (V2038)
Sip (V2027)
Sirti (V2014)
Societa' Autopiste Sperimentali di Nardo (V2010)
Societa Naz. per il **Trasporto** Combinato (V2048)
Solari Udine (V2020, V2038)
Syrea (V2041)
Tecnotour (V2027)
Telesia (V2021)
Telettra (V2027)
Universita' Degli **Studi** di Trieste (V2006)
Universita di Napoli (V2036)

IRL - IRELAND
Bus **Atha** Cliath - Dublin Bus (V2027)
Cara Software & Services Int. (V2004)
Dublin Corporation (V2033)
Inet (V2034)
Norcontel (V2027)
Telecom Eireann (V2027)
University College Cork (V2002)

L - LUXEMBOURG
Interferries Tralier Service (V2048)

PARTICIPATING ORGANIZATIONS

NL - NETHERLANDS

Algemene Verkeersdienst **Rijkspolitie** (V2046)
Belmont Management (V2046)
C. Van Heezik (V2048)
Cap Gemini International Support (V2003*, V2051)
DAF (V2048)
DCE Nederland (V2048)
Delft University of Technology (V2045)
De Langstraat (V2032)
Dutch Communication Center (V2021)
European Geographic Technologies (V2033)
Dutch Ministry of Transport (V2048)
Dutch **PTT** (V2048)
Free University of Amsterdam (V2029)
Gemeente Amsterdam (V2033)
Hague Consulting Group (V2036*)
IBM Netherlands (V2051)
Instituut Voor Ruimtelijke Organisatie (V2044)
Intergraph (V2052)
Intis (V2034)
Koninklijk Nederlands Vervoer (V2025)
NEA Transportation Research & Training (V2051)
Nederlandse **Philips** Bedrijven (V2013, V2033, V2044, V2054)
Netherlands Economic Institute (V2048)
Rijkswaterstaat (V2011, V2012, V2017, V2020, V2024*, V2026, V2028, V2033, V2036, V2044, V2045, V2046)
Royal Netherlands Meteorological Inst. (V2045)
Siemens (V2044)
Simac Systems (V2048)
SWOV, Institute For Road Safety Research (V2002, V2007)
Technolution (V2044)
Tele Atlas (V2052)
TNO, Netherlands Organisation for Applied Research (V2002, V2003, V2004, V2032, V2040, V2044*, V2045*)
Trailstar (V2003)

TRC, University of Groningen (V2002, V2004, V2005, V2009*)

Verenigd Streekvetvoer Nederland (V2023, V2025)

P - PORTUGAL

Brisa Auto Estradas de Portugal (V2037)
Camara Municipal de Lisboa (V2026)
Cisterpor (V2037)
CPRM Marconi (V2037)
Crocker, Delaforce (V2037)
Empresa Invest. Desen. Electronica (V2026)
Fctuc, University of Coimbra (V2005)
Feup-dec, University of Porto (V2005)
Gustavo **Cudell** (V2037)
Junta Autonoma de Estradas (V2037*)
SETA (V2037)
Universidade **Technica** de Lisboa (V2031)

UK - UNITED KINGDOM

Automobile Association (V2021, V2028, 2047)
Birmingham City Council (V2018)
British Broadcasting Corporation (V2028, V2047, V2050)
British **Telecommunications** (V2012, V2013, V2018, V2028, V2033, V2047)
Castle Rock Consultants (V2012, V2018, V2021*, V2028*, V2038*, V2043, V2044)
Centro Birmingham (V2018, V2025)
City of London (V2033)
Community Network Services (V2034)
Cranfield Centre for Logistics And Transport (V2031*)
Cranfield School of Management (V2003)
DTP Traffic Control And Comms Division (V2047)
Eurotunnel (V2047)
Ford (V2013, V2028, V2031, V2033, V2047, V2050)
GEC Ferranti **Defence** Systems (V2031)
GEC Marconi **Defence** Systems (V2013, V2033)
GEC Marconi Research Centre (V2011)
GEC **Plessey** Semiconductors (V2011)

DRIVE 1992

PARTICIPATING ORGANIZATIONS

Hampshire County Council (V2050)
Husat (V2008, V2009, V2032)
Ian **Catling** Consultancy (V2013*, V2033*)
ICS Black Box (V2007)
Imperial College of Science, Technology & Medicine (V2034*, V2043)
Indikta Display Systems Limited (V2038)
Inmarsat (V2048)
Intercity Trucks (V2048)
ITS, University Of Leeds (V2002, V2005*, V2016*, V2025, V2033, V2042, V2044)
Keyline/G.I.S (V2018)
Laurie Pickup and Associates (V2029)
Lockheed Information Management Systems (V2033)
London Transport (V2033, V2049)
Motorola (V2012)
MRC Applied Psychology Unit (V2004, V2009)
Newcastle upon Tyne Polytechnic (V2026)
Ordnance Survey (V2050)
P&O Containers (V2034)
Peek Traffic (V2016)
Philips Research Laboratories (V2004, V2009)
Polytechnic of Central London (V2048)
Queen Mary & Westfield College (V2007*)
RAC Enterprises (V2033)
Rover Group (V2004*, V2013, V2018)
Scottish Office (V2042)
Siemens **Plessey** Controls (V2047, V2049, V2050)
Southampton City Council (V2050)
Sowerby Research Centre (British Aerospace) (V2004, V2008, V2013)
STC - Integrated Networks (V2018)
Tankfreight (V2034)
The Motor Industry Research Association (V2007)
The MVA Consultancy (V2019*, V2035, V2037)
The Welsh Office (V2034)
Traffic Controls Systems Unit (V2049)
Transport & Road Research Laboratory (V2002, V2007, V2008*, V2017, V2019, V2020, V2028, V2031, V2033, V2042, V2047, V2049, V2050)
Transportation Planning Associates (V2042*)
University College London (V2029)
University of Lancaster (V2036)
University of Newcastle upon Tyne (V2024, V2026*, V2033)
University of Southampton, TRG (V2033, V2049, V2050)
University of Ulster (V2034)
W.S. Atkins Consultants (V2020*, V2034, V2045)
Welsh Office (V2045)
West Midlands Travel (V2018)
West Yorkshire HETS (V2005, V2016)
Wootton Jefferys Consultants (V2018, V2047*, V2049*)

The following participations are from organizations based in EFTA countries

A - AUSTRIA

Amt der Tiroler Landesregierung (V2041)
Brenner Autobahn Aktiengesellschaft (V2041)
Bundesminist. Oeff. Wirtschaft & Verkehr (V2041)
Factum, Christine Chaloupka & Ralf Risser (V2002)
Oesterreichischer Rundfunk (V2041)
Tauern Autobahn (V2024, V2041)

N - NORWAY

Data Instruments (V2009)
Institute of Transport Economics (V2008, V2009)
Micro Design (V2026, V2027)
Norwegian Public Roads Authority (V2024, V2026, V2027)
Senter for Industriforskning (V2039)

DRIVE 1992

PARTICIPATING ORGANIZATIONS

S - SWEDEN

Amu Gruppen (V2032)

Bilspedition Information Systems (V2051)

Chalmers University of Technology (V2002)

EB Traffic Systems (V2049)

Nobeltech Systems (V2054)

SAAB Automobile (V2006, V2054)

SAAB Mecel (V2013)

SAAB **Scania-combitech** (V2026)

Swedish Institute of Computer Science (V2013, V2054)

Swedish National Road Administration (V2002*, V2012, V2013, V2021, V2024, V2028, V2049)

Swedish Telecom Radio (V2054)

University of Lund (V2002, V2005, V2031)

Teli (V2012)

Test Site West Sweden (V2054)

TFK - Transport Research Institute (V2024, V2026, V2051, V2049, V2064)

Volvo (V2012*, V2028, V2031, V2051, V2054)

VTI - Road And Traffic Research Instit. (V2002, V2004, V2006, V2032)

SF-FINLAND

Nokia (V2012)

Technical Res Centre of Finland (V2002)

Appendix 6

Project Contacts for DRIVE II Program

(source: Commission of European Communities, 1992)

The following is a list of contact persons and numbers for DRIVE II projects in order of project number

V2001 ASTRA

INGENIEURGRUPPE IW-AACHEN (D)

Contact: Krug S.

Tel: (49)241-502 056

Fax: (49)241-531 622

V2002 HOPES

SWEDISH NAT. ROAD ADMIN. (S)

Contact: Dryselius B.

Tel: (46)8-757 6620

Fax: (46)8-983 030

V2003 COMBICOM

CAP GEMINI INTERNATIONAL (NL)

Contact: Durr E.

(31)70-395 7239

(31)70-319 1186

V2004 ARIADNE

ROVER GROUP (UK)

Contact: MacCaulay B.

Tel: (44)203 675 511

Fax: (44)203 691418

V2005 VRU-TOO

ITS, UNIVERSITY OF LEEDS (UK)

Contact: Carsten O.

Tel: (44)532-335 348

Fax: (44)532-335 334

V2006 EMMIS

CENTRO RICERCH E FIAT (I)

Contact: Gay P.

Tel: (39)11-902 3291

Fax: (39)11-902 3673

V2007 SAMOVAR

QUEEN MARY & WESTFIELD COL. (UK)

Contact: Fincham W.

(44)71-975 5344

(44)81-981 0259

V2008 HARDIE

TRRL (UK)

Contact: Stevens A.

Tel: (44)344-770 945

Fax: (44)344-770 356

V2009 DETER

TRC, UNIVERSITY OF GRONINGEN (NL)

Contact: Brookhuis K

Tel: (31)50-636 758

Fax: (31)50-636 784

V2010 TESCO

CSST (I)

Contact: Morello E.

Tel: (39) 11-878 033/839 7385

Fax: (39)11-812 2832

V2011 COMIS

TELEFUNKEN SYSTEMTECHNIK (D)

Contact: Linss W.

Tel: (49)731-392 3751

Fax: (49)731-392 4946

V2012 PROMISE

VOLVO (S)

Contact: Hellaker J.

Tel: (46)31-772 4075

Fax: (46)31-772 4086

Project Contacts

V2013 SOCRATES KERNEL

Ian **Catling** Consultancy (UK)

Contact: Ian Catling

Tel: (44)81 643 4451

Fax: (44)81 643 4452

V2014 ICAR

INRETS (F)

Contact: Heddebaut M.

Tel: (33)2043 83 13/43

Fax: (33)2043 8359

V2015 INVAID II

ON-CAMPUS TECHNOLOGY(E)

Contact: **Guillen S.**

Tel: (34)6-386 4565

Fax: (34)6-386 4568

V2016 PRIMAVERA

ITS, UNIVERSITY OF LEEDS (UK)

Contact: Montgomery F.

Tel: (44)532-335 339

Fax: (44)532-335 334

V2017 EUROCOR

TRUTH (GR)

Contact: Chrisoulakis J.

Tel: (30)1-645 5888

Fax: (30)1-644 3126

V2018 QUARTET

CONSORZIO 5T (I)

Contact: Mauro V. (I)

Tel: (39)11-650 2424

Fax: (39) 1 1-657 432

V2019 HERMES

THE MVA CONSULTANCY (UK)

Contact: Bielefeldt C.

Tel: (44)483-728 051

Fax: (44)483-755 207

V2020 EAVES

W.S.ATKINS CONSULTANTS (UK)

Contact: Steed J.

Tel: (44)372-726 140

Fax: (44)372-740 055

V2021 INTERCHANGE

CASTLE ROCK CONSULTANTS (UK)

Contact: Davies P.

Tel: (44)602-430 830

Fax: (44)602-430 823

V2022 EURO-TRIANGLE

TRACER (B)

Contact: Tegenbos R.

Tel: (32)2-675 0949

Fax: (32)2-660 4602

V2023 PHOEBUS

CGA (F)

Contact: **Raciazek A.**

Tel: (33)1-6988 5646

Fax: (33) 1-6988 5440

V2024 CASH

RIJKSWATERSTAAT (NL)

Contact: Van Wijk D.

Tel: (31)70-319 5610

Fax: (31)70-319 1117

V2025 EUROBUS

CETE MEDITERRANEE (F)

Contact: de Saint Laurent B.

Tel: (33) 4224 7621

Fax: (33) 4224 7624125

V2026 ADEPT

UNI. OF NEWCASTLE UPON TYNE (UK)

Contact: **Hills P.**

Tel: (44)91-222 6547

Fax: (44)91-222 8352

V2027 GAUDI

BARCELONA TECNOLOGIA (E)

Contact: **Angusto J.**

Tel: **(34)3-415 9517**

Fax: **(34)3-415 5236**

V2028 ATT-ALERT

CASTLE ROCK CONSULTANTS (UK)

Contact: Davies P.

Tel: **(44)602-430 830**

Fax: **(44)602-430 823**

V2029 BATT

TRENDS (GR)

Contact: Argyrakos G.

Tel: (30) 1-330 **1040**

Fax: **(30)1-330 1134**

V2030 MARTA

TMT Pragma

Contact: **Filippi F.**

Tel: **(39)6- 854 3921**

Fax: **(39)6-854 8706**

V2031 EDDIT

CRANFIELD CENT. FOR LOGISTICS (UK)

Contact: Oxley P.

Tel: **(44)234-752 751**

Fax: **(44)234-750 875**

V2032 TELAID

TRUTH (GR)

Contact: Naniopoulos **A.**

Tel: **(30)31-991 560/2636**

Fax: **(30)31 991 564**

V2033 LLAMD

Ian Catling Consultancy (UK)

Contact: Ian Catling

Tel: **(44)81 643 4451**

Fax: **(44)81 643 4452**

V2034 FRAME

IMPERIAL COLLEGE LONDON (UK)

Contact: Gurcan M.

Tel: **(44)71-589 5111 EXT.5286**

Fax: **(44)71-581 3143**

V2035 LIAISON BERLIN

SenVuB (D)

Contact: Gerdum E.

Tel: **(49)30-2122 2513**

Fax: **(49)30-211 7151**

V2036 DYNA

HAGUE CONSULTING GROUP (NL)

Contact: **GUM H.**

Tel: **(31)70-346 9426**

Fax: **(31)70-346 4420**

V2037 PORTICO

Junta Autonoma de **Estradas** (P)

Contact: Marques **Souza R.**

Tel: **(351)1-295 3525**

Fax: (351) 1-295 **7503**

V2038 GEMINI

CASTLE ROCK CONSULTANTS (UK)

Contact: Klein G.

Tel: **(44)602-430 830**

Fax: **(44)602-430 823**

V2039 KITS

AUTOMA (I)

Contact: Boero M.

Tel: **(39)10-2092 591/594**

Fax: (39) **10-203 987**

V2040 MELYSSA

CETE DE LYON (**F**)

Contact: Nouvier J.

Tel: **(33)7841 8125**

Fax: **(33)7826 4039**

Project Contacts

V2041 CITRA

ITALTEL TELESIS (I)

Contact: Angeleri E.

Tel: (39)2-4388 2555

Fax: (39)2-4388 3140

V2042 QUO VADIS

TRANSPORTATION PLANNING ASSOC. (UK)

Contact: Schofield M.

Tel: (44)21-236 6204

Fax: (44)21-236 4709

V2043 ARTIS

UTE OCT-TELLING (E)

Contact: Romero J.M.

Tel: (34) 1-248 4840

Fax: (34)1-248 1294

V2044 GERDIEN

TNO (NL)

Contact: Blonk J.

Tel: (31) 15-692 338

Fax: (31) 15-692 111

V2045 ROSES

TNO (NL)

Contact: **Pauwelussen J.**

Tel: (31) 15-696 412

Fax: (31) 15-620 766

V2046 ACCEPT

ROBERT BOSCH (D)

Contact: **Heinzelmann A.**

Tel: (49)5121-492 170

Fax: (49)5121-492 520

V2047 PLEIADES

WOOTTON JEFFREYS CONSULTANTS (UK)

Contact: Jeffrey D.

Tel: (44)483-480 033

Fax: (44)483-488 887

V2048 METAFORA

TRADEMCO (GR)

Contact: Evmolpidis V.

Tel: (30)1-770 7456

Fax: (30) 1-777 5880

V2049 PROMPT

WOOTTON JEFFREYS CONSULTANTS (UK)

Contact: Burton R.

Tel: (44)483-480 033

Fax: (44)483-488 887

V2050 SCOPE

CITY OF COLOGNE (D)

Contact: Rupprecht S.

Tel: (49)221-221 1855

Fax: (49)221-221 1900

V2051 IFMS

DAIMLER-BENZ (D)

Contact: **Schmeck K.**

Tel: (49)711-173 9741

Fax: (49)711-173 9831

V2052 EDRM 2

ROBERT BOSCH (D)

Contact: Claussen H.

Tel: (49)5121-494 857

Fax: (49)5121-492 538

V2053 ADS

AUTOSTRADA (I)

Contact: Battiboia S.

Tel: (39)51-846 900/453

Fax: (39)51-846 479

V2054 CITIES

ADM. DE L'EQUIP. ET DES DEPLACEMENT (B)

Contact: Vanderborgh **F.**

Tel: (32)2-219 7280 EXT 417

Fax: (32)2-223 0937

DRIVE 1992

Project Contacts

V2055 RHAPIT

HESSISCHES LANDESAMT FÜR STRASSEN-
BAU (D)

Contact: Gumprecht G.

Tel: **(49)611-366 308**

Fax: **(49)611-366 435**

V2056 CORD

ERTICO (B)

Contact: **Filipi F.**

Tel: **(32)2-538 0262**

Fax: **(32)2-538 0273**

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Martell, David K., "Cost Benefits Available to Industry for Better Quality Driver Information," IBC Technical Services Ltd, Improving Road Traffic Management in 1990s: The Integration of I.T. and Practical Solutions, Conference Proceeding, December 1, 1992.

Tarrant, D.E. and J.D. Turner, "ROMANSE: a Road Management System for Europe," IBC Technical Services Ltd, Improving Road Traffic Management in 1990s: The Integration of I.T. and Practical Solutions, Conference Proceeding, December 1, 1992.

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