FOTsis experience on FESTA *Using* stage

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FOTsis overview

Description & Goals

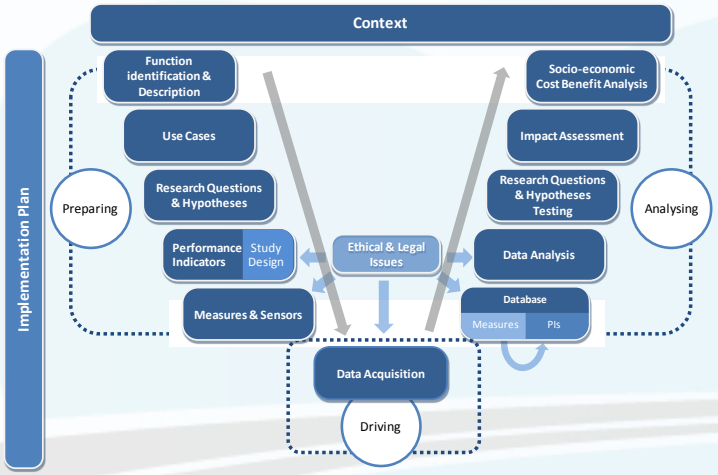
- **FOTsis** is a large scale field testing of the **road infrastructure management systems** needed for the operation of close-to-market cooperative technologies, in order to **assess in detail both their effectiveness and their potential for a full-scale deployment** in European roads.

- **Objectives**
  - To provide a common advanced road services platform.
  - Improve the connectivity between road-related service entities through an enhanced communications network.

  - Provide an **open, scalable and flexible system and service architecture**, based on the ITS Station Communications architecture and the most recent IEEE and ISO working groups' developments.

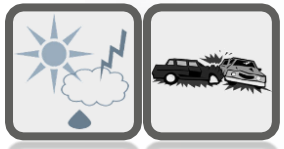
Description & Goals

- **FOTsis** follows the FESTA methodology in the selection of the functions/services to be tested, in the design of the tests and in the analysis of the results to obtain the most significant results evaluating the impact of the selected services in terms of improvements in traffic efficiency, road safety and environmental sustainability.



- **Main stages**
  - Preparing → The 7 FOTsis services, the test-sites, testing basis
  - Using / Execution →
    - The FOT Plans
    - The FOTsis architecture and service deployments
    - The data acquisition and management
  - Analysis → FOTsis Database and analysis methodologies

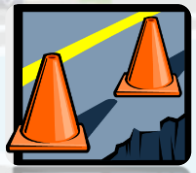
The 7 FOTsis services

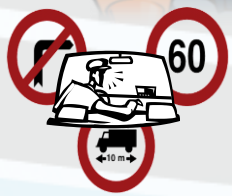


FOTsis is testing 7 **services** in several experimental environments throughout Europe:

- **S1: Emergency Management**
- **S2: Safety Incident Management**
- **S3: Intelligent Congestion Control**
- **S4: Dynamic Route Planning**
- **S5: Special Vehicle Tracking**
- **S6: Advanced Enforcement**
- **S7: Infrastructure Safety Assessment**

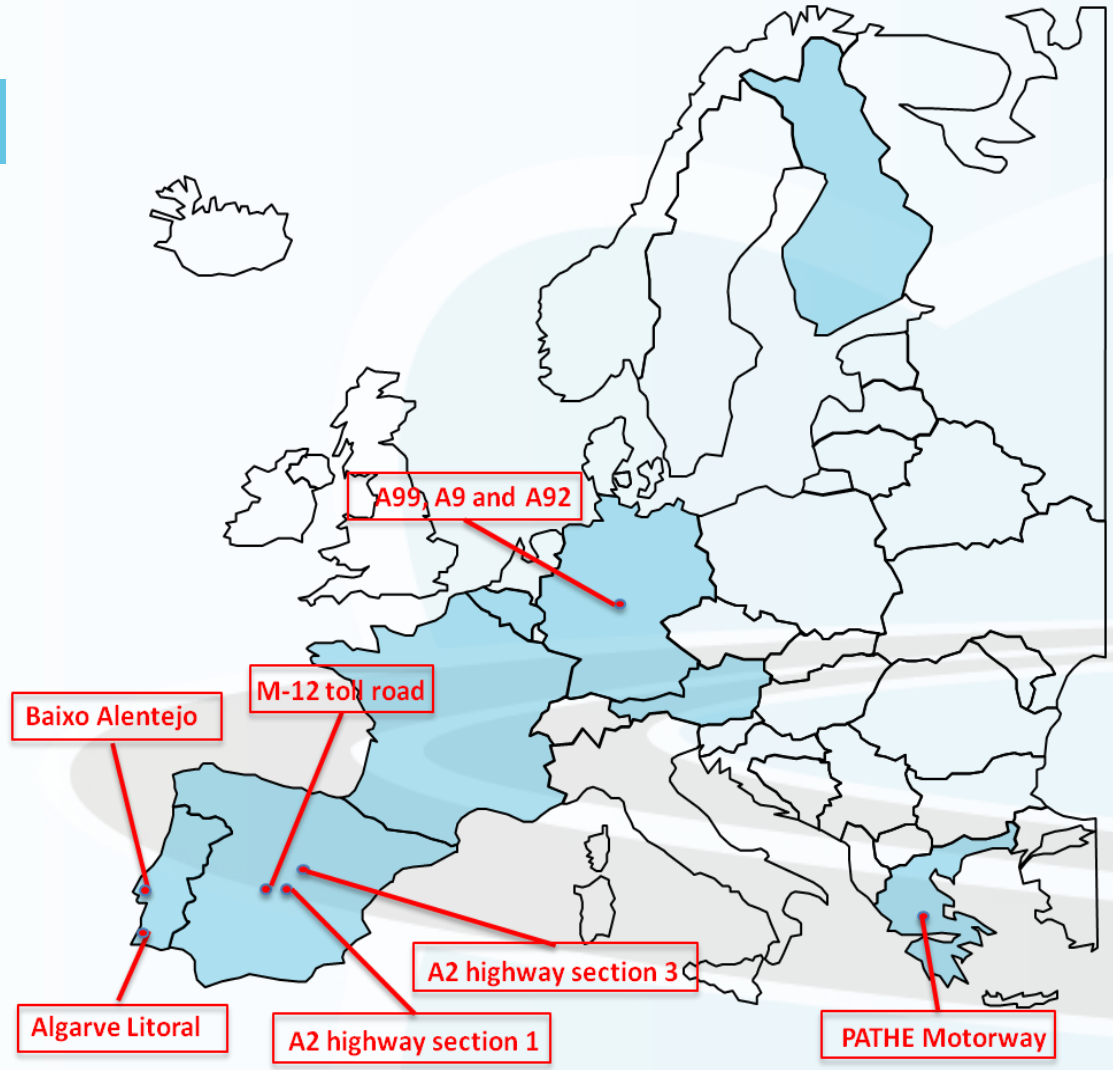
One of the main objectives of **FOTsis** is to assess the infrastructure's capability to provide these services





The FOTsis test-sites

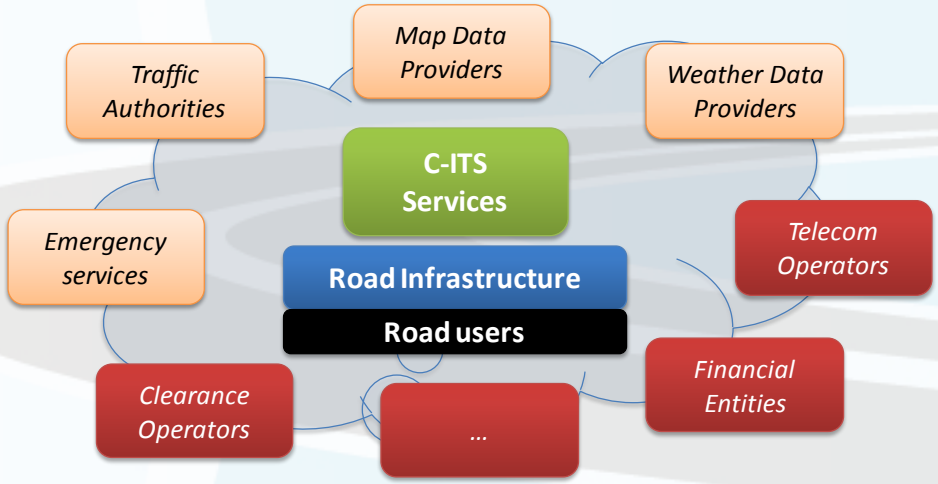
FOTSIS TEST SITES	
SPAIN	M-12 toll road A2 highway section 1 A2 highway section 3
PORTUGAL	Baixo Alentejo Algarve Litoral
GERMANY	A99 A9 A92
GREECE	Pathe Motorway



FOTsis & the FESTA methodology

FOTsis particularities

- FOTsis services are mainly infrastructure-based:
  - Centred around the service providers and the highway operators
  - There are many involved entities: ITS-related and non-ITS related.
  - Different technical and operational requirements (security, privacy, …)
  - Administrative and procedural regional differences in regulations.
- This creates a complex environment with technical and organizational particularities.



FOTsis particularities

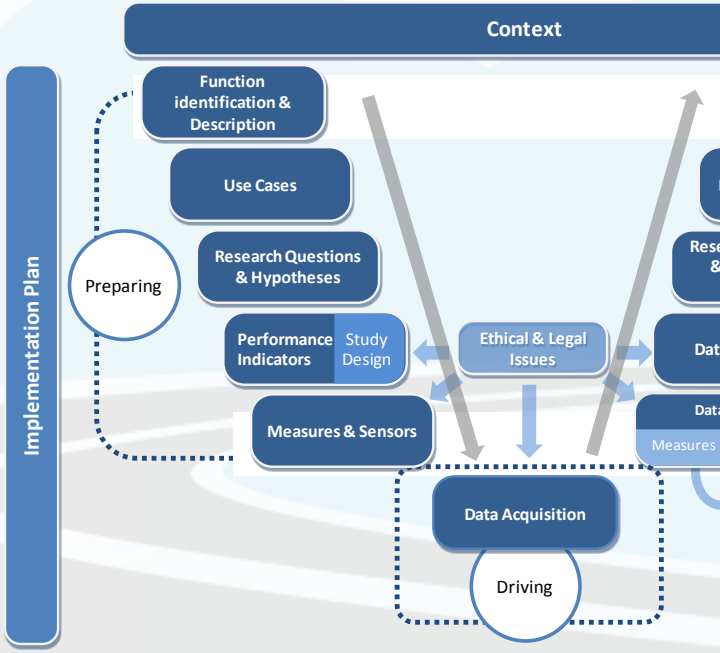
- There are severe requirements when integrating services with the day-to-day operation of some entities:
  - Public traffic management centers, emergency response centers and teams, …
  - Data exchange with existing systems can be subject to specific requirements of timing, structure, etc.
  - Administrative permits for operations can be a complex issue.
  - There are significant differences between test-sites.
  - There are many inter-dependencies with many different entities.

- It is necessary to take into account these particularities when addressing any of the stages in the FOT.

FOT Plans – Where to start?

- **FOT Plans** establish the final methodology for the collection of data from the test sites, services and users in a way that the evaluation can later be carried out in the most efficient way.

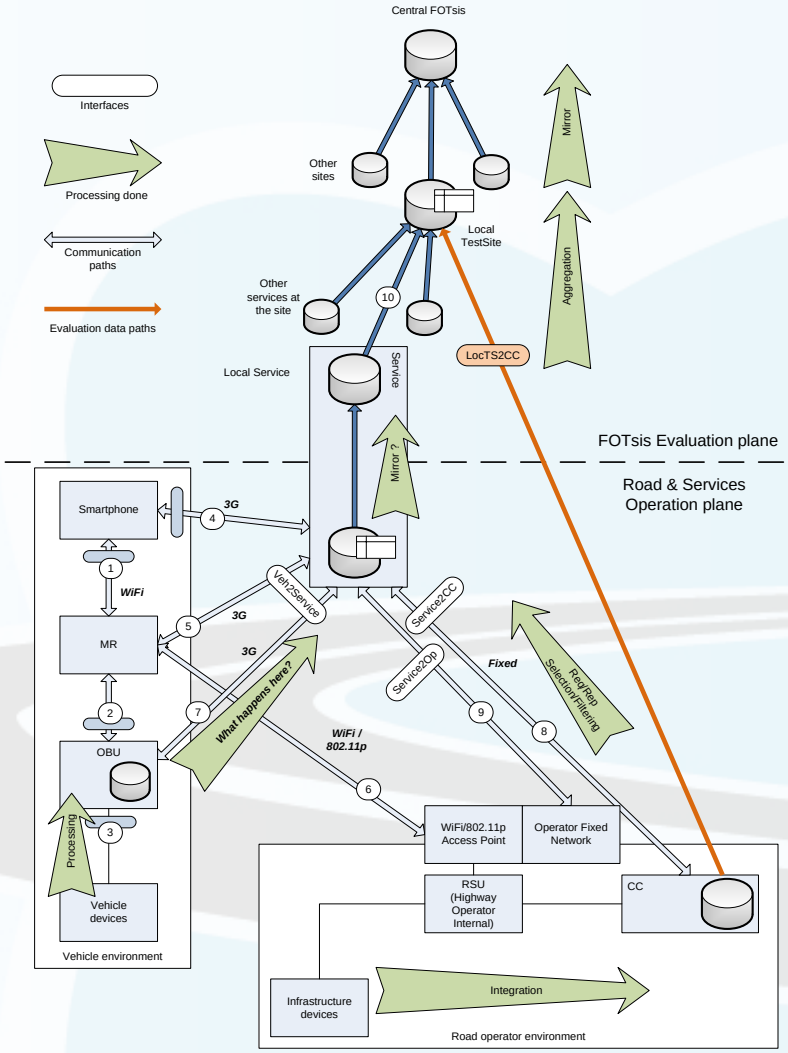
  - FOT Plans are the crossing-point between the more **theoretical approach** of the **Research Questions/Hypotheses stage** of the FOT design and the **practical knowledge about available data at test-sites for evaluation** and the development of the FOTsis DB structure.



FOT Plans – Where to start?

- During the preparation stage, preliminary aspects concerning data quality procedures and data management are defined.
  - Data sources
  - Main data repositories
  - Main data flows
  - Data structures

- And more importantly, what are the **data management guidelines**.



FOT Plans – Implementation

- The FOT Plans must put in the field all the aspects defined in the preparation stage, taking into account the particularities of the implementation of services and evaluation procedures at each test-site.
  - Are all the data sources accessible in the same way (if at all)?

    e.g. What are requirements of a given external data provider?
  - Are there any limitations to the type or structures of data that can be collected from external entities? Can these have an impact on the FOT data management and storage procedures?
  - **…**

- There are a number of risks which may have not been foreseen until now.

  ⇨ Feedback / Loop to preparation activities!

FOT Plans – Risks

- During the execution of the tests, it is critical that any possible deviations that may have an impact on data collection and processing is identified and the proper mitigation strategies applied.
- Mitigation activities include activities **during the execution** and also **pre-requisites** or conditions to be met before the execution of the FOT starts.

T9	Incomplete data / Poor quality data available at Evaluation level	
Category	Technical risk	
Comment	The evaluation level FOTsis DB data is the processed service data and other external data which have been uploaded and which will be used for the impact assessment. It includes both objective (data collected automatically or historical data) and subjective data (data collected through direct interaction with the users). Evaluation level incomplete/poor quality can be due to the following reasons: - Uploading link disruption. - Data quality assurance processes inadequate or malfunctioning. - Questionnaires unavailable at the start of the FOTsis. - Questionnaires not properly designed o Questionnaires do not collect all the relevant data. o Questionnaires too long/too complex so only partially filled in. - Data are not properly stored in the FOTsis DB. Different Aggregation level data structures do not include all the relevant information for impact assessment. - Subjective data are not properly linked with the corresponding objective data - Data Analysis tools do not process and/or retrieve data properly	
Related risks	T8 – Incomplete data / Poor quality data available at Service level O5 – Defined test conditions are not available during tests O6 – Services external data expected provision is not sufficient O7 – Relevant external service entities change their status throughout the FOT	
Overall risk	Low - Severity is high. - Detectability is high. - Recoverability is high.	
Mitigation strategy	Prerequisites	- Data structures and interfaces at the FOTsis DB Aggregation levels agreed and specified - FOTsis DB fully implemented - FOTsis DB data upload guidelines prepared and available - Data quality guidelines prepared and available - FOT Plans include expected data inputs and backup systems - Service ←→ FOTsis local/central DB pilot tests conducted - FOTsis local/central DB data Aggregation level II and higher processing tools pilot tests conducted - FOTsis local/central DB quality assurance procedures' test. - User feedback Questionnaires agreed and specified (Mobile app, web, paper, interviews). - Questionnaires data collection and DB uploading pilot tests conducted [when applicable].
	During FOT	- Verify regularly that data uploaded are consistent at FOTsis DB Aggregation Level I and higher - Verify that data collected follows the planned inputs (e.g. comparison of number of drivers) - Ensure that backups or source data are stored. - Report issues when occurring.
Report	- The report of issues related to this risk should include: - Reference to the test within which the issue was identified (as defined in the FOT plan). - Responsible of the test (as defined in the FOT plan) - Description of the issue o Precise timestamp of the moment issue was detected. o The stage in which the issue was presumed to have happened (service sending of DB data, DB receiving of DB data, data quality assurance procedures, …) o Affected data / structures of data. - Corrective actions taken and impact - Request for a re-sending - Rebuilding of data from source - Estimation of the impact of the issue regarding planned data inputs.	

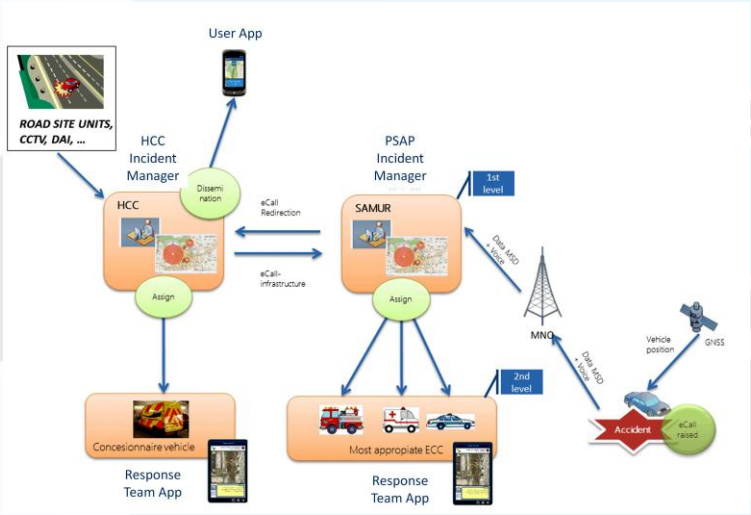
Recoverability is high.
ites
- Data structures and interfaces at the FOTsis DB Aggregation levels agreed and specified
- FOTsis DB fully implemented
- FOTsis DB data upload guidelines prepared and available
- Data quality guidelines prepared and available
- FOT Plans include expected data inputs and backup systems
- Service ←→ FOTsis local/central DB pilot tests conducted
- FOTsis local/central DB data Aggregation level II and higher processing tools pilot tests conducted

FOT Plans – The services

- Finally, the FOT Plans must reflect, in terms of data to be collected, the flow of the data in services in terms of relevant “checkpoints” at certain interfaces or times in which data is important, either for the service operation or for evaluation.
- In some FOTsis services, specifying this flow is quite complex (and not easily transferrable to the other services.

- Service 1 – Emergency management, basically integrates the emergency response centre and the highway control centre, with their respective response teams and other actors for incident detection and information dissemination.

The service and evaluation data acquisition is quite complex.



Data acquisition

FOTsis data management

FOTsis data management general guidelines

- In principle, services are the basis of the data acquisition methodology.
  - Links with any external entities must be done through services.
  - Services must collect all the [objective] data necessary for evaluation besides the service operation information.
  - Services are responsible for uploading all the data to the evaluation database.
- The data only goes upstream to the evaluation database.
- FOTsis services are essentially event-driven. The evaluation database and the services databases are structured around events. This means storage is not critical and no deletion of execution data is considered necessary.
- Continuous information (traffic status, weather conditions, …) are also required, and must be collected and stored as well.

FOTsis data management

FOTsis data management general guidelines (II)

- Due to the nature of some services, impact analysis in FOTsis will be most probably conducted as a combination of statistical analysis and focus group studies.
  - Subjective information is critical in FOTsis.
  - Questionnaires have been carefully designed to include all the necessary information for evaluation, but also to make sure that information would be effectively collected! (Not overly long and complex forms, not too frequent requests to the users, …)
- FOTsis evaluation database structure was designed taking into account: the requirements for evaluation, the design of the services, and the test-site particularities.
- Data collection mechanisms have been specified taking into account the requirements of the analysis and impact assessment methodologies.
  - Aggregation times, uploading intervals, minimum data sets, …

FOTsis data acquisition means

Objective data – FOTsis environment entities

- FOTsis services are infrastructure-side based, and therefore a major source of information is the data from the road operators, traffic managers, external data providers, etc.
  - This data is mostly *static*: highway layout details, historical data about traffic conditions, incidents, reports from various entities, etc.
  - However, some services and in evaluation, *dynamic* data is also necessary: continuously updated road environment and traffic status data, etc.

- In this case, the issue is mainly how to incorporate this information into the operative of the services, and, ultimately into the evaluation database

  ➡ Analysis of the data structures and interfaces applicable is necessary.

FOTsis data acquisition means

Objective data – Road users

- Road users in FOTsis can be of different types.
  - Professional and non-professional drivers, emergency response teams, special vehicle drivers, highway operators, emergency management centre operators, etc.
  - Each of them have different requirements in relation to how they prefer to interact with the service, and a significant effort has been devoted to accommodate these requirements on one hand, and on the other, to minimize the amount of data that users themselves need to input into the services.
- Means of collecting data from the users include:
  - Dedicated applications or web-based applications in nomadic devices (drivers).
  - Dedicated applications or web-based applications in fixed PCs (operators).
  - Positioning data coming from GPS in nomadic devices, MR or on-board devices (vehicles).
  - Timing information coming from GPS or network timing mechanisms.
- Objective data from users is stored directly in the services' databases.

FOTsis data acquisition means

Subjective data

- Subjective data is used in impact analysis to get direct feedback from the users in relation to some specific Research Questions, or is used as a basis to prepare the focus group questionnaire rounds, when combined with the appropriate objective data.
- There are two main groups of subjective data subjects: service users and stakeholders (basis for the business model development).
- Subjective data is mainly collected through interviews and questionnaires.
  - Interview during the recruiting process, to shape the target groups.
  - Periodic questionnaires (weekly, monthly) via web during the tests.
  - Periodic questionnaires (daily) via service applications themselves.
  - Mid-test and after test interviews to collect final user data.

SEVENTH FRAMEWORK PROGRAMME

FOTsis

European Field Operational Test on Safe, Intelligent and Sustainable Highway Operation

Thank you for your attention!

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