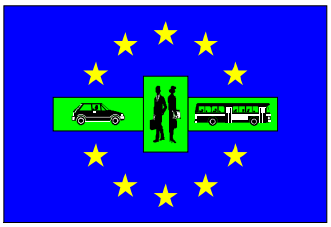


European ITS Framework Architecture

-

Physical Architecture

Annex 2 – Function and Data Store Overviews and Templates

Annex 2 of D3.2 - Issue 1

August 2000

This public report has been produced by the KAREN (Keystone Architecture Required for European Networks) project, as part of the 4th Framework Programme - Telematics Application Programme – road sector.

KAREN partners contributing to this report are:

SIEMENS TRAFFIC CONTROLS LIMITED
UNIVERSITY OF LEEDS
ALCATEL AUSTRIA
ALCATEL SPACE INDUSTRIES
TNO
FIAT CRF
MIZAR

Document control sheet

Activity name: KAREN

Work area: Framework Architecture Development - WP3

Document title: Physical Architecture

Document number: D3.2 – Annex 2

Electronic reference:

Main author(s) or editor(s): Richard A.P. Bossom

Other author(s): Simon Chambers, Rino Ciancaglini, Alessandro Coda, Jean-Luc Durand, Gino Franco, Peter Jesty, Markus Szvetits.

Dissemination level[1]: Public usage

Version history:

Version number	Date	Editor	Summary of changes
Issue 1	August 2000	R.A.P. Bossom	Final Public Issue

Approval:

	Name	Date
Prepared	*Richard Bossom*	*July 2000*
Reviewed	*Gino Franco*	*August 2000*
Authorised	*Jan Willem Tierolf*	*August 2000*

Circulation:

Recipient	Date of submission
CEC	August 2000

[1] This is either: Restricted (to the programme, to the activity partners) or for Public usage

Table of Contents

Figures

Tables

Executive Summary

This Document is the second Annex (Annex 2) to the Main Document part of the European ITS Physical Architecture Deliverable Document (D3.2). It contains the descriptions for each of the Functions and Data Stores in the European ITS Functional Architecture, plus templates for use in creating the descriptions of "example Systems".

The Function and Data Store descriptions are intended to provide a "quick and easy reference" to the descriptions that can be used when studying the "example Systems" that are described in the first Annex (Annex 1) to the European ITS Physical Architecture Main Document. Using these descriptions should avoid the need to refer to either Annex 1 or Annex 3 of the European ITS Functional Architecture Deliverable Document (D 3.1). Note that in the case of the Functions, only the Overview and User Needs list are included in this Annex.

The templates cover document structure, Diagrams and Tables that will be needed as part of the descriptions of any "example Systems" that are created in the same way as those in Annex 1 of the European ITS Physical Architecture Main Document. Further details of when and how they should be used will be found in Chapter 4 of the Main Document.

1. Introduction

1.1 Outline

This Document is part of the set of deliverables produced by the KAREN Project to describe the European ITS Framework Architecture. It is the second Annex to the European ITS Physical Architecture Main Deliverable Document (D3.2) and contains descriptions of the Functions and Data Stores from the European ITS Functional Architecture. These Functions and Data Stores have been specified as being part of some of the "example Systems" that have been developed in the Physical Architecture. They are intended to show examples of the physical Systems that can be developed using components from the Functional Architecture. Details of the rational behind this approach and the methodology that has been used will be found in Chapters 2 and 3 of the Main Document.

1.2 Where the document fits in the Architecture Documentation

The document is one of a set of two Annexes to the main European ITS Framework Architecture Physical Architecture Deliverable Document (D 3.3). The other Annex in the set is:

D3.3, Annex 1 - Physical Architecture - Descriptions of "example Systems"

1.3 Overview of the Document Structure

This Document is divided into six Chapters plus an Appendix. The first of these Chapters (Chapter 2) contains a list of Functions, their Overview descriptions and User Needs lists. These are taken from Annex 1 to the European ITS Functional Architecture Deliverable Document (D 3.1) – see reference (a) in Chapter 6. Chapter 3 contains the descriptions of the Data Stores, taken from Annex 3 to the European ITS Functional Architecture Document – again see the reference in Chapter 6. The objective of providing this Annex is to provide an easy reference to information about the Functions and Data Stores, without necessarily having to refer to the Functional Architecture Documents.

Chapter 4 contains a sample of a System Specification. The purpose of such a Specification is to provide sufficient information to enable the System to be purchased. This may be form either from one supplier, or from two or more, if the size and scope of Sub-systems and Modules is sufficiently large and diverse. The sample System Specification is for the Urban Traffic Management System (P30) that is described in Annex 1 to the Main Document.

A template that can be used for the creation of the description of an "example System" is provided in Chapter 5. This template only applies to "example Systems" that are Physical Systems, and not to those that are Architectures. Thus it provides all the sections and headings that will be found in the descriptions of "example Systems" in Annex 1 to the Main Document. The creation of such "example Systems" is described in Chapter 4 of the Main Document.

Chapter 6 contains references to other European ITS Framework Architecture Documents that are used in this Document.

The Appendix contains templates of Diagrams and tables for use with the document template in Chapter 5.

1.4 List of Abbreviations

COMETA European Project that has defined the In-vehicle Architecture for Freight Vehicles

2. List of Functions

2.1 Introduction

This Chapter contains a description of all the Functions used by the “example Systems” in the Physical Architecture. The “example Systems” are described in the Chapters of the first Annex to the European ITS Physical Architecture Main Document (D 3.2).

2.2 Content of Functional Descriptions

The descriptions of the Functions that are contained in this Chapter have been taken from Annex 1 to the European ITS Functional Architecture Deliverable Document (D 3.1) – see Chapter 5 for the full reference. Only two parts of the description for each Function are included in this Document. They are the “Overview” section and the User Needs list. The Function descriptions are arranged in numerical order to make reference easier. For more information about any of the Functions, please consult its full description in Annex 1 of the Functional Architecture Document (D 3.1).

1.1.1 Create EP Contract

Overview

This Low Level Function shall allow the user to establish a contract with an Electronic Toll Collection or Toll Road Operator. It shall present the users with information about the different types of services available, and record their choices.

User Needs: 4.1.0.1, 4.1.0.2, 4.1.0.3, 4.1.0.4, 4.1.2.1, 4.1.2.2, 4.1.3.2, 4.1.3.3, 4.1.3.4, 6.1.2.8

1.1.2 Establish Contract Statistics

Overview

This Low Level Function shall process the different contracts established by the user to get valuable information for the corresponding Electronic Toll Collection or Toll Road Operators

User Needs: 4.1.0.2, 4.1.3.1, 4.1.3.2, 4.1.3.3, 4.1.3.4

1.2.1 Load User's Account

Overview

This Low Level Function shall allow the user to credit its electronic payment account. It shall display to the user the different contracts passed by them, read the information related to the desired transaction , check the validity of the source account. If this account is correctly balanced, it shall credit the Electronic Payment account, and notify this to the Financial Clearinghouse terminator, and to the Transaction Data Store. If the credit is performed on an account previously included in the black list, and if the new balance is sufficient, a message shall be sent to the "control fraud" Function to remove the message from this black-list.

User Needs: 4.1.0.1, 4.1.0.2, 4.1.0.3, 4.1.2.2, 4.1.3.2, 4.1.3.3, 4.1.3.4, 4.1.4.1, 6.1.2.8

1.2.2 Debit User's Account

Overview

This Low Level Function shall debit the user's Electronic Payment account according to the recently performed transaction. No other transactions shall be included in the debit.

User Needs: 4.1.0.1, 4.1.0.2, 4.1.0.3, 4.1.0.5, 4.1.2.2, 4.1.3.2, 4.1.3.3, 4.1.3.4

1.2.3 Inform Users on Transactions

Overview

This Low Level Function shall provide the user with a list of the transactions performed by them. It shall also provide them with the status of their Electronic Payment accounts. Both types of information shall only be provied on request from the user.

User Needs: 4.1.0.2, 4.1.0.3, 4.1.3.3, 4.1.3.4, 6.1.2.8

1.3.1 Detect User

Overview

This Low Level Function shall detect the on-coming user. When detected, the Function shall trigger the other Functions in the Provide Electronic Payment Facilities Area.

User Needs: 4.1.1.1, 4.1.1.2, 4.1.1.3

1.3.2 Identify User

Overview

This Low Level Function shall identify the user. It shall also inform the other Functions in Provide Electronic Payment Facilities Area about the use that is being made of various parts of the road transport infrastructure (e.g. parking occupancy, time of travel between toll gates, …)

User Needs: 4.1.0.2, 4.1.1.1, 4.1.1.2, 4.1.1.3, 4.1.3.1, 4.1.3.4

1.3.3 Check User's Contract

Overview

This Low Level Function shall read the corresponding contracts, and verify the access rights, based on the user's ID. In case of a free ride request, the rest of the transaction shall be given up, and the Function shall send an agreement message to the access control Function.

User Needs: 4.1.0.1, 4.1.0.2, 4.1.1.1, 4.1.1.2, 4.1.1.3, 4.1.2.2, 4.1.3.1, 4.1.3.4

1.3.4 Inform and Guide User

Overview

This Low Level Function shall guide the user to get the precise definition of the way they want to perform the payment of the transaction. It shall enable them to select the appropriate contract, inform them about their rights to use the service, and display the associated price. This Function shall be activated after the use of Functions in either the Manage Public Transport Operations Area or the Provide Traveller journey Assistance Area, or even directly for simple operations. The Function shall also compute the price of a given service upon reception of the appropriate parameters from the Provide Traveller journey Assistance Area. This Function shall act as a focus point for the other Functions of "perform Electronic Payment transaction", and shall dispatch the information and process on them (except for 1.3.1 and 1.3.2). The Function shall also allow the user to get a refund in the case of a cancelled transaction. In this case the service fee shall be negative.

User Needs: 4.1.0.2, 4.1.1.1, 4.1.2.2, 4.1.3.3, 6.1.2.8

1.3.5 Compute Service Fee

Overview

This Low Level Function shall calculate the fee corresponding to the required service and to the user, based on the characteristics of this service, and on the contract established by the user. Using the general tariffs for the service given by the database, the Function shall use the price conditions specified in the contract to calculate the exact fee, and propose different payment modes with the associated costs.

User Needs: 4.1.0.1, 4.1.0.2, 4.1.0.4, 4.1.0.5, 4.1.1.1, 4.1.2.2, 4.1.3.3, 4.1.3.4

1.3.6 Check Advanced Payment

Overview

This Low Level Function shall verify that the service required by the user has not been already paid. It shall be possible for the payment to have covered the total amount required or part of the amount.

User Needs: 4.1.0.2, 4.1.0.4, 4.1.2.2, 4.1.3.3, 4.1.3.4

1.3.7 Recover Fee

Overview

This Low Level Function shall ask the user for the payment of the selected service. After compliance, it shall send the agreement to the control fraud Function, and provide the user with an acceptance message. If the user payment is not valid (either the user gives wrong information, or the account is declared invalid), the Function shall send a fraud message. In case of a refund, the fee to recover shall be negative, but the process shall be the same.

User Needs: 4.1.0.1, 4.1.0.2, 4.1.0.3, 4.1.1.1, 4.1.1.2, 4.1.2.2, 4.1.3.2, 4.1.3.3, 4.1.3.4, 4.1.4.1

1.4.1 Distribute Fees Revenue

Overview

This Low Level Function shall apportion the sum of fees revenue according to rules defined during the service registration phase. It shall define for each operator the sum to be credited.

User Needs: 4.1.0.1, 4.1.2.1, 4.1.2.2, 4.1.3.2, 4.1.3.3, 4.1.3.4

1.4.2 Credit Operator's Account

Overview

This Low Level Function shall credit the operator's account based on the transaction performed by the users.

User Needs: 4.1.2.1, 4.1.3.2, 4.1.3.3, 4.1.3.4

1.4.3 Inform Operators on Transactions

Overview

This Low Level Function shall allow the operators to view all the transactions concerning one of the services they provide.

User Needs: 4.1.0.2

1.5.1 Check User's rights

Overview

This Low Level Function shall determine the users' access rights to use the service requested, based on the users ID, the contract they established with the operators, the actual traffic conditions, and the access rights allowed by the traffic management area, operator or service provider.

User Needs: 4.1.0.2, 4.1.1.1, 4.1.1.2, 4.1.1.3, 4.1.4.1

1.5.2 Detect Payment Violations

Overview

This Low Level Function shall check the validity of the Electronic Payment account provided by the user. If several overdraft notification have been received for this account (or for the owner of the account for his different accounts), the account shall be included in the black list, which means that the user shall not be allowed to used this account until sufficient crediting is made. The Function shall register all the payment frauds. It shall allow the user to use the service upon reception of the agreement message.

User Needs: 4.1.0.1, 4.1.0.2, 4.1.1.3, 4.1.2.2, 4.1.3.3, 4.1.3.4, 4.1.4.1

1.5.3 Detect Access violations

Overview

This Low Level Function shall detect all attempts to use the service without having first fulfil the required conditions. It shall then block the different devices (via the "Block Access" Function), thus preventing the user from using the service. It shall also register the offence in the "fraud" Data Store.

User Needs: 4.1.0.1, 4.1.0.2, 4.1.1.3, 4.1.2.2, 4.1.3.3, 4.1.3.4, 4.1.4.1

1.5.4 Block Access

Overview

This Low Level Function shall be charged with the control of physical access to a service. It shall command devices that prevent users from entering areas, using machines. Upon detection of a trespassing attempt, it shall send the information to the "Detect Access Violations" Function, and if necessary (accident detected) send a warning to the Manage Traffic Area. Upon reception of an agreement message, it shall let the user proceed.

User Needs: 4.1.1.1, 4.1.1.3, 4.1.3.1, 4.1.4.1

1.6.1 Manage Tariffs

Overview

This Low Level Function shall be charged with the upkeep of the "tariffs" Data Store. It shall use update messages from the other Functions or from the operators or information providers.

User Needs: 7.3.2.1, 7.3.2.2, 7.3.2.3, 7.3.2.4

1.6.2 Manage Access Rights

Overview

This Low Level Function shall be charged with the updating of the "access rights" Data Store. It shall use information coming from Functions in the Manage Traffic Area or a Toll Operator.

User Needs: 4.1.0.2, 7.3.2.1

2.1.1 Acquire Mayday Call on Roadside

Overview

This Low Level Function shall provide facilities to enable any traveller to send a mayday call from a roadside system. It shall include a human/machine interface to receive information from a traveller and to give them the information contained in the mayday call acknowledgement. It shall also include functionality that sends and receives messages from an emergency centre.

User Needs: 5.1.0.1

2.1.2.1 Identify and Classify Emergencies

Overview

This Low Level Function shall be in charge of collecting incident notification, mayday call and alarm. It shall filter and gather them to complete the associated information (location, cargo status, identification of vehicle and traveller...) in order to produce an emergency ready to be planned. It shall also give an immediate acknowledgement to mayday call and transmit every incident/mayday call for traffic management purpose.

User Needs: 9.4.0.3, 9.4.0.4, 5.1.0.2, 5.1.0.3, 5.1.0.4, 5.1.0.5 5.1.0.7, 7.2.0.5, 7.2.0.7, 7.2.2.1, 7.2.2.2, 7.2.2.3

2.1.2.2 Manage Incident and Emergency Information

Overview

This Low Level Function shall provide an interface with the Incident and Emergency Data Store which contains the description of all incident/alarms notifications (and mayday call) received and all emergencies processed by the system. It shall read or load data for any use in the emergency process and shall also produce statistics from this data.

User Needs: 9.4.0.3, 9.4.0.4, 5.1.0.2, 5.1.0.3, 5.1.0.7, 7.2.0.5, 7.2.0.7, 7.2.1.2, 7.2.2.1, 7.2.3.1

2.1.2.3 Plan Emergency Intervention

Overview

This Low Level Function shall be in charge of defining/building the emergency intervention. As input, it shall get an emergency as well defined as possible. Using pre-defined procedures and information, it shall select the needed emergency services, contact them, establish with them the action plans, computes emergency road and prevent emergency drivers.

User Needs: 9.4.0.3, 9.4.0.4, 5.1.0.2, 5.1.0.3, 5.1.0.7, 5.2.0.1, 5.2.0.2, 5.2.0.3, 5.2.0.5, 7.2.0.8, 7.2.1.2, 7.2.1.3, 7.2.2.1

2.1.2.4 Process Emergency Progress Reports

Overview

This Low Level Function shall include all functionality related to co-ordination of the emergency services and traffic authorities. It shall provide also informed acknowledgement to mayday call originator.

User Needs: 5.1.0.4, 7.2.1.2, 7.2.1.3

2.1.3 Manage Emergency Vehicle

Overview

This Low Level Function shall include all functionality that the system realised for emergency driver : (at minimum) to receive emergency road, to request for individual prioritising, to give and to receive emergency intervention progress report. It shall include also a man/machine interface with emergency driver.

User Needs: 5.2.0.1, 5.2.0.4, 5.2.0.5, 7.2.1.1

2.1.4 Provide Emergency Control to the Operator

Overview

This Low Level Function shall provide a man machine interface to the Emergency Operator so that emergencies and all related information can be managed. It shall also provide all means necessary to control the other Functions: classification, planning, follow up of the emergency process and preparation of data for emergency process. The Operator shall be able to provide input through a keyboard, some form of "point and click" based data collection, an electro-mechanical device, or audio converter. It shall be possible for the output can be sent to the Operator using an audio device, a visual device, a mechanical device, as printed material, or any combination of these. Output shall also be available on electronic storage devices at the request of the Operator.

User Needs: 7.2.1.2

2.1.5 Provide Access and Maintain Data for Emergency

Overview

This Low Level Function shall include all functionality that enable it to acquire/update data that is useful during incident/emergency processing and that can be prepared before. This data shall comprise but not be limited to road network map, predefined emergency road, emergency services references and roles, plus emergency procedures. This Function is the mandatory interface with the Common Emergency Data Store.

User Needs: 7.2.1.2, 7.2.0.5, 7.2.0.7

2.2 Manage stolen vehicle notification

Overview

This Low Level Function shall manage the notification that a vehicle has been stolen. It shall take the data sent to it by the actual stolen vehicle and forward it to both the Emergency Operator and Emergency System terminators. As part of the forwarding process, any re-formatting that is need to enable the data to be sent to either terminator shall be performed. The output to the Emergency Operator shall be accompanied by some form of alarm indication to draw the attention of the Operator to the fact that a vehicle has been stolen. Similar action shall be taken when the vehicle stolen notification is cancelled by data received from the vehicle.

User Needs: 5.1.1.1, 5.1.1.2, 5.1.1.3

3.1.1.1 Collect Urban Traffic Data

Overview

This Low Level Function shall collect traffic data from the urban road network. This data shall be provided as raw input by sensors within the Function that shall be capable of detecting the presence of all types of road vehicle, from bicycles to heavy freight vehicles. This raw input shall be processed to provide actual traffic flow data, e.g. flow, speed, etc. It shall be passed to other Functions for collation and use in traffic management.

User Needs: 2.1.1.3, 7.1.0.10, 7.1.1.1, 7.1.1.2, 7.1.1.4, 7.1.1.5, 7.1.11.3

3.1.1.2 Monitor Urban Car Park Occupation

Overview

This Low Level Function shall collect traffic data from the entrances and exits of car parks in the urban road network, as well as from the spaces themselves. This data shall be provided as raw input by sensors within the Function that are capable of detecting the passage and presence of all types of road vehicle, from bicycles to heavy freight vehicles. The data from the entrances and exits shall be processed to provide actual traffic count data, i.e. numbers of vehicles, at the entrances and exits of each car park. The resulting data shall be passed to other Functions for collation, use in urban traffic control and for providing traveller information. The data from the spaces shall be used to determine whether a vehicle has exceeded the time that it can occupy a space. When this occurs, the information shall be sent to the Provide Support for Law Enforcement Area for further processing.

User Needs: 2.1.1.3, 7.1.0.10, 7.1.1.5, 7.1.11.1

3.1.1.3 Provide Urban Traffic Forecasts and Strategies

Overview

This Low Level Function shall provide predictions of traffic conditions and traffic management strategies for the urban road network. It shall use current and historical traffic data from the urban road network as input to algorithms that enable it to predict what the traffic flow shall be like and produce the new strategies. These predictions and strategies shall be produced periodically or at the request of the Operator. When completed the predictions shall be sent to other Functions and to other Areas within the System. The traffic management strategies shall be sent to the urban traffic control Function.

User Needs: 2.1.2.1, 2.1.2.3, 7.1.0.1, 7.1.0.2, 7.1.0.10, 7.1.0.12, 7.1.0.13, 7.1.2.2, 7.1.2.4, 7.1.6.1, 7.1.7.4, 7.1.8.1, 7.1.11.2

3.1.1.4 Manage Urban Traffic Data

Overview

This Low Level Function shall manage the Urban Traffic Data Store. It shall receive urban traffic and car park data from other Functions in the Manage Traffic Area and from other Systems. This data shall be loaded into the Store and also sent to other Functions and Areas for their use. The data in the Store shall be divided into three parts, current, historic and predicted.

User Needs: 2.1.1.1, 2.1.1.3, 2.1.2.3, 2.1.4.1, 2.1.4.2, 7.1.0.6, 7.1.0.7, 7.1.0.8, 7.1.0.9, 7.1.0.11, 7.1.0.12, 7.1.0.13, 7.1.2.1, 7.1.2.3, 7.1.2.7, 7.1.8.1

3.1.1.5.1 Provide Urban Traffic Management

Overview

This Low Level Function shall provide traffic control facilities for the urban road network. It shall enable the traffic to be controlled so that the most efficient use is made of the urban road network. The Function shall be able to implement control strategies in a planned sequence according to the time of day and day of week. Facilities shall be provided to enable these strategies to be overridden by the Operator, by inputs for priority from selected vehicles and by inputs from the incident and demand management Functions. It shall be possible for the Function to use current, historic and predicted traffic data from the urban network and to change its actual control commands to take account of this data in real-time. This shall enable the Function to continuously adapt its control of the urban road network to suit the actual traffic conditions if so required. The Operator interface Function shall be able to obtain details of the current and previous modes of control on some or all parts of the urban road network. Feedback of the results of commands sent to the output actuation Function shall be monitored so that if necessary corrective action can be taken if commands are not followed.

User Needs: 2.1.2.2, 2.1.3.1, 5.2.0.2, 5.2.0.3, 6.1.1.4, 7.1.0.2, 7.1.0.4, 7.1.0.5, 7.1.0.6, 7.1.0.10, 7.1.0.12, 7.1.0.13, 7.1.4.5, 7.1.4.8, 7.1.4.9, 7.1.5.1, 7.1.5.5, 7.1.5.6, 7.1.5.7, 7.1.5.8, 7.1.9.1, 7.1.9.2, 7.1.9.3, 7.1.9.4, 7.1.12.1, 7.1.12.2, 7.3.1.3, 7.3.1.4

3.1.1.5.2 Provide Planned Urban Traffic Management Facilities

Overview

This Low Level Function shall provide facilities that enable urban traffic control strategies to be implemented automatically by a timed sequence. This sequence mechanism within the Function shall permit the implementation to be by any combination of time of day, day of week, day of month, or day of year. The sequences shall be received from the Operator interface Function which shall also be able to request output of the sequences currently available for use. Requests for implementation of control strategies shall be sent to the urban traffic control Function.

User Needs: 7.1.0.10, 7.1.3.6, 7.1.3.7

3.1.1.5.3 Provide Urban Car Park States

Overview

This Low Level Function shall translate car park occupancy levels into car park "states". This translation shall enable the output Function to show either spaces or "state" according to the type of equipment that is available. The occupancy levels shall be provided by the car park occupancy monitoring Function.

User Needs: 7.1.0.10, 7.1.4.4

3.1.1.5.4 Provide Urban Traffic Speed Management

Overview

This Low Level Function shall provide the management of vehicle speed settings within the urban road network. It shall receive commands to implement speed settings from either the Operator interface or the urban traffic control Functions. The Operator request shall take priority and shall override that from the urban traffic control Function. Speed settings shall be sent by the Function to the urban output actuation Function and provide driving facilities Area.

User Needs: 7.1.0.10, 7.1.7.1, 7.1.7.2, 7.1.7.3, 7.1.7.5, 7.1.7.6

3.1.1.5.5 Provide Urban Output Actuation

Overview

This Low Level Function shall provide output of commands to travellers that enable the urban road network to be managed in a safe and efficient way. These commands shall be provided by the urban traffic control Function, or be determined from local data if this Function is not available. Output of the commands shall be possible in a variety of ways such as single indications, and/or multiple indications, and/or text messages. It shall be possible for the output to be read and acted upon by all types of drivers, cyclists and pedestrians using the urban road network. Facilities shall be provided by the Function so that incorrect action the commands can be reported to the maintenance management Function.

User Needs: 6.1.1.4, 7.1.0.2, 7.1.0.3, 7.1.0.5, 7.1.0.10, 7.1.3.4, 7.3.1.3, 7.3.1.4

3.1.1.5.6 Provide Urban Traffic Lane Management

Overview

This Low Level Function shall provide management of the lanes on roads in the urban network. The Function shall enable the management of the lanes so that the most efficient use can be made of the available road space. It shall enable the use of lanes to be changed in a way that is safe for vehicle operation and that causes the minimum disruption to all forms of urban road traffic. Implementation of commands to alter the use of lanes shall be sent to the urban output actuation Function.

User Needs: 7.1.0.10, 7.1.4.3, 7.1.5.2, 7.1.5.3, 7.1.5.4, 7.1.10.1

3.1.1.5.7 Provide Operator Urban Traffic Management Facilities

Overview

This Low Level Function shall enable the Operator to manage the control of traffic in the urban road network. It shall be possible for the Operator to change the current urban traffic control strategy, except when it is imposed as part of an incident or demand management strategy, or to provide selective vehicle priority. The Operator shall be informed of the success or failure of the requested change. It shall also be possible for the Operator to examine and update the sequence of urban traffic control strategies that are implemented automatically, and to see the "log" of previously implemented urban traffic control strategy changes. The Operator shall be able to provide input through a keyboard, some form of "point and click" based data collection, an electro-mechanical device, or audio converter. It shall be possible for the output can be sent to the Operator using an audio device, a visual device, a mechanical device, as printed material, or any combination of these. Output shall also be available on electronic storage devices at the request of the Operator.

User Needs: 7.1.0.10, 7.1.3.1, 7.1.3.2, 7.1.3.3, 7.1.3.5

3.1.1.5.8 Detect Urban Traffic Violations

Overview

This Low Level Function shall detect violations of urban traffic control commands and report them to functionality in the Provide Support for Law Enforcement Area. Reporting of a violation shall only occur when it is detected that a vehicle does not follow the current urban traffic commands. Details of these commands shall be provided by the urban traffic management Function.

User Needs: 7.1.0.10, 7.1.11.3

3.1.1.5.9 Manage Urban Static Traffic Data

Overview

This Low Level Function shall be responsible for managing the store of static data that is used by urban traffic management Functions. It shall be able to receive updates from the Operator and shall make all data available to the urban traffic management Function. Data about charges and vehicle access regulations for the urban road network shall also be sent to Functions in the Provide Electronic Payment Facilities Area. When vehicle location data is received, the Function shall send data about traffic regulations that apply to the geographic area relevant to the location to Functions in the Provide Advanced Driver Assistance Area.

User Needs: 7.1.0.10, 8.2.5.3

3.1.2.1 Collect Inter-urban Traffic Data

Overview

This Low Level Function shall collect traffic data from the inter-urban road network. This data shall be provided as raw input by sensors within the Function that are capable of detecting the presence of all types of road vehicle, from bicycles to heavy freight vehicles. This raw input shall be processed to provide actual traffic flow data, e.g. flow, speed, etc. It shall be passed to other Functions for collation and use in traffic control.

User Needs: 2.1.1.3, 7.1.0.11, 7.1.1.1, 7.1.1.3, 7.1.1.5

3.1.2.2 Monitor Service Area Vehicle Occupation

Overview

This Low Level Function shall collect traffic data from the entrances and exits of service area vehicle parks in the inter-urban road network. This data shall be provided as raw input by sensors within the Function that are capable of detecting the passage of all types of road vehicle, from bicycles to heavy freight vehicles. This raw input shall be processed to provide actual traffic count data, i.e. numbers of vehicles, at the entrances and exits of each service area vehicle park. The resulting data shall be passed to other Functions for collation, use in inter-urban traffic control.

User Needs: 2.1.1.3, 7.1.0.11

3.1.2.3 Provide Inter-urban Traffic Forecasts and Strategies

Overview

This Low Level Function shall provide predictions of traffic conditions and traffic management strategies for the inter-urban road network. It shall use current and historical traffic data for the inter-urban road network as input to algorithms that enable it to predict what the traffic flow shall be like and produce the new strategies. These predictions and strategies shall be produced periodically or at the request of the Operator. When completed the predictions shall be sent to other Functions and to other Areas within the System. The traffic management strategies shall be sent to the inter-urban traffic control Function.

User Needs: 2.1.2.1, 2.1.2.3, 7.1.0.1, 7.1.0.2, 7.1.0.11, 7.1.0.12, 7.1.0.13, 7.1.2.2, 7.1.2.4, 7.1.6.1, 7.1.7.4, 7.1.8.1

3.1.2.4 Manage Inter-urban Traffic Data

Overview

This Low Level Function shall manage the Inter-urban Traffic Data Store. It shall receive inter-urban traffic and service area data from other Functions in the Manage Traffic Area and from other Systems. This data shall be loaded into the Store and also sent to other Functions and Areas for their use. The data in the Store shall be divided into three parts, current, historic and predicted.

User Needs: 2.1.1.1, 2.1.1.3, 2.1.2.3, 2.1.4.1, 2.1.4.2, 7.1.0.6, 7.1.0.7, 7.1.0.8, 7.1.0.9, 7.1.0.11, 7.1.0.12, 7.1.0.13, 7.1.2.1, 7.1.2.3, 7.1.2.7, 7.1.8.1

3.1.2.5.1 Provide Inter-urban Traffic Management

Overview

This Low Level Function shall provide traffic control facilities for the inter-urban road network. It shall enable the traffic to be controlled so that the most efficient use is made of the inter-urban road network. The Function shall be able to implement control strategies in a planned sequence according to the time of day and day of week. It shall be possible for these strategies to include control of access to the inter-urban network (ramp metering), plus lane use and speed control commands. Facilities shall be provided to enable these strategies to be overridden by the Operator, as well as by inputs from the incident, demand and access management Functions. It shall be possible for the Function to use current, historic and predicted traffic data from the inter-urban network and to change its actual control commands to take account of this data in real-time. This shall enable the Function to continuously adapt its control of the inter-urban road network to suit the actual traffic conditions if so required. The Operator interface Function shall be able to obtain details of the current and previous modes of control on some or all parts of the inter-urban road network. Feedback of the results of commands sent to the output actuation Function shall be monitored so that if necessary corrective action can be taken if commands are not followed.

User Needs: 2.1.2.2, 2.1.3.1, 5.2.0.2, 6.1.1.4, 7.1.0.2, 7.1.0.4, 7.1.0.5, 7.1.0.6, 7.1.0.11, 7.1.0.12, 7.1.0.13, 7.1.4.1, 7.1.4.2, 7.1.4.5, 7.1.4.8, 7.1.4.9, 7.1.5.1, 7.1.5.5, 7.1.5.6, 7.1.5.7, 7.1.5.8

3.1.2.5.2 Provide Planned Inter-urban Traffic Management Facilities

Overview

This Low Level Function shall provide facilities that enable inter-urban traffic control strategies to be implemented automatically by a timed sequence. This sequence mechanism within the Function shall permit the implementation to be by any combination of time of day, day of week, day of month, or day of year. The sequences shall be received from the Operator interface Function which shall also be able to request output of the sequences currently available for use. Requests for implementation of control strategies shall be sent to the inter-urban traffic and access control Functions.

User Needs: 7.1.0.11, 7.1.3.6, 7.1.3.7

3.1.2.5.3 Provide Service Area Vehicle Occupancy States

Overview

This Low Level Function shall translate service area occupancy levels into service area "states". This translation shall enable the output Function to show either spaces or "state" according to the type of equipment that is available. The occupancy levels shall be provided by the service area occupancy monitoring Function.

User Needs: 7.1.0.11, 7.1.4.4

3.1.2.5.4 Provide Inter-urban Traffic Speed Management

Overview

This Low Level Function shall provide the management of vehicle speed settings within the inter-urban road network. It shall receive commands to implement speed settings from either the Operator interface or the inter-urban traffic control Functions. The Operator request shall take priority and shall override that from the inter-urban traffic control Function. Speed settings shall be sent by the Function to the inter-urban output actuation Function and the provide driving facilities Area.

User Needs: 7.1.0.11, 7.1.7.1, 7.1.7.2, 7.1.7.3, 7.1.7.5, 7.1.7.6

3.1.2.5.5 Provide Inter-urban Output Actuation

Overview

This Low Level Function shall provide output of commands to travellers that enable the inter-urban road network to be managed in a safe and efficient way. These commands shall be provided by the inter-urban traffic control Function. Output of the commands shall be possible in a variety of ways such as single indications, and/or multiple indications, and/or text messages. It shall be possible for the output to be read and acted upon by all types of drivers, cyclists and pedestrians using the inter-urban road network. Facilities shall be provided by the Function so that incorrect action the commands can be reported to the maintenance management Function.

User Needs: 6.1.1.4, 7.1.0.2, 7.1.0.3, 7.1.0.5, 7.1.0.11, 7.1.3.4

3.1.2.5.6 Provide Inter-urban Lane Management

Overview

This Low Level Function shall provide management of the lanes on roads in the inter-urban network. The Function shall enable the management of the lanes so that the most efficient use can be made of the available road space. It shall enable the use of lanes to be changed in a way that is safe for vehicle operation and that causes the minimum disruption to all forms of inter-urban road traffic. Implementation of commands to alter the use of lanes shall be sent to the urban output actuation Function.

User Needs: 7.1.0.11, 7.1.4.3, 7.1.5.2, 7.1.5.3, 7.1.10.1

3.1.2.5.7 Provide Operator Inter-urban Traffic Management Facilities

Overview

This Low Level Function shall enable the Operator to manage the control of traffic in the inter-urban road network. It shall be possible for the Operator to change the current inter-urban traffic control strategy, except when it is imposed as part of an incident or demand management strategy, or to provide selective vehicle priority. The Operator shall be informed of the success or failure of the requested change. It shall also be possible for the Operator to examine and update the sequence of inter-urban traffic control strategies that are implemented automatically, and to see the "log" of previously implemented inter-urban traffic control strategy changes. The Operator shall be able to provide input through a keyboard, some form of "point and click" based data collection, an electro-mechanical device, or audio converter. It shall be possible for the output can be sent to the Operator using an audio device, a visual device, a mechanical device, as printed material, or any combination of these. Output shall also be available on electronic storage devices at the request of the Operator.

User Needs: 7.1.0.11, 7.1.3.1, 7.1.3.2, 7.1.3.3, 7.1.3.5

3.1.2.5.8 Detect Inter-urban Traffic Violations

Overview

This Low Level Function shall detect violations of inter-urban traffic control commands and report them to functionality in the Provide Support for Law Enforcement Area. Reporting of a violation shall only occur when it is detected that a vehicle does not follow the current inter-urban traffic commands. Details of these commands shall be provided by the inter-urban traffic management Function.

User Needs: 7.1.0.11

3.1.2.5.9 Manage Inter-urban Static Traffic Data

Overview

This Low Level Function shall be responsible for managing the store of static data that is used by the inter-urban traffic management Function. It shall be able to receive updates from the Operator and shall make all data available to the inter-urban traffic management Function. Data about charges and vehicle access regulations for the urban road network shall also be sent to Functions in the Provide Electronic Payment Facilities Area. When vehicle location data is received, the Function shall send data about traffic regulations that apply to the geographic area relevant to the location to Functions in the Provide Advanced Driver Assistance Area.

User Needs: 7.1.0.11, 8.2.5.3

3.1.3.1 Assess Bridge Status

Overview

This Low Level Function shall assess the current status of any bridges that are located on the road network served by the System. It shall use sensors to analyse analogue data about the weather and the bridge infrastructure. From the analysis the Function shall propose that the bridge be opened or closed to some or all types of vehicles, thus providing an incident management facility for bridges. The Function shall enable these proposals to be confirmed by the Operator before being implemented through displays to Drivers and other Travellers.

User Needs: 2.2.2.2, 7.1.0.1, 7.1.4.6

3.1.3.2 Assess Tunnel Status

Overview

This Low Level Function shall assess the current status of any tunnels that are located on the road network served by the System. It shall use sensors to analyse analogue data about the atmospheric conditions, fire status and the tunnel infrastructure. From the analysis the Function shall propose that the tunnel be opened or closed to some or all types of vehicles, thus providing an incident management facility for tunnels. The Function shall enable these proposals to be confirmed by the Operator before being implemented through displays to Drivers and other Travellers.

User Needs: 2.2.2.2, 7.1.0.1, 7.1.4.7

3.1.3.3 Provide Bridge and Tunnel Operator Interface

Overview

This Low Level Function shall provide an interface through which the Operator can monitor and manage the accessibility of tunnels and bridges to vehicles and travellers using other modes. It shall enable the Operator to confirm any proposed changes in the current level of access as well as monitoring conditions at the tunnels and bridges. The Operator shall be able to provide input through a keyboard, some form of "point and click" based data collection, an electro-mechanical device, or audio converter. It shall be possible for the output can be sent to the Operator using an audio device, a visual device, a mechanical device, as printed material, or any combination of these. Output shall also be available on electronic storage devices at the request of the Operator.

User Needs: 7.1.4.6, 7.1.4.7

3.1.3.4 Output Bridge Information

Overview

This Low Level Function shall provide facilities for the output of information to Drivers and other Travellers on bridges, or as they are about to cross them. The information that is output shall be based on data provided by the Assess Bridge Status Function. The output shall be available in visual form, either as signals (stop/go), or as lane use indicators, or as text messages. It shall be possible for Drivers and Travellers to clearly see which messages are to be obeyed (mandatory) and which are for information (warnings). Visual outputs must be clearly visible in all types of ambient light conditions (including darkness). Outputs in other forms such as audio, shall also be provided for the benefit of Travellers with sight impairment. Barriers may also be used as a physical means of preventing access to the bridge by Vehicles and/or Travellers.

User Needs: 7.1.4.6

3.1.3.5 Output Tunnel Information

Overview

This Low Level Function shall provide facilities for the output of information to Drivers either in tunnels, or as they are about to enter them. The information that is output shall be based on data provided by the Assess Tunnel Status Function. The output shall be available in visual form, either as signals (stop/go), or as lane use indicators, or as text messages. It shall be possible for Drivers to clearly see which messages are to be obeyed (mandatory) and which are for information (warnings). Visual outputs must be clearly visible in all types of ambient light conditions (including darkness). Barriers may also be used as a physical means of preventing access to the tunnel by Vehicles.

User Needs: 7.1.4.7

3.2.1 Detect Incidents

Overview

This Low Level Function shall detect that possibly incidents have occurred. It shall provide facilities that enable the use of both data provided by other Functions and video image data as inputs. Both types of data shall be analysed for patterns that suggest the occurrence of an incident. Details of an incident occurrence shall be sent to another Function for classification storage.

User Needs: 7.2.0.1, 7.1.3.6, 7.2.0.6, 7.2.5.1

3.2.2 Identify and Classify Incidents

Overview

This Low Level Function shall identify and classify incidents. It shall use data about incidents that is provided by another Functions, the functionality in other Areas of the System and received from terminators. The data shall be identified and classified as a particular type of incident according to its source using internal "rules" within the Function. It shall then be sent for storage and subsequent assessment.

User Needs: 5.1.0.3, 7.1.3.6, 7.2.0.1, 7.2.0.6, 7.2.0.7, 7.2.2.1, 7.2.2.2, 7.2.5.1

3.2.3 Assess Incidents and Determine Responses

Overview

This Low Level Function shall manage the assessment and response to incidents that have been detected by other Functions. Periodically it shall review the data that has been collected about incidents and decide if any action is needed. When action is needed the Function shall search for an appropriate incident strategy, for which it shall obtain Operator confirmation before implementing. It shall be possible for an incident strategy to involve revisions to the current traffic management strategy, output of warning messages (locally and globally), plus notification of the Manage Public Transport Operations and Provide Safety and Emergency Services Areas. If the Function finds that there is no appropriate strategy the Operator shall be informed so that either a strategy can be produced, or the Operator can take action by direct intervention using other Functions. Updates about the progress of dealing with current incidents received from the Emergency Services shall be assessed and any current incident strategies refined to accommodate changes.

User Needs: 7.1.3.6, 7.2.0.1, 7.2.0.2, 7.2.0.3, 7.2.0.4, 7.2.0.8, 7.2.0.9, 7.2.2.3, 7.2.4.1, 7.2.4.2, 7.2.5.2, 7.2.6.1

3.2.4 Manage Incident Data

Overview

This Low Level Function shall be responsible for the management of data about incidents and the production of statistical reports. It shall receive data about reported incidents and updates to that data from other Functions and incident data from other Systems. All the data shall be Stored and retrieved when requested by another Function for assessment. When requested by the Operator, the Function shall retrieve the data from the Store and produce the required incident statistics reports.

User Needs: 7.2.2.1, 7.2.2.3, 7.2.3.1

3.2.5 Provide Incident Management Operator Interface

Overview

This Low Level Function shall provide the interface through which the Operator can control the management of incidents and the implementation of incident management strategies. It shall enable the Operator to confirm the implementation if needed, to input and update incident data, and to provide incident management strategies. The Function shall also enable statistical reports on the occurrence of incidents and the use strategies to be provided to the Operator on request. The Operator shall be able to provide input through a keyboard, some form of "point and click" based data collection, an electro-mechanical device, or audio converter. It shall be possible for the output can be sent to the Operator using an audio device, a visual device, a mechanical device, as printed material, or any combination of these. Output shall also be available on electronic storage devices at the request of the Operator.

User Needs: None

3.3.1 Receive Information on Travel Factors

Overview

This Low Level Function shall receive data about the use of transport modes by travellers in the geographic area served by the System. This data shall come from either other Functions in the Manage Traffic Area, or other Areas, or the Weather Service and Multi-modal System terminators. The received data shall be checked for consistency and then sent to another Function for storage.

User Needs: 7.3.0.2

3.3.2 Implement Demand Management Strategy

Overview

This Low Level Function shall implement demand management strategies when requested by the Operator. The implementation of a strategy shall be requested through the Operator interface Function. Implementation shall be achieved by sending data about what action is required to Functions in other parts of the Manage Traffic Area and to other Areas. The response to these requests to other Areas shall be checked and the Operator informed if it is not as expected.

User Needs: 2.1.1.1, 7.3.0.3, 7.3.1.1, 7.3.1.2, 7.3.1.3, 7.3.1.4, 7.3.2.1, 7.3.3.1, 7.3.4.1

3.3.3 Develop Demand Management Strategy

Overview

This Low Level Function shall produce new demand management strategies at the request of the Operator. These strategies shall be designed to encourage a re-distribution of the use of travel modes away from the current highly used mode(s). The Function shall use data about the current usage of different modes. It shall assess these against "rules" for distribution provided by the Operator. The resulting strategy shall be sent to the store management Function for later use, and to the Implementation Function if action is required immediately.

User Needs: 2.1.2.4, 2.1.2.5, 2.1.3.1, 7.3.0.4, 7.3.0.5

3.3.4 Manage Demand Data Store

Overview

This Low Level Function shall manage the Demand Data Store and produced reports at the request of the Operator. These reports shall be produced using data that is in the Store and shall be sent to the Operator. Data received about the use of transport modes shall be loaded directly into the Store. It shall also be possible to send the data to the implementation Function if a strategy is currently in use. The Function shall provide data from the Store to enable new demand management strategies to be developed.

User Needs: 2.1.4.1, 2.1.4.2

3.3.5 Provide Demand Management Operator Interface

Overview

This Low Level Function shall provide the interface through which the Operator can control the management of traveller demand for transport modes. It shall enable the Operator to develop and implement demand strategies both off-line and in real time and to be informed of the effects of their implementation. Facilities shall be provided to enable reports on the use of transport modes to be produced using stored data. The Operator shall be able to provide input through a keyboard, some form of "point and click" based data collection, an electro-mechanical device, or audio converter. It shall be possible for the output can be sent to the Operator using an audio device, a visual device, a mechanical device, as printed material, or any combination of these. Output shall also be available on electronic storage devices at the request of the Operator.

User Needs: 7.3.0.2

3.4.1 Monitor Weather Conditions

Overview

This Low Level Function shall collect data about weather conditions. It shall be possible for the data to come from Weather Systems or to be detected using sensors within the road network. The data shall be forwarded to another Function for storage.

User Needs: 7.1.1.6

3.4.2 Monitor Atmospheric Pollution

Overview

This Low Level Function shall provide data about atmospheric pollution in the road network. It shall achieve this by continuously monitoring the weather conditions using sensors. The data obtained by the Function shall be forwarded to another Function for storage.

User Needs: 7.1.1.8

3.4.3 Monitor Noise Pollution

Overview

This Low Level Function shall provide data about noise pollution in the road network. It shall achieve this by continuously monitoring the noise levels using sensors. The data shall be forward to another Function for storage.

User Needs: 7.1.1.7

3.4.4 Predict Environmental Conditions

Overview

This Low Level Function shall use collected data to predict the environmental conditions that will occur in and around the road network managed by the System. The collected data shall be provided by another Function. It shall be used with an algorithm and static data to produce the predictions. These shall be sent to another Function for storage.

User Needs: 7.1.2.5, 7.1.2.6

3.4.5 Provide Environmental Conditions Operator Interface

Overview

This Low Level Function shall provide the interface through which the Road Network Operator shall be able to manage the collection of environmental data and its use by other functionality within the System. As part of this activity it shall be possible for the Operator to obtain output of the data currently being collected, prediction of environmental conditions and historical data. It shall also be possible for the Operator to update the static data used in the prediction of environmental conditions. The Operator shall be able to provide input through a keyboard, some form of "point and click" based data collection, an electro-mechanical device, or audio converter. It shall be possible for the output can be sent to the Operator using an audio device, a visual device, a mechanical device, as printed material, or any combination of these. Output shall also be available on electronic storage devices at the request of the Operator.

User Needs: None

3.4.6 Manage Environmental Conditions Data

Overview

This Low Level Function shall manage the Data Store of environmental data. In performing this activity, it shall collect and collate data provided by other Functions and from other System(s) and load them into the Data Store. When requested by the Operator, or at periodic intervals, the Stored data shall be sent to the prediction function. The resulting environmental conditions predictions shall be added by the Function to the contents of the Data Store. Data shall be sent to other Functional Areas and other parts of the Manage Traffic Area again at periodic intervals, or at the request of the Operator.

User Needs: 2.1.4.1, 6.1.1.4, 7.1.0.4

3.5.1 Evaluate Short Term Maintenance Needs

Overview

This Low Level Function shall evaluate the short term maintenance needs of the road network and shall request any needed repair activities. It shall use data about the amount of traffic that has been using the road network and weather information. This shall be compared against what it means in terms of required short term maintenance and from this recommended activities shall be derived. If these are confirmed by the Operator then the Maintenance Organisation shall be requested to carry out the work.

User Needs: 2.2.0.1, 2.2.0.3, 2.2.0.5, 2.2.3.1, 2.2.4.1

3.5.2 Evaluate Long Term Maintenance Needs

Overview

This Low Level Function shall evaluate the long term maintenance needs of the road network and shall request any needed repair activities. It shall collect data about the use that traffic has been making of the road network and weather information. This shall be compared against what it means in terms of required long term maintenance and from this recommended activities shall be derived. If the application of these activities are confirmed by the Operator then the Maintenance Organisation shall be requested to carry out the work.

User Needs: 2.2.0.6, 2.2.3.1, 2.2.4.1

3.5.3 Evaluate Equipment Maintenance Needs

Overview

This Low Level Function shall evaluate the need for maintenance of equipment and request any needed repair activities. It shall collect information on equipment faults provided by other Functions and shall compare these with information about required maintenance activities. From this comparison recommended activities shall be derived. If the application of these activities are confirmed by the Operator then the Maintenance Organisation shall be requested to carry out the work.

User Needs: 2.2.2.1, 2.2.2.2

3.5.4 Evaluate De-icing Need

Overview

This Low Level Function shall evaluate the need for the de-icing of roads and pavements. It shall collect data about the current state of the road and pavement surfaces and evaluate these against criteria for the need to apply de-icing. When de-icing is found to be required, the Function shall request the Maintenance Organisation to carry out the activity.

User Needs: 2.2.1.1

3.5.5 Provide Operator Maintenance Operations Interface

Overview

This Low Level Function shall provide the interface through which the Operator can control maintenance activities. It shall enable the Operator to confirm or reject both short term and long term maintenance activities, to review and update the criteria by which the need for maintenance and repair is decided and to monitor maintenance activities. The Operator shall be able to provide input through a keyboard, some form of "point and click" based data collection, an electro-mechanical device, or audio converter. It shall be possible for the output can be sent to the Operator using an audio device, a visual device, a mechanical device, as printed material, or any combination of these. Output shall also be available on electronic storage devices at the request of the Operator.

User Needs: None

3.5.6 Manage Maintenance Data Store

Overview

This Low Level Function shall be responsible for the management of the store of maintenance data. This store shall contain databases of maintenance operations and of the road network, infrastructure and road-side equipment. It shall be possible for other maintenance Functions to obtain data from the store and for its contents to be changed through the operator interface Function. The Function shall update the data about maintenance activities based using input from other Functions and from the Maintenance Organisation.

User Needs: 2.2.0.6, 2.2.2.3

4.1.1 Estimate Vehicle Indicators

Overview

This Low Level Function shall monitor Public Transport vehicle real time parameters (e.g. location, status, and occupancy) as well as fleet parameters (e.g. transportation demand). Data shall be collected directly from vehicles through any available data communication links.

User Needs: 2.1.0.1, 2.1.4.2, 10.1.0.4, 10.1.2.1, 10.1.2.2, 10.2.2.1, 10.1.5.1, 10.2.1.6

4.1.2 Predict Vehicle Indicators

Overview

This Low Level Function shall provide predictions of vehicle and fleet parameters (e.g. arrival time of a vehicle at a given point), for any required time horizon. These predictions shall be based on the knowledge of the current situation and historical data. It shall be possible for predicted information on vehicles to be delivered directly to traveller/passengers by means of dedicated devices (e.g. bus-stop and on-board displays). The same information shall also be made available to travellers via functionality in Area 6.

User Needs: 2.1.1.3, 10.1.4.1, 10.1.4.2, 10.1.4.3, 10.4.0.1, 10.4.1.1, 10.4.1.2, 10.4.1.3, 10.4.2.1, 10.4.2.2

4.1.3 Calculate Service Performance

Overview

This Low Level Function shall calculate predefined performance indicators. These indicators shall be based on continuously observed real time data available from the operating Public Transport vehicles.

User Needs: 10.1.0.4, 10.1.2.3, 10.2.4.1, 10.2.4.2

4.1.4 Confer to Vehicles

Overview

This Low Level Function shall enable both data and voice dialog with Public Transport vehicles and drivers. The dialogue shall be used for situations that are not included in updates provided by regularly transmitted data, e.g. emergencies, special messages to drivers, etc.

User Needs: 5.1.0.1, 5.1.0.2, 5.1.0.4, 5.1.0.5, 10.1.5.1, 10.2.2.2, 10.5.0.2, 10.5.0.1, 10.5.0.3

4.2.1 Plan & Schedule Services

Overview

This Low Level Function shall provide support to PT Service Providers for the preparation of the complete scheduling of the public transport service and its successive updates. Planning shall include details such as: Public Transport networks, quality of service parameters (e.g. frequency of vehicles, routes, etc.), timetables, synchronisation, driver duty scheduling, co-ordination with other mode of transport, etc. Variations of normal service due to planned special events and predicted traffic conditions shall also be performed.

User Needs: 2.1.0.1, 2.1.0.2, 10.1.0.1, 10.1.0.3, 10.1.1.1, 10.1.4.4, 10.4.0.1, 10.4.1.3, 10.4.2.1

4.2.2 Plan Vehicle Pooling Services

Overview

This Low Level Function shall perform optimised planning for combining and organising specific groups of people having similar origin/destination combinations. When possible the planning shall be performed in combination with scheduled Public Transport services and other modes of transport.

User Needs: 10.1.0.1, 10.1.0.3, 10.2.0.4, 10.3.0.1, 10.3.0.3, 10.3.0.4

4.2.3 Manage Fare Schemes

Overview

This Low Level Function shall provide support to Operators for defining and managing tariffs according to fare policy and requirements of demand management in the overall network. It shall define the types of fare structures and actual parameters (e.g. zones, times, distances), the types of fare product and card, and sales policy which shall also be integrated with other mode of transport and other services. The Function shall rely on functionality in Area 1 for actual tickets/cards sales. Information to public shall be made available through functionality in Area 6.

User Needs: 4.1.2.2, 7.3.2.4, 10.1.4.1, 10.1.4.2, 10.1.4.4

4.2.4 Manage PT Route Stores and Operator Interface

Overview

This Low Level Function shall be responsible for providing the management interface that enables route data and traffic predictions to be loaded into the PT static route data Store. The data shall be provided by Functions in the Manage Traffic Area and loaded by this Function into the PT Static Route Data Store. It shall comprise data about the road network served by the PT operation and strategies that have been devised by the Manage Traffic Area for that road network. The Function shall provide an interface that enables the Public Transport Operator to amend and add to the data in the Data Store and to obtain reports describing the data. IT shall also be possible for the Operator to obtain reports about the service data that is also in the Data Store.

User Needs: 10.2.1.9

4.3.1 Provide Service on Demand

Overview

This Low Level Function shall provide on-demand transport services to individual travellers. The service shall be provided on the basis of availability, origin/destination required and special needs, e.g. disabled travellers. It shall be possible for the Public Transport fleet that is used for this service to include buses, vans, and taxis.

User Needs: 10.2.0.1, 10.2.0.3, 10.2.1.7, 10.2.1.8, 10.3.0.1, 10.3.0.2

4.3.2 Provide Maintenance Co-ordination

Overview

This Low Level Function shall optimise maintenance schedules based on relevant criteria. It shall be possible for these criteria to be based on monitored faulty infrastructure and vehicles. Co-ordination with road works planned in the network shall also be included.

User Needs: 2.2.0.1, 2.2.0.3, 2.2.0.5

4.3.3 Manage PT Drivers

Overview

This Low Level Function shall handle mid and short term assignment of drivers. It shall include normal scheduling, its variation and adaptations, plus details of on-demand and vehicle sharing services when applicable.

User Needs: 10.1.1.2

4.3.4 Manage Vehicle Sharing

Overview

This Low Level Function shall plan vehicle sharing facilities. The Function shall do this by combining traveller requests according to availability of vehicles and drivers, and according to the overall Public Transport management strategies. It shall be possible for the Public Transport fleet used for this service to include buses, vans, and taxis.

User Needs: 10.2.0.4, 10.2.0.5, 10.2.1.7, 10.2.1.8, 10.3.0.1, 10.3.0.2, 10.3.0.3, 10.3.0.4, 10.3.0.5, 10.3.0.7, 10.4.0.1

4.3.5 Monitor Infrastructure

Overview

This Low Level Function shall provide the continuous monitoring of both road side and in-vehicle infrastructure. The Function shall ensure that faulty equipment can be promptly identified and reported.

User Needs: 2.2.2.1, 2.2.2.3, 10.3.0.1, 10.3.0.2

4.4.1 Optimise Control Action

Overview

This Low Level Function shall optimises corrective actions based on on-line vehicle monitoring and planned schedule. The aim shall be to improve the service reliability and schedule adherence. Co-ordination with control strategies undertaken for other modes of transport shall also be an objective of this Function. The functionality shall be usually supported by the intervention of Operators defining the optimisation criteria. Relevant variations of the planned service shall be continuously communicated to related systems and Travellers by dedicated devices, e.g. bus-stop and/or on-board displays, etc.

User Needs: 2.1.0.1, 2.1.0.2, 2.1.3.1, 2.1.4.1, 5.3.1.1, 5.3.1.2, 5.3.1.3, 7.1.0.2, 10.1.3.1, 10.1.3.2, 10.1.0.1

4.4.2 Require Vehicle Priority

Overview

This Low Level Function shall generates requests for priority for those Public Transport vehicles which are selected by the current control action. The selection shall be based on the predicted arrival time of the vehicle at a given point along the route.

User Needs: 10.1.6.1

4.4.3 Control Vehicle Driving

Overview

This Low Level Function shall convert the actions defined by the control strategies into commands to be acted upon directly by the controlled vehicles or their drivers. The control of automatically driven Public Transport vehicles, if applicable, shall also be included in this Function.

User Needs: 10.4.1.1

4.4.4 Manage Additional Vehicles

Overview

This Low Level Function shall manage and co-ordinate the reserve vehicles to act upon special control measures. These shall be decided as part of the control strategy, e.g. substitute faulty vehicles, enforce a particular service, etc.

User Needs: 10.1.3.1, 10.1.3.2

5.1.1 Monitor Visibility Range

Overview

This Low Level Function shall provide the measure, by instrumental means, of the visibility range. The visibility range shall be related to the distance at which objects on the road can be detected by the driver without instrumental aids.

User Needs: 8.1.0.1

5.1.2 Generate Enhanced Vision of Driving Area

Overview

This Low Level Function shall generate an "image", that is better than human vision can provide. It shall use instrumental means (camera, processing, lighting vision out of the visible spectra, etc.) to provide the "image" of the driving area.

User Needs: 8.1.0.2

5.1.3 Provide Enhanced Lighting

Overview

This Low Level Function shall provide a better illumination of the driving area than is currently available. It shall use intelligent light control (beam orientation, beam shaping, UV lights, etc.) and also provide co-operation with vehicles crossing the path of vehicle for which illumination is being provided.

User Needs: 8.1.0.2

5.1.4 Provide Anti-glaring (Co-operative) Facilities

Overview

This Low Level Function shall provide anti-glaring assistance by exchanging information between vehicles that cross each others paths. It shall be possible for the Function to include a variety of facilities, including but not limited to switching high/low beams, pulsing synchronised beams, etc.

User Needs: 8.1.0.2

5.2.1 Provide Longitudinal Dynamic Control

Overview

This Low Level Function shall provide the automated control of both accelerator and brakes of the vehicle. It shall provide these facilities together with all features for a safe operation, diagnostics, control network and failure prediction of the automatic vehicle controls.

User Needs: 8.2.0.1, 8.2.1.3, 8.2.6.2, 8.4.3.4, 8.2.6.1, 8.3.0.3, 8.4.3.3

5.2.2 Provide Lateral Dynamic Control

Overview

This Low Level Function shall provide the automated control of the steering of the vehicle and the automatic differential braking control. It shall provide these facilities together with all features for their safe operation, diagnostics, control network and failure prediction.

User Needs: 8.2.2.1, 8.2.6.7, 8.3.0.3, 8.4.3.2

5.2.3 Provide Driver-(Automatic Controls) Interactivity

Overview

This Low Level Function shall provide features for interactivity between the driver and the automatic controls. It shall include an on-board safe architecture, plus facilities for the continuous tracing of actuations, monitoring of commands from the infrastructure and provisions/procedures for automatic take-over/release of controls.

User Needs: 8.3.2.3

5.2.4 Provide Infrastructure Support

Overview

This Low Level Function shall provide all kinds of driving support from the infrastructure including features for road/lane following, speed regulation, distance keeping, lane enter/exit and reserved lanes protection. The Function shall also provide the diagnostics for all the facilities and the communication capability (to the driver or to the automatic controls). It shall also include facilities for vehicle identification, rule violation detection and for generation of actions for prosecution.

User Needs: None.

5.2.5 Provide Pre-Crash Restraints Deployment

Overview

This Low Level Function shall provide facilities for the deployment of on-board active safety systems associated with predictive collision sensors all around the vehicle.

User Needs: 8.6.0.1, 8.6.0.2

5.3.1 Provide Dynamic Scenario Intelligence

Overview

This Low Level Function shall provide a continuos monitoring of the driving scenario for the longitudinal control of the vehicle. It shall include facilities for detecting and interpreting road/lane limits, all objects on the expected vehicle trajectory, road signs and signals. The Function shall also provide facilities for the evaluation of the safety limits for vehicle manoeuvres (free areas, vehicle dynamics and available road-tire friction).

User Needs: 8.3.0.2, 8.3.1.3, 8.3.2.1

5.3.2 Provide Longitudinal Dynamic Control of the Vehicle

Overview

This Low Level Function shall provide facilities for the longitudinal control of the vehicle. It shall use the output from the facilities provided by the "Provide Longitudinal Dynamic Control" Function (5.2.1) and the knowledge of the driving scenario provided by "Provide Dynamic Scenario Intelligence" Function (5.3.1). The Function shall therefore be able to control the vehicle to avoid collisions based on the outcome of the two Functions.

User Needs: 8.2.3.2, 8.2.3.3, 8.2.3.4, 8.2.3.5, 8.3.1.1, 8.3.1.2

5.3.3 Provide Facilities for Parking

Overview

This Low Level Function shall provide capabilities for object detection at low distance all around the vehicle. These shall be used for the longitudinal control of the vehicle at low speed for parking manoeuvres.

User Needs: 8.5.2.1, 8.5.2.2

5.3.4 Provide Facilities for Intelligent Speed Adaptation

Overview

This Low Level Function shall provide the driver with the ability to keep the vehicle below a mandatory speed limit automatically. It shall also provide facilities for the continuous display of the current mandatory speed limit for manual set of the speed limit.

User Needs: 8.2.3.2, 8.2.3.3, 8.2.3.4, 8.2.3.5, 8.2.5.1, 8.2.5.5

5.3.5 Provide Facilities for Stop & Go

Overview

This Low Level Function shall provide capabilities for wide-angle object detection in front of the vehicle, low distance keeping at low speed and longitudinal automatic control for "in-queue" vehicle operation.

User Needs: 8.3.1.7

5.3.6 Provide Facilities for Adaptive Cruise Control

Overview

This Low Level Function shall provide capabilities for long distance object detection and for automatically keeping the set speed or a safe distance from the preceding vehicle on the same lane.

User Needs: 8.2.1.2, 8.2.3.2, 8.2.3.3, 8.2.3.4, 8.2.3.5, 8.2.5.5, 8.3.1.1

5.3.7 Provide Facilities for Speed Enforcement

Overview

This Low Level Function shall provide facilities to receive speed limits from outside the vehicle and to recommend them to the driver. It shall also be able to control automatically the vehicle speed according to the set value.

User Needs: 8.2.5.2

5.3.8 Provide Facilities for Anti-collision Emergency Braking

Overview

This Low Level Function shall provide the capability to detect, with high reliability, all kinds of object along the vehicle's expected trajectory. It shall also be able to warn the driver and/or apply an emergency braking to avoid a collision.

User Needs: 8.2.3.2, 8.2.3.4, 8.2.3.5, 8.2.3.6, 8.3.1.5

5.3.9 Provide Facilities for Vehicle Platooning

Overview

This Low Level Function shall provide facilities to create a platoon (or road train) of vehicles. It shall include all the capabilities to supervise the following vehicles, or to be controlled automatically by the leading vehicle. The Function shall also provide facilities for the vehicle to enter and to leave the convoy, to monitor the driving area around the vehicle for emergencies, to diagnose and communicate any malfunction within the vehicle, to stay at short distance from the preceding vehicle and in general to implement all the procedures that will be mandatory for this type of automatic vehicle operation.

User Needs: 8.2.3.1, 8.2.3.2, 8.2.3.3, 8.2.3.4, 8.2.3.4, 8.2.3.5, 8.2.3.6, 8.2.3.7, 8.3.1.1

5.4.1 Provide Dynamic Scenario Intelligence

Overview

This Low Level Function shall provide a continuos monitoring of the driving scenario for the lateral control of the vehicle. It shall include facilities for detecting and interpreting road/lane limits, all objects on the expected vehicle trajectory, road signs and signals. The Function shall also provide facilities for the evaluation of the safety limits for vehicle manoeuvres (free areas, vehicle dynamics and available road-tire friction) plus the monitoring and interpretation of the crossing area and of the rear area of the vehicle.

User Needs: 8.4.0.2

5.4.2 Provide Lateral Dynamic Control of the Vehicle

Overview

This Low Level Function shall provide the lateral control of the vehicle. It shall use the output from the facilities provided by the "Provide Lateral Dynamic Control" Function (5.2.2) and the knowledge of the driving scenario provided by "Provide Dynamic Scenario Intelligence" Function (5.4.1). The Function shall therefore be able to control the vehicle to avoid collisions based on the outcome of the two Functions.

User Needs: 8.2.3.2, 8.2.3.3, 8.2.3.4, 8.2.3.5, 8.4.3.5

5.4.3 Provide Facilities for Parking

Overview

This Low Level Function shall provide capabilities for object detection at short distance all around the vehicle and for lateral control (steering) at low speed. These facilities shall enable vehicle parking manoeuvres to be performed.

User Needs: 8.5.2.1, 8.5.2.2

5.4.4 Provide Facilities for Lane/Road Keeping

Overview

This Low Level Function shall provide the driver with the ability, by information or active steering, to keep the vehicle within its current lane of the carriageway or inside the road limits.

User Needs: 8.2.2, 8.2.2.1, 8.2.2.2, 8.2.3.2, 8.2.3.3, 8.2.3.4, 8.2.3.5, 8.3.1.3

5.4.5 Provide Facilities for Lane Change

Overview

This Low Level Function shall provide the driver with information or haptic steering warnings about the feasibility of a lane change manoeuvre. It shall use long range rear vehicle area monitoring which shall be in addition to the facilities provided by the "Provide Dynamic Scenario Intelligence" Function (5.4.1).

User Needs: 8.2.3.2, 8.2.3.3, 8.2.3.4, 8.2.3.5, 8.3.1.3, 8.4.0.1

5.4.6 Provide Facilities for Reserved Lanes I/O

Overview

This Low Level Function shall provide all the facilities to enter and to leave reserved lanes (on highways). Together with the capabilities for implementing the reserved lanes operating rules (distance, speed, acceleration, remote controllability, etc.) the Function shall also provide the diagnostics to guarantee the current vehicle conformity before entering the lane and a predictive failure detection.

User Needs: 8.3.1.3, 8.4.0.1

5.4.7 Provide Infrastructure Support for Lane Following

Overview

This Low Level Function shall provide all kinds of support to facilitate lane following. It shall include facilities that are able to use different types of lane boundary marking. They types shall include but not be limited to active and passive wires into the road surface, magnets, optical and magnetic tapes or paint, road side reflectors, LCC communication, etc. The Function shall also include continuous diagnostic checks of the functionality of these support facilities.

User Needs: None.

5.4.8 Provide Facilities for Overtaking

Overview

This Low Level Function shall provide facilities for monitoring the front and rear areas of the vehicle. With associated information the Function shall enable a safe overtaking manoeuvre to be automatically performed by the vehicle.

User Needs: 8.4.0.1

5.4.9 Provide Facilities for Stop & Go ++

Overview

This Low Level Function shall provide similar facilities for Stop & Go as provided by the "" Function (5.3.5). These facilities shall therefore comprise the capabilities for wide-angle object detection in front of the vehicle, low distance keeping at low speed and lateral automatic control for "in-queue" vehicle operation. The Function shall also include the capability for low speed lateral control.

User Needs: 8.3.1.7

5.5.1 Monitor Driver Status

Overview

This Low Level Function shall provide the continuous monitoring of the driver status. It shall be capable of detecting impairment of the driver due to any reason. These reasons for driver impairment shall include but not be limited to fatigue, alcohol/drug abuse, sudden health problems, prolonged inattention, etc.

User Needs: 8.5.0.2

5.5.2 Enhance Driver Alertness

Overview

This Low Level Function shall provide all kinds of methods to enhance driver alertness. The methods of driver alertness enhancement shall include but not be limited to acoustical/optical warnings, haptic stimulation, changes in ambient (on-board) conditions (temperature, smell, etc.

User Needs: 8.5.0.3

5.5.3 Monitor Vehicle Status

Overview

This Low Level Function shall provide the continuous monitoring of the vehicle to detect impending breakdowns or performance losses that could have an impact on vehicle safety.

User Needs: 8.5.1.2

5.5.4 Record Operational Data

Overview

This Low Level Function shall provide the record of data that is related to vehicle safety and/or for understanding accidents. The data shall include but not be limited to driver status/behaviour, on vehicle status/dynamic performance and images of the driving scenario.

User Needs: None.

5.5.5 Provide Automatic Take-over of Controls

Overview

This Low Level Function shall provide the capability for the automatic take-over of the vehicle control in the case of driver impairment being detected and confirmed. It shall also include the procedures necessary to stop the vehicle safely.
User Needs: 8.5.1.2

5.5.6 Provide Warnings to Surrounding Traffic

Overview
This Low Level Function shall provide warnings to the surrounding traffic in case of driver impairment and of actuation of the procedure for the vehicle to be safely stopped.
User Needs: 8.5.0.4

5.5.7 Provide Mayday Call

Overview
This Low Level Function shall provide the capability for a mayday call to be made. It shall be possible for this call to be both manually actuated by the driver, or automatically started by the driver monitoring system or the crash sensor.
User Needs: 8.5.1.1, 8.5.1.2, 8.5.1.3

5.6 Provide Driver-Vehicle Interaction

Overview
This Low Level Function shall provide all kinds of Driver-Vehicle interaction facilities both for current functionalities and for Advanced Driver Assistance Systems. It includes all kind of visual, acoustic and haptic information together with the capability to manage all inputs from the driver (manual, acoustic, etc.). It includes also the management of virtual reality driving support systems.
User Needs: 8.2.5.4, 8.3.1.2, 8.3.1.4

5.7.1 Provide Vehicle-Infrastructure Communication

Overview
This Low Level Function shall provide on-board availability of all the communication means and interfaces. It shall include but not be limited to Dedicated Short Range Communication, IR-DSRC, Radio Data System TMC, GSM cellular phone, Digital Audio Broadcasting, Universal Mobile Telecommunication Service, etc. The Function shall also provide special interfaces (firewalls) to the vehicle control systems and provide controls for data integrity.
User Needs: 8.2.4.1

5.7.2 Provide Vehicle-Vehicle Communication

Overview
This Low Level Function shall provide facilities for inter-vehicle communication including protocols for access the communication channel and for data integrity control. Provisions for avoiding false data generation and broadcasting shall be an integral part of the Function.
User Needs: 8.2.4.1

5.7.3 Provide Vehicle Position Determination

Overview
This Low Level Function shall provide the capability for the vehicle to determine its position. This shall be determined with the accuracy required by the service provider to really dispatch the specific service to the vehicle. The Function includes the features to upgrade the available services - GPS, DGPS, GNSS, etc.
User Needs: None.

5.7.4 Provide Vehicle Telematic Architecture

Overview

This Low Level Function shall provide a suitable on-board architecture (networks and protocols) for all the telematic services. It shall include suitable provisions for different services and specific "gates" or firewalls for use when the information flows from one service to another, e.g. speed enforcement going from the DSRC interface to the vehicle control bus.

User Needs: None.

5.8.1 Provide Pre-Trip Information

Overview

This Low Level Function shall provide on-board availability for all the services required for trip planning and mode/route selection. It shall provide access to the facilities provided by the Provide Traveller Journey Assistance Functions (Area 6).

User Needs: None.

5.8.2 Provide Dynamic Route Guidance

Overview

This Low Level Function shall provide availability of dynamic route guidance information on-board the vehicle. It shall make it possible for the facilities provided by the Manage Traffic and Provide Traveller Journey Assistance Functions (Areas 3 and 6) to be used within the vehicle.

User Needs: None.

5.8.3 Provide Travel Information

Overview

This Low Level Function shall provide on-board updated information on all events that can influence travel. Information about tourist facilities and other items of interest to the traveller shall be provided by the Function. It shall provide the facilities available from the Provide Traveller Journey Assistance Functions (Area 6) on-board the vehicle.

User Needs: None.

5.8.4 Provide Road Assistance

Overview

This Low Level Function shall provide facilities needed when the vehicle stops for unexpected reasons, such as breakdown, incident, health needs, etc. These facilities shall enable connection to and provision of assistance by service providers. The Function shall also include facilities for mayday call handling and the access to the Provide safety and Emergency Facilities Functions (Area 2).

User Needs: 8.5.1.1, 8.5.1.2, 8.5.1.3

5.8.5 Provide Road Regulations

Overview

This Low Level Function shall make available on-board the vehicle the current status of road signs and signals. It shall also include an indication as to whether the status is a recommendation or an enforcement. The Function shall provide availability of part of the facilities provided by the Manage Traffic and Provide Support for Law Enforcement Functions (Areas 3 and 7) on-board the vehicle.

User Needs: None.

5.8.6 Collect Floating Cars Data

Overview

This Low Level Function shall make available to the Manage Traffic Functions (Area 3) and/or service providers data collected by the vehicle. This data shall comprise but not be limited to details of the current traffic state, weather conditions and visibility conditions. The Function shall transmit this data at periodic intervals so that the vehicles become probes within the road network.

User Needs: None.

5.8.7 Provide Stolen Vehicle Tracking/Prosecution

Overview

This Low Level Function shall provide data to the Provide Support for Law Enforcement and Manage Freight and Fleet Operations Functions (Areas 7 and 8) and to service providers. This data shall enable the continuous monitoring of the vehicle, the detection of theft and the vehicle tracking by means such as GPS and GSM. The Function shall also be able to provide data that may possibly assist with crime prosecution. It shall also provide under control of the Provide Support for Law Enforcement Functions (Area 7) theft countermeasures facilities such as engine stop.

User Needs: 5.1.1.4

5.8.8 Provide Detection of Law Violations

Overview

This Low Level Function shall provide all the on-board vehicle facilities for the detection of law violations. These violations shall comprise but not be limited to those connected with speed limits, red-light passing, etc. The Function shall also provide facilities for the transmission of the relevant information to the Provide Support for Law Enforcement Functions (Area 7).

User Needs: None.

5.8.9 Provide (EFT) Electronic Financial Transactions

Overview

This Low Level Function shall provide on-board the vehicle facilities for all type of financial transactions. These facilities shall include but not be limited to those for communications, data integrity controls, vehicle identification and location, service request, service cost charge, etc. for electronic fee collection, access control and in general for all the on-board pay-services.

User Needs: 4.1.0.1, 4.1.3.1

5.8.10 Provide LAN Interface

Overview

This Low Level Function shall provide all the functionality required to interface a vehicle with an on-board telematic network to the outside world. The outside world shall be represented either by Terminators, or by other Functional Areas.

User Needs: None.

6.1 Define Traveller's GTP

Overview

This Low Level Function shall construct a set of factual data and general trip preferences. This shall be done once as a preparation to full personalisation, although this part shall not be absolutely necessary in all applications. The Function shall also activate measures to reduce the amount of information generated. The following parts can or have to be defined: Each time a new trip is initiated this set can be adapted for the trip at hand; also during trip evaluation this set can be changed, this time for all trips.

User Needs: 6.1.0.4; 6.1.0.5, 6.1.0.6, 6.1.0.7, 6.1.2.8, 6.1.3.1; 6.1.3.2, 6.1.3.3, 6.1.3.8, 6.2.2.8; 6.2.3.1, 6.2.3.2, 6.2.3.3, 6.2.3.4, 6.2.3.5, 6.2.3.6, 6.2.3.7, 6.4.1.4, 6.4.2.2, plus 6.3 (special case of 6.1, 6.2, 6.4 and 10.4).

6.2.1 Define Traveller's ATP

Overview

This Low Level Function shall compose the set of factual data and preferences for the actual trip. If available the Function shall use the definition of this data in GTP. Otherwise, or if the trip deviates from GTP data or it involved pedestrian and/ or cycling modes the data shall be produced by the Function. The data shall comprise but not be limited to the destination, any necessary bookings, the schedule, and whatever else is deemed interesting for trip satisfaction. It shall enable Support Trip Function to react in the correct way when perturbations occur with the travel network.

User Needs: 6.1.0.5, 6.1.0.6, 6.1.0.7, 6.1.3.8, 6.2.2.3; 6.2.3.1, 6.2.3.2, 6.2.3.3, 6.2.3.4, 6.2.3.5, 6.4.1.4

6.2.2 Define Prime Criteria

Overview

This Low Level Function shall request from the traveller the prime criteria are around which the trip planner has to construct the trip plan. As part of This process, it shall be possible for the Function to suggested possible prime criteria to the Traveller. It shall be possible for the criteria to be as simple as an arrival time. However it must also be possible for other issues like schedules (notably airline schedules) to be consulted to eliminate alternatives and to reduce the search space. This Function must provide further support personalisation.

User Needs: 6.1.0.4, 6.1.0.5, 6.1.0.6, 6.1.0.7, 6.2.3.1, 6.2.3.2, 6.2.3.3, 6.2.3.4, 6.2.3.5, 6.4.1.4

6.2.3 Propose Trip Alternatives

Overview

This Low Level Function shall present a number of alternative itineraries to the Traveller. If shall be possible for these itineraries to use the GTP and ATP data as well as other kinds of information. These other kinds of information may comprise but not be limited to possible perturbations of the schedules. This Function work in an iterative way to produce more and more accurate itineraries. Successive itineraries shall be stored internally so that they can be re-called if later versions turn out to be unsatisfactory.

User Needs: 6.1.1.1, 6.1.1.2, 6.1.1.3, 6.1.1.4, 6.1.2.2; 6.1.2.10, 6.2.1.1, 6.2.1.3, 6.2.2.2, 6.2.2.6; 6.2.3.1, 6.2.3.2, 6.2.3.3, 6.2.3.4, 6.2.3.5, 6.4.1.3, 6.4.1.4, 6.4.1.5, 7.3.0.1, 10.1.4.2, 10.1.4.4, 10.4.2.1, 10.4.2.2

6.2.4 Select and Define Bookings

Overview

This Low Level Function shall receive from the Traveller an indication of desired bookings. It shall be possible for alternatives to be proposed, until the Traveller indicates that the best choice has been made. The Functions shall not make any actual bookings.

User Needs: 6.1.1.4, 6.1.2.3, 6.1.2.10, 6.1.3.1, 6.1.3.4, 6.1.3.6, 6.2.2.1, 6.2.2.3, 6.2.2.6, 6.2.3.1, 6.2.3.2, 6.2.3.3, 6.2.3.4, 6.2.3.5, 6.4.1.1, 7.3.0.1

6.2.5 Plan Road Trip(s)

Overview

This Low Level Function shall plan road based portions of trips. It shall use road network and regular traffic information, plus weather and traffic perturbation information. If the trip is for HGV or freight vehicles the Function shall take into account route restrictions. Any restrictions dictated by the cargo type (tunnels, residential areas, etc.) shall also be considered. For emergency vehicles a detailed route and schedule shall be produced in the form of a 'green wave'. Road trips for cyclists and pedestrians shall be produced by the Function using the road network data and related perturbations, but disregarding traffic incident information.

User Needs: 6.1.3.6, 6.2.0.4, 6.2.1.3; 6.2.2.5, 6.2.3.1, 6.2.3.2, 6.2.3.3, 6.2.3.4, 6.2.3.5, 6.4.0.1, 6.4.1.1, 6.4.1.3, 6.4.1.4, 7.3.0.1, 7.3.4.1

6.2.6 Perform Bookings and Payments

Overview

This Low Level Function shall make any bookings for services that are needed as part of a trip. The best choice bookings shall be used if possible. If the best choice cannot be used due to perturbations, alternatives shall be suggested to the Traveller. Any necessary pay action must be initiated by the Function.

User Needs: 6.1.3.1, 6.1.3.4, 6.1.3.6, 6.2.3.1, 6.2.3.2, 6.2.3.3, 6.2.3.4, 6.2.3.5

6.2.7 Produce Itinerary and Trip File

Overview

This Low Level Function shall load into the Data Store for trip files the preferences pronounced during trip definition and all trip data. This data shall include but not be limited to such things as bookings and payments made. The data shall be stored in such as way that it can be used to give the Traveller further support during the trip and to be used to generate warnings if perturbations occur. The Function shall also provide the Traveller with an itinerary encompassing travel modes, schedules, bookings, payments made and further information coming out of the Plan Trip Function. If so desired, maps for road trips or route descriptions shall be included, as well as safety advice concerning all conditions en route.

User Needs: 6.1.2.7, 6.2.2.4; 6.2.3.1, 6.2.3.2, 6.2.3.3, 6.2.3.4, 6.2.3.5, 6.4.0.1, 6.4.1.3

6.2.8 Provide GTP Store Operator Interface

Overview

This Low Level Function shall provide an interface that enables the Travel Information Operator to manage the contents of the GTP Data Store. It shall be possible for the Operator to review and update the data in the Store. Apart from general data management, the interface shall provide reports to the Travel Information Operator on the trip and mode selection criteria. The Function shall enable the Operator to change these criteria fi they do not conform to the current transport policy. The Operator shall be able to provide input through a keyboard, some form of "point and click" based data collection, an electro-mechanical device, or audio converter. It shall be possible for the output can be sent to the Operator using an audio device, a visual device, as printed material, or any combination of these. Output shall also be available on electronic storage devices at the request of the Operator.

User Needs: 6.1.2.9

6.3.1 Track Traveller and Implement Trip Plan

Overview

This Low Level Function shall follow the progress of the Traveller and implement each part of the trip plan. It shall be possible for a variety of tracking methods to be used by the Function to determine the actual location of the Traveller. If none are available, the Function shall follow the time schedule. i.e. use a form of dead reckoning. As the Traveller moves through the travel network, the Function shall monitor progress against the trip plan. Based on this data the Function shall request assessment of any perturbations in the travel network. If required by the trip plan, the Function shall activate the route guidance Function.

User Needs: 6.4.0.3, 6.4.1.2

6.3.2 Assess Perturbations

Overview

This Low Level Function shall assess any perturbations to conditions in the travel network. The assessment shall be performed against the trip plan and their consequences shall be listed. Eventual trip plan changes shall be prepared by the Function.

User Needs: 6.1.1.4, 6.1.2.1, 6.1.2.2, 6.2.0.6, 6.2.2.13

6.3.3 Inform Traveller

Overview

This Low Level Function shall inform the moving traveller any perturbations to the travel network and the eventual consequences to the trip plan. Any feedback given by the Traveller shall be used to update the data in the trip file Data Store. The results of the implementation of the trip plan shall be sent by this Function to the evaluation Function.

User Needs: 6.1.0.3, 6.1.2.3, 6.2.0.4, 6.2.0.5, 6.2.0.6, 6.2.2.1, 6.2.2.2, 6.2.2.3, 6.2.2.4, 6.2.2.5, 6.2.2.13

6.3.4 Provide Route Guidance

Overview

This Low Level Function shall provide route guidance to Travellers who are vehicle Drivers. It shall be possible for the information to be it based on the original or the adapted trip plan and route. The information shall take account of the latest traffic information so that congestion and other problems can be avoided.

User Needs: 6.2.1.1, 6.2.1.2, 6.2.2.2, 6.2.3.1, 6.2.3.2, 6.2.3.3, 6.2.3.4, 6.2.3.5, 6.4.0.1, 6.4.1.1, 6.4.1.2, 6.4.1.5, 6.4.2.4, 10.2.3.1

6.3.5 Provide Tip File Management Operator Interface

Overview

This Low Level Function shall provide a management interface to the Trip Plan Data Store for the Travel Information Operator. Periodically, the Function shall collect data from the Store about the content of the Trip Plans that are being produced. This data shall be formatted and presented to the Operator as a management report. The Operator shall be able to provide input through a keyboard, some form of "point and click" based data collection, an electro-mechanical device, or audio converter. It shall be possible for the output can be sent to the Operator using an audio device, a visual device, as printed material, or any combination of these. Output shall also be available on electronic storage devices at the request of the Operator.

User Needs: 6.1.2.9

6.4 Evaluate Trip

Overview

This Low Level Function shall evaluate the success of the trip planning and implementation. This shall be based on data provided by the Support Trip Function (F 6.3) and input from the Traveller collected after the trip has been completed. It shall be possible for the Function to collect this input as comments on the trip and on the support given. The results of the analysis shall be sent to the Travel Information Operator. The Function shall also keep the reusable part of the trip data and/or the trip skeleton available for other occasions when it can be used. It shall also be possible for the Function to produce updates to the GTP data for use in subsequent trip planning.

User Needs: 6.1.0.5, 6.4.1.7

7.1.1 Perform Measure

Overview

This Low Level Function shall carry out or collect the measure of some phenomena to check that the users comply with the rules enacted for the System. These measures shall be either those which are not performed by the other Areas in the course of their activities, or measures automatically carried out by other Areas, but which are not systematically checked.

For example, the Function shall perform the measure for the weight in motion, recording the weight per axle and total weight for freight vehicles, and it shall ask the Manage Freight and Fleet Operations Area to provide commercial vehicles' speed records. It shall be possible for measures to be performed directly by the Function, or received from the roadside actuators. The measures can be continuous (video record for example), or discrete (weigh in motion). The Function shall ask for the identification of the vehicle. The Function shall receive guidelines about the way to perform the controls from Functions in the Manage Traffic Area.

User Needs: 3.1.0.1, 3.1.0.2, 3.1.0.3, 3.1.0.4, 3.1.1.3, 3.1.1.4

7.1.2 Check Compliance

Overview

This Low Level Function shall check the compliance of the recorded images with the established rules. It shall be possible for this check to be performed in real time or off-line. If the vehicle is identified, the Function shall extract from the User's Registration Data Store the information needed to check that the user is allowed to behave as in the record. It shall also use information sent by the Manage Freight and Fleet Operations Area. If no identification is available, the Function shall request it from the Identify Violator Function, sending it an image of the violator extracted from the response. It shall be possible for the rules can be more or less strictly applied according to guidelines sent by the Manage Traffic Function Area. Upon detection of a fraud, the Function shall send the associated elements to the Process Fraud Notifications Function.

User Needs: 3.1.0.1, 3.1.0.2, 3.0.1.3

7.2.1 Analyse Image

Overview

This Low Level Function shall analyse the image sent by the Process Fraud Notifications or Detect Fraud Functions. The analysis shall be to determine the ID of the violator vehicle, and the type of fraud (violation) involved. The Function shall then send these elements to the Determine Violator ID Function.

User Needs: 3.1.0.1, 3.1.0.2, 3.1.0.3, 3.1.1.1, 3.1.1.2

7.2.2 Determine Violator ID

Overview

This Low Level Function shall be charged with obtaining the identity of the violator, i.e. the person who has committed the fraud (violation). It shall do this by extracting data from the User's Registration Data Store using the identification of the violating vehicle as the reference for the data. The vehicle identification shall be provided by another Function as input to this Function.

User Needs: 3.1.0.1, 3.1.0.2, 3.1.0.3, 3.1.1.1, 3.1.1.2

7.3.1 Sort Fraud Notifications

Overview

This Low Level Function shall carry out the classification of the fraud notifications received from the other Areas or from the Detect Fraud Function. If the violator's identity is not included in the notification, the Function shall send the elements to the Identify Violator Function to get it. The classification shall be done according to different criteria : level of seriousness, field (road, financial, commercial ,…), repeat offence. All the elements available on the fraud, with the parameters corresponding to the different criteria, shall then be sent to the Establish Prosecution File Function.

User Needs: 3.1.1.1, 3.1.1.2

7.3.2 Establish Prosecution File

Overview

This Low Level Function shall be charged with sending to the right Law Enforcement Agency terminator the file containing all the elements necessary for the prosecution of the violator. It shall also send the resulting file, plus all the elements received, to the Store Fraud Function. For frauds detected directly by this Area, and concerning freight vehicles, the Function shall also send a fraud notification, including all the elements to the Manage Freight and Fleet Operations Area.

User Needs: 3.1.1.1, 3.1.1.2, 3.1.0.5

7.4 Store Fraud

Overview

This Low Level Function shall be charged with the management of the Fraud Data Store. It shall store in the Fraud Data Store all the fraud (violation) notifications and prosecution files, and shall provide these elements to the Law Enforcement Agency(ies) terminator upon reception of a specific request.

User Needs: 3.1.0.2, 3.1.0.3, 3.1.0.5

7.5.1 Manage Rules

Overview

This Low Level Function shall update the content of the Rules Data Store. The Function shall take into account new elements provided by the different organisations that constitute the Law Enforcement Agency(ies) terminator.

User Needs: 3.1.0.1, 3.1.0.5

7.5.2 Manage Users' Registration

Overview

This Low Level Function shall be charged with updating the User's Registration Data Store, using new elements sent by the Law Enforcement Agency(ies) terminator. These registrations shall concern the identification of users, the ownership or utilisation relationship between users and vehicles, and the registration of operators allowed to perform commercial operations on the road network.

User Needs: 3.1.0.5

8.1.1.1 Negotiate Principal Requests

Overview

This Low Level Function shall ensure the commercial interface to the customer - the Principal actor in the Consignor/Consignee terminator, who has a road freight transport need. As such the Function shall handle customer transport opportunity, order and contract. The Function shall also have responsibility for finding the best appropriate fleet supplier, optimising multi-modal transport in inter-urban area and booking storage areas. Once the commercial negotiation is achieved, this Function shall hand over the execution of the contract to the Function in charge of performing the freight transport operation. The hand over shall include the transfer of responsibility for administrative activities including invoicing and payments.

User Needs: 9.5.1.1, 9.5.1.3, 9.5.1.4, 9.5.2.14

8.1.1.2 Choose a Fleet Supplier

Overview

This Low Level Function shall be responsible for providing the commercial interface between the freight management centre and the fleet suppliers. As such it shall handle supplier's order, proposal and contract. It shall also in charge to negotiate with the supplier when a registered order change is requested.

User Needs: 9.5.1.1, 9.5.1.3, 9.5.1.4, 9.5.2.10, 9.5.2.14

8.1.1.3 Administrate Freight Transactions

Overview

This Low Level Function shall be responsible for the administrative operations of a freight management centre. As such it shall send invoices to customers and process payments. When it receives an invoice from fleet supplier it shall take action to enable payment.

User Needs: 9.5.1.1, 9.5.1.3, 9.5.1.4

8.1.2.1 Handle Customs Declaration

Overview

This Low Level Function shall be responsible for providing custom declaration. It shall obtain the declaration acknowledgement from the Law Enforcement Agency on request from other Functions in the Area.

User Needs: 9.5.1.3, 9.5.1.4

8.1.2.2 Handle Hazardous Goods Transport Declaration

Overview

This Low Level Function shall be responsible for providing a hazardous goods transport declaration. It shall obtain the declaration approval from the Law Enforcement Agency on request from other Functions in the Area.

User Needs: 9.5.1.3, 9.5.1.4

8.1.2.3 Prepare and Deliver Official Transport Documents

Overview

This Low Level Function shall be responsible for the preparation of documents needed to enable the freight transport operation to proceed. It shall organise the provision of any official freight transport documents required in particular to cover customs and hazardous goods transport declaration. When ready the Function shall send the documents to the fleet supplier. Responsibility for future activities shall then be handed over to the Function in charge of controlling the freight transport operation.

User Needs: 9.5.1.3, 9.5.1.4

8.1.3 Control Freight/Cargo Operations

Overview

This Low Level Function shall be responsible for the control of the freight transport operation. It shall get information on the status of the cargo and send it on request to the Freight Operator. The Function shall control whether or not the transport operation is completed and when necessary activate the closure request.

User Needs: 9.5.1.6

8.1.4 Evaluate Freight Operations Performance

Overview

This Low Level Function shall be responsible for the evaluation of the performance of the freight operation. In particular the Function shall evaluate the cost of any delays in the delivery of the freight.

User Needs: 9.5.1.10, 9.5.1.11

8.1.5.1 Identify Possible Transport Optimisations

Overview

This Low Level Function shall be in charge of optimising multi-modal transport in an inter-urban area. The optimisation shall consist of getting access to a database that contains current freight transport operations for all transport modes that is managed outside the System. The Function shall evaluate the current situation against the need(s) expressed by the Freight Operator. The current road freight transport conditions shall be sent by the Function to the external database.

User Needs: 9.5.5.1, 9.5.5.4, 9.5.5.5

8.1.5.2 Book Storage Places

Overview

This Low Level Function shall be in charge of facilitating the booking of storage area. It shall achieve this through communication with the Freight Reservation Agency actor in the External Service Provider terminator.

User Needs: 9.5.4.4, 9.5.4.5

8.2.1.1 Negotiate Freight Operator Requests

Overview

This Low Level Function shall be responsible for the commercial interface between Fleet Management in a similar Freight Management Centre or form of Freight Shipper that has taken the responsibility for a road freight transport. As such it shall handle the Freight Centre orders and contracts. The Function shall delegate finding of the best appropriate vehicle in order to optimise the fleet resources to the appropriate Function. Once the commercial negotiation is achieved, the Function shall hand over further activity to the Function in charge of performing the fleet transport operation, including closure of the order from an administrative point of view, plus invoicing and payments. This Function shall also look over the fleet occupancy rate and send when needed transport capacity availability advice or transport opportunity request.

User Needs: 9.5.1.1, 9.5.1.3, 9.5.1.4, 9.5.2.10, 9.5.2.14

8.2.1.2 Administrate Fleet Transactions

Overview

This Low Level Function shall be responsible for the administrative operations for a fleet management centre. As such it shall send invoices to the Freight Shipper actor in the Consignor/Consignee terminator and process payment.

User Needs: 9.5.1.1, 9.5.1.3, 9.5.1.4

8.2.2.1.1 Elaborate and Store Operational trip and load plan

Overview

This Low Level Function shall be responsible for the evaluation of the operational trip and load plans from all received transport order confirmation. It shall make use of route information and environment conditions, such as traffic, weather, pollution, etc obtained from appropriate route information providers. It shall also have the responsibility for providing information about the transport of hazardous goods when required.

User Needs: 9.5.1.5, 9.5.2.8, 9.5.2.9, 9.5.2.10

8.2.2.1.2 Determine Compliant Resources

Overview

This Low Level Function shall determine what is the best appropriate vehicle to transport a particular item of freight and assign driver tasks. When doing so the Driver's workload shall be analysed as well as the vehicle fleet status, such as availability and state. This Function shall be in charge to optimise Vehicle and Driver scheduling.

User Needs: 9.5.2.2, 9.5.2.3, 9.5.2.4, 9.5.2.5, 9.5.2.14

8.2.2.1.3 Prepare and Deliver Operational Transport Document

Overview

This Low Level Function shall be responsible for the preparation of the operational documents to be delivered to the Driver. Then the Function shall hand over further activity to the Function in charge of controlling the fleet transport operation.

User Needs: 9.5.2.2, 9.5.2.3, 9.5.2.4, 9.5.2.5, 9.5.2.7, 9.5.2.14, 9.5.3.22

8.2.2.2.1 Prepare/Process information to/from board

Overview

This Low Level Function shall be responsible for the management and control of the fleet transport operation. It shall obtain information on the status of the cargo, current transport conditions and safety evaluation including a check of whether or not there is an incident. This information shall be transmitted to other Functions if needed. The Function shall control whether or not the transport operation is completed and activates closure request when required It shall also provide up to date information on the status of hazardous freight transport.

User Needs: 9.1.0.2, 9.5.1.6, 9.5.2.10, 9.5.2.13, 9.5.3.12

8.2.2.2.2 Manage Incident

Overview

This Low Level Function shall manage the actions required when an incident takes place during the course of a trip. If needed, the Function shall send the information to the Provide Safety and Emergency Facilities Area. Functionality in that Area shall provide instructions to the fleet centre which in turn shall give these instructions to the Vehicle. Internal instructions related to freight care shall also be sent to the Vehicle.

User Needs: 9.4.0.4, 5.3.1.3, 5.3.1.5

8.2.2.2.3 Process On-board Payments

Overview

This Low Level Function shall receive on-board payment receipts and store them. The receipts shall be sent either by the in-vehicle functionality and stored in the data base by the Function Prepare/process Information to/from trip, either directly received from the Driver. They shall be processed on a regular time basis.

User Needs: 9.5.3.23

8.2.2.2.4 Evaluate Transport Conditions

Overview

This Low Level Function shall be in charge of all evaluation of transport conditions. It shall make in particular two evaluations. The first shall cover compliance evaluation with respect to global regulations and shall be made off-line by comparing the recorded status with respect to the regulations. The evaluation shall be made for driver behaviour and vehicle conformity. If any discrepancy is identified then a notification shall be sent to the Provide Support for Law Enforcement Area. The Functions shall also evaluate the transport conditions, covering deviation from route and delay evaluation. This evaluation shall be made on-line.

User Needs: 9.5.0.2, 9.5.3.10, 9.5.3.13, 9.5.3.14

8.2.2.2.5 Evaluate and Record Safety Status

Overview

This Low Level Function shall evaluate the safety status of the Driver, Vehicle, Equipment and Cargo. It shall achieve this by comparing the recorded values of status with the expected ones. The Function shall record the result of the analysis and notify the Driver of any unsafe transport conditions.

User Needs: 9.4.0.1, 9.4.0.2, 9.5.3.10, 9.5.3.18

8.2.2.3.1 Manage and Schedule Maintenance Activities

Overview

This Low Level Function shall be in charge of organising freight vehicle maintenance. It shall take into account freight vehicle status as well as constraints such as freight transport planning.

User Needs: 9.5.2.15

8.2.2.3.2 Manage Vehicle and Equipment

Overview

This Low Level Function shall be in charge of managing Vehicle and Equipment characteristics. It shall perform activities such as acquisition, first registering in the data store and with legal authorities, registering of all events and incidents and retirement decision

User Needs: 9.2.0.1, 9.2.0.2, 9.5.0.2, 9.5.3.3

8.2.2.3.3 Manage Driver Employment

Overview

This Low Level Function shall be responsible for the management of Drivers. This shall comprise but not be limited to such things as, expertise level, availability and law violation consequences.

User Needs: 9.5.3.24

8.2.3 Evaluate Fleet Operations Performance

Overview

This Low Level Function shall be in charge of all evaluation of the performances of the fleet operation. In particular the Function shall be in charge of the determination of the global availability status, economical rates, and route performances.

User Needs: 9.5.1.10, 9.5.1.11, 9.5.2.16, 9.5.3.21

8.3.1.1 Check Transport Order

Overview

This Low Level Function shall be in charge of ensuring that the loaded goods or hooked equipment (trailer / swap body / container…) to be handled at a given place, correspond to the goods / equipment that are described in the corresponding transport order. The Function is triggered by the Driver when needed but most frequently at the start of loading (hooking) operation. The Function will ensure that there is a match between the unique identifiers that is marked on the loaded goods or hooked equipment and two other things. These shall be other features such as weight, nature of goods (compatibility between them or with already loaded other goods etc.), and the identifiers that are stored in the corresponding driver instructions. If this is not the case, this will be stored in the On-board Database Data Store so as to provide input for an appropriate report, asking possibly for new instructions. The Function shall correspond with that developed by the COMETA Project (COMETA Function 3.1.2) to check whether the cargo and or equipment conforms to transport order

User Needs: 9.5.3.8

8.3.1.2 Create New Transport Unit

Overview

This low level function shall allow a Driver to accept a proposed new transport load unit (logistic unit). This shall be either in addition to those listed in the transport order or for a back haul from a Consignee, when the transport contract is said “open” and on time basis. If the Freight Shipper actor in the Consignor terminator is not supposed or able to do so, the Driver will allocate an identifier to the unit. As alternatives it shall be possible for the Diver to ask for one from the Fleet Manager, create a bar-coded label and a transport order, or modify the existing one through exchanges with the Fleet Manager, Forwarder, or Principal. The Function shall correspond with that developed by the COMETA Project (COMETA Function 3.1.3) to create a new transport unit.

User Needs: 9.5.3.1, 9.5.3.11

8.3.1.3 Monitor Transport Order

Overview

This Low level function shall support the monitoring of a transport order all along its life cycle. At starting phase of the execution, after achievement of all necessary operations during the preparation phase it shall store transport order on the On-board Database Data Store. During an on going mission, it shall support too, any modification required or felt necessary, associated to events and locations. It shall also indicate, program and trigger the types of monitoring of transport order progress required from the On-board Application and/or the Driver. In particular, this Function shall automatically trigger reports (electronic signature of the road waybill or consignment note) or require the Driver to add relevant information. It shall also be possible for the Function to send reports on Driver initiative, pick up report and proof of delivery (or a delivery difficulty, or even refusal, etc.). The Function shall correspond with that developed by the COMETA Project (COMETA Function 3.11.2) tot monitor transport order execution and merge with transport order part of COMETA Function 3.1.1 that manages task and transport order contents and modifications

User Needs: 9.2.0.1, 9.5.1.2, 9.5.1.4, 9.5.1.7, 9.5.1.8, 9.5.3.2, 9.5.3.4

8.3.1.4 Monitor Operational Task

Overview

This Low level function shall support the monitoring of an operational task all along its life. At starting phase of the execution of a task, after achievement of all necessary operations during the preparation phase, task description shall be stored in the On-board Database Data Store. During an on going mission, it shall support any modification required or felt necessary, associated to events and locations. It shall help the Driver to report, on a time basis, or according to given tasks phases or associated events and locations, or passing threshold points (this includes, for instance, the management of gate in / gate out procedures for inter-modal transport terminals). This Function shall automatically trigger task reports or require the Driver to add relevant information. The Function shall correspond with that developed by the COMETA Project (COMETA Function 3.11.1) to monitor operational tasks and merge with part of Function 3.1.1 that manages task and transport order contents and modifications.

User Needs: 9.2.0.1, 9.5.1.2, 9.5.1.4, 9.5.2.12, 9.5.3.2, 9.5.3.4, 9.5.3.5, 9.5.3.6, 9.2.0.1, 9.5.1.2, 9.5.1.4, 9.5.2.12, 9.5.3.2, 9.5.3.4, 9.5.3.5, 9.5.3.6, 9.5.3.11

8.3.2.1 Monitor Driver

Overview

This Low Level function shall manage all specific Freight and Fleet Management data and processes about the Driver during the trip. Typically the data that is managed may include: Driver physical status, Driver expenses, Driving behaviour etc. Note that only specific Freight and Fleet Management functionality shall be present here. All functionality related to generic driving facilities shall be found in the Provide Advanced Driving Assistance Systems Area. All data required from Freight and Fleet Management process shall be obtained through a specific data-link. The Function shall correspond with that developed by the COMETA Project (COMETA Function 3.8) that monitors the Driver.

User Needs: 9.4.0.1, 9.4.0.2, 9.5.3.2, 9.5.3.9

8.3.2.2 Monitor Vehicle

Overview

This Low Level function shall manage all specific Freight and Fleet Management data and processes about vehicle during the trip. Note that only specific Freight and Fleet Management functionality shall be present here. All functionality related to generic driving facilities shall be found in the Provide Advanced Driving Assistance Systems Area. All data required from any other Freight and Fleet Management functionality shall be obtained through a specific data-link. The Function shall correspond with that developed by the COMETA Project (COMETA Function 3.7) that monitors the Vehicle.

User Needs: 9.3.0.2, 9.4.0.1, 9.4.0.2, 9.5.2.6, 9.5.3.2, 9.5.3.9, 9.5.3.20

8.3.2.3 Monitor Cargo

Overview

This Low Level function shall manage all data and processes that are concerned with the Cargo during the trip that it makes. The Function shall correspond with that developed by the COMETA Project (COMETA Function 3.9) that monitors Cargo.

User Needs: 9.4.0.1, 9.4.0.2, 9.4.0.3, 9.5.3.2, 9.5.3.9, 9.5.3.16, 9.5.3.17

8.3.2.4 Monitor Equipment

Overview

This Low Level function shall manage all data and processes about Freight and Fleet Management equipment during the trip. The Function shall correspond with that developed by the COMETA Project (COMETA Function 3.10) that monitors equipment.

User Needs: 9.3.0.2, 9.4.0.1, 9.4.0.2, 9.5.2.6, 9.5.3.2, 9.5.3.9

8.3.3 Comply with Regulation

Overview

This Low Level Function shall check from on-board data the compliance all applicable regulations. Typically, such regulations may include the European Union's social regulations as well as the availability on-board of statutory documents required for executing the transport order. Other regulations checked by this Function may include those covering compliance with road regulations such as speed limits, forbidden lanes / roads to heavy vehicles, weight limits - "Weigh in Motion" – etc. This Function shall also give access to that data to authorities and to the Fleet Manager. For Legal Authorities this access shall be provided either by a removable device storing all regulation data, or by communication with road-side system. This Function shall also guaranty data against fraud, and from being accessed by unauthorised persons. The Function shall correspond with that developed by the COMETA Project (COMETA Function 3.2) that ensures compliance with regulations.

User Needs: 9.1.0.1, 9.1.0.3 9.1.0.4,9.3.0.1, 9.3.0.3, 9.5.1.4, 9.5.2.6, 9.5.3.4,

3. Data Stores

3.1 Introduction

This Chapter contains a description of all the Data Stores used by the "example Systems" in the Physical Architecture. The "example Systems" are described in the Chapters of the first Annex to the European ITS Physical Architecture Main Document (D 3.2).

3.2 Content of the Data Store Descriptions

The descriptions of the Data Stores that are contained in this Chapter have been taken from Annex 3 to the European ITS Functional Architecture Deliverable Document (D 3.1) – see Chapter 5 for the full reference. The complete description of each Data Store is included in this Document.

1.1 EP Contracts Store

Description of Contents

This Data Store is used within the Provide Electronic Payments Facilities Area. It contains details of the different contracts set up between the users of ITS services and the corresponding operators. The Data Store allows the extraction of details about the contracts by specifying the user ID, operator ID, service ID.

1.2 User's Account Store

Description of Contents

This Data Store is used within the Provide Electronic Payments Facilities Area. It contains details of all the accounts used by the users for the electronic payment of services.

The data in the Store is structured in the following way:

- user ID;
- account ID for each user ID;
- supply for each account;
- brief history for each account:
  - periods of overdraft,
  - maximum overdraft reached.

Other data may be added if required.

1.3 Service Information Store

Description of Contents

This Data Store is used within the Provide Electronic Payments Facilities Area. It contains all the characteristics of the service available to the users.

The data in the Store may be organised so that data for each service is kept together. For each service the data structure may be as follows:

- service ID;

- nature of service;
- operator providing the service;
- associated account (where the payment will go);
- location of service (where the user can use it);
- types of contracts possible;
- categories of people allowed to use this service (that is to pass a contract for it, regardless of access rights which are defined by regulating bodies);
- enforcement procedures;
- modes of booking;
- identification of tariffs (pointer to tariff data store);
- rules of fee apportionment if several operators provide the same service;
- list of the Ids of services grouped for the apportionment.

1.4 Transactions Store

Description of Contents

This Data Store is used within the Provide Electronic Payments Facilities Area. It includes all the electronic transactions performed by the users regarding ITS services.

The data in the Store may be structured the following way :

- date of service use;
- place of service use;
- service ID;
- other relevant data used to characterise the service use (duration, etc.);
- contract ID;
- user ID;
- operator ID;
- date of payment;
- mode of payment;
- user's account ID used;
- operator's account used;
- incident notification.

1.5 Tariffs Store

Description of Contents

This Data Store is used within the Provide Electronic Payments Facilities Area. It contains the tariffs of all the services available to the user.

The data in the Store may be organised so that data for each service is kept together. For each service the data structure may be as follows:

- service ID;
- tariff according to the characteristics of the precise usage done (for example, duration of service usage, location, date, etc.);
- discount rates according to the type of contract used.

1.6 Fraud Store

Description of Contents

This Data Store is used within the Provide Electronic Payments Facilities Area. It contains all the frauds (i.e. failure by the user to provide the correct payment that is required for the service) detected related to the use of services paid by electronic means. These frauds include

information such as, invalid payments, overdraft account, and breaching of an access control system.

The structure of the Data Store may be as follows :
- date of fraud detection;
- date of message to enforcement bodies;
- location of fraud;
- user ID (if identified);
- service ID;
- nature of fraud;
- if overdraft account : account ID, amount of overdraft;
- access control systems breaching, ID of these systems;
- result (user blocked / user passing through).

The Store also includes the black list of users, i.e. those who have committed a fraud in some way, e.g. non-payment.

1.7 Access Rights Store

Description of Contents

This Data Store is used within the Provide Electronic Payments Facilities Area. It contains the access rights for all kinds of users, all kinds of services, and all environment conditions. These rights are for each user and are independent of the financial conditions of the user's account.

The structure of the Data Store may be as follows :
- service ID,
- access rights for each user category (unlimited; limited to some duration, limited to some period, etc.) and for each environment condition.

2.1 Common Emergency Data Store

Description of Contents

This Data Store is used within the Provide Security and Emergency Facilities Area. It contains details of all the information needed to process the data that is produced when any emergency takes place.

Each entry in the Data Store may include some or all of the following items (not restrictive):
- road network maps;
- predefined emergency road;
- emergency services references and description;
- rules to classify an emergency;
- the related Road Systems Reference and description for each one procedure to be run.

2.2 Incident And Emergency Data Store

Description of Contents

This Data Store is used within the Provide Security and Emergency Facilities Area. It contains details of all incident/alarm notifications (including mayday calls) that have been received by the PSEF Functions without any processing.

Each entry in the Data Store may contain some or all of the following data items:

- time;
- incident location;
- description of the vehicles involved in the incident, known status, and description of cargo (if any);
- the number of people involved in the incident and their health status;
- any additional information relevant for emergency process;
- description of originator and/or the system that was the source of the incident notification.

This Data Store will also contain details of all emergencies that have been processed. Each entry in the Store may contain some or all of the following data items:
- a consolidated problem description comprising:
  - time;
  - location;
  - description of the vehicles involved in the incident, known status, and description of cargo (if any);
  - the number of people involved in the incident and their health status;
  - any additional information relevant for emergency process;
  - a list of all associated incidents;
  - a description of planned actions:
    - the emergency services that will be involved in the action,
    - the hour at which the action will start,
    - the number of vehicles involved,
    - a description of the result of each action,
    - a list of progress reports for each action.

3.1 Urban Traffic Data Store

Description of Contents

This Data Store is used within the Manage Traffic Area. It contains traffic flow data for the urban road network and car park data. The data in the Store is divided into two parts, one for data from the actual urban road network and the other for car park data. Each part may have up to three sets of data, comprising, historic, current and predicted data.

The actual data in the urban road network part of the Store may comprise but not be limited to the following items:
- date/time: (numbers);
- location: (characters);
- flow: (numbers);
- speed: (numbers);
- headway: (numbers);
- occupancy: (numbers);
- queue: (digit - indicating yes/no);
- count: (numbers).

There will be one set of the above data for each location in the urban road network where some or all of the data is obtained. Within each set there will be both current and historic data. Predicted data may use a different set of locations and contain a smaller sub-set of the above data.

The second part of the Data Store will contain data for car parks located in the urban road network. For each car park, the data may be divided into three parts comprising, historic,

current and predicted data.

The actual data in this part of the Store may comprise but not be limited to the following items:
- date/time: (numbers);
- car park location: (characters);
- count: (numbers);
- occupancy status: (digit - shows increasing or decreasing).

There will be one set of data for each car park in the urban road network. Within each set there will be both current and historic. The count may be either the number of vehicles in the car park, or the number of spaces. Which ever is used, it will be consistent across all car parks served by a particular System. Predicted data may not contain a value for the increasing/decreasing indicator.

3.2 Inter-urban Traffic Data Store

Description of Contents

This Data Store is used within the Manage Traffic Area. It contains traffic flow data for the inter-urban road network and service area occupancy data. The data in the Store is divided into two parts, one for data from the actual inter-urban road network and the other for service area occupancy data. Each part may have up to three sets of data, comprising, historic, current and predicted data.

The actual data in the inter-urban road network part of the Store may comprise but not be limited to the following items:
- date/time: (numbers)
- location: (characters)
- flow: (numbers)
- speed: (numbers)
- headway: (numbers)
- occupancy: (numbers)
- queue: (digit - indicating yes/no)
- count: (numbers)

There will be one set of data for each location in the inter-urban road network at which some or all of the data is obtained. Within each set there will be both current and historic data. Predicted data may use a different set of locations and contain a smaller sub-set of the above data.

The second part of the Data Store will contain data for the vehicle parking that is available at service areas located in the inter-urban road network. For each service area, the data may be divided into three parts comprising, historic, current and predicted data.

The actual data in this part of the Store may comprise but not be limited to the following items:
- date/time: (numbers)
- service area location: (characters)
- count: (numbers)
- occupancy status: (digit - shows increasing or decreasing)

There will be one set of data for each parking at each service area located in the inter-urban

road network. Within each set there will be both current and historic data. The count may be either the number of vehicles in the service area, or the number of spaces. Which ever is used, it will be consistent across all service areas served by a particular System. Predicted data may not contain a value for the increasing/decreasing indicator.

3.3 Environmental Data Store

Description of Contents

This Data Store is used within the Manage Traffic Area. It contains data about the environmental conditions within the geographic area managed by the System. This data will have been produced by Functions within the Area from inputs that they have received.

The data in the Store may comprise but not be limited to the following items:
- day/date: (number);
- time: (number);
- location: number);
- temperature: (number);
- humidity: (number);
- wind direction: (five alphanumeric characters);
- wind speed: (number);
- pollution levels: (a set of numbers).

The number of entries will be fixed by the number of times that samples are taken. The number and type of pollutants recorded may vary from location to location and from one System to another.

3.4 Incident Data Store

Description of Contents

This Data Store is used within the Manage Traffic Area. It is divided into two parts. The first part contains data collected about current and predicted incidents and second part contains incident management strategies.

In the first part of the Data Store, the incident data may comprise the following items:
- start date/time: (numbers);
- forecast duration: (number);
- actual duration: (number);
- incident location: (characters);
- incident type: (characters);
- incident severity: (characters);
- number and type of vehicles: (numbers and characters);
- incident strategy used: (characters);
- emergency services vehicles used: (numbers and characters).

The data in some of these entries will be provided as the incident state changes, whilst in others it will be updated as the incident impact progresses and remedial action is taken.

The data in the second part of the Data Store covers incident strategies. If may comprise the following items:
- incident strategy identification: (characters);
- locations to which strategy applies: (characters);
- actions to be taken: (characters).

The actions may be a series of commands that can be sent directly to other Functions, such as

those concerned with traffic management. Other actions may be requests for the Operator to call one or more Emergency Services, or take other action that cannot be implemented by a specific Function.

3.5 Demand Data Store

Description of Contents

This Data Store is used within the Manage Traffic Area. It contains both data collected on the use of transport modes and demand management strategies.

The data in the Stored may comprise but not be limited to the following items:
- date/time: (numbers);
- transport mode: (characters);
- use: (numbers);
- strategy identity: (characters);
- strategy information: (characters).

The number of entries will be fixed by the number of transport modes, the period over which they are stored and the number of strategies.

3.6 Maintenance Data Store

Description of Contents

This Data Store is used within the Manage Traffic Area. It contains records of all maintenance actions that have been carried out, including those that are yet to be completed.

The data in the Store may comprise but not be limited to the following items:
- equipment identity;
- location;
- type of equipment;
- type of fault;
- fault description;
- date/time reported;
- date/time of Maintenance Company notification;
- date/time of fault clearance notification;
- action taken to rectify fault;
- Maintenance Contractor bonus/penalties.

This data will cover all types of equipment (those located at the Roadside and at Central locations) and also the actual road network itself. In this case the "equipment identity" will contain the road name and/or number whilst the "type of equipment" will show the type of road.

3.7 Urban Road Static Data Store

Description of Contents

This Data Store is used within the Manage Traffic Area. It contains the static data for the urban traffic road network managed by the System. The static data covers the actual layout and configuration of the urban road network.

As a minimum the Data Store may include some or all of the following items of data:
- road type: (numbers and characters);
- type of data: (numbers and characters);
  - link:

    - type: (numbers and characters),
    - start and end locations: (numbers),
    - length: (numbers),
    - number of lanes/carriageways: (numbers),
    - lane/carriageway width(s): (numbers),
    - vehicle type usage restrictions: (numbers and characters),
    - vehicle parking restrictions: (numbers and characters),
    - speed limit(s): (numbers),
    - presence of other objects (tunnels/bridges): (numbers and characters);
  - junction:
    - type: (numbers and characters),
    - location: (numbers),
    - equipment installed: (numbers and characters),
    - type: (numbers and characters),
      - configuration (phases/durations/turning movements): (numbers and characters),
      - available methods of management: (numbers and characters),
      - non-available vehicle movements: (numbers and characters),
      - next up-stream junction: (numbers and characters),
      - next down-stream junction: (numbers and characters)
- date of last update: (numbers).

This data will be used by a variety of Functions to enable traffic in the urban network to be managed. It will also be provided to the Manage Public Transport Area so that its service routes and schedules can be planned. Some of the data may also be provided to Vehicles to enable driver guidance and information to be provided.

3.8 Inter-urban Road Static Data Store

Description of Contents

This Data Store is used within the Manage Traffic Area. It contains the static data for the inter-urban traffic road network managed by the System. The static data covers the actual layout and configuration of the inter-urban road network.

As a minimum the Data Store may include some or all of the following items of data:

- road type: (numbers and characters);
- type of data: (numbers and characters);
  - link:
    - type: (numbers and characters),
    - start and end locations: (numbers),
    - length: (numbers),
    - number of lanes/carriageways: (numbers),
    - lane/carriageway width(s): (numbers),
    - vehicle type usage restrictions: (numbers and characters),
    - vehicle parking restrictions: (numbers and characters),
    - vehicle speed limit(s): (numbers),
    - presence of other objects (tunnels/bridges): (numbers and characters);
  - junction:
    - type: (numbers and characters),
    - location: (numbers),
    - equipment installed: (numbers and characters):
      - type: (numbers and characters),

  - configuration: (numbers and characters),
  - available methods of management: (numbers and characters),
  - non-available vehicle movements: (numbers and characters),
  - next up-stream junction: (numbers and characters),
  - next down-stream junction: (numbers and characters);
- date of last update: (numbers).

This data will be used by a variety of Functions to enable traffic in the inter-urban network to be managed. It will also be provided to the Manage Public Transport Area so that its service routes and schedules can be planned. Some data may also be provided to Vehicles to enable driver guidance and information to be provided.

4.1 Real Time PT Vehicle Status

Description of Contents

This Data Store is used within the Manage Public Transport Operations Area. It contains the last reported indicators of each Public Transport vehicle in the fleet. Each vehicle is identified by description of static characteristics such as type of vehicle, service number, driver, etc.

The list of updated indicators associated to each vehicles includes as a minimum vehicle location and on-board equipment status. Other possible indicators can be whatever is necessary and/or available: number of passengers, engine parameters, weight of the vehicle, maximum speed, average stop time, delay, etc.

Each set of indicators should be completed with the absolute time corresponding to the last update.

4.2 Historical PT Vehicle Data

Description of Contents

This Data Store is used within the Manage Public Transport Operations Area. It contains the historical average value indicators for Public Transport vehicles in the fleet.

Information may be stored by route, by service, by type of vehicle etc. as needed. For each of the above categories as minimum the stored data should be archived classified by type of day with the needed level of detail (working days, holidays, school days, off school days, rainy days, sunny days, traffic restriction days, etc). The level of detail is coherent with the detailed specification of the system: e.g. average travel time can be as detailed as calculated for every few meters of road along the route or distinguishing between characteristic stretch of road or just between two terminals.

The entries of the database includes also the exact description of the time, place and whatever else is needed to identify the scenario to which the set of data is referred to.

Stored data are constantly updated with new measurements available and previously smoothed and validated, the time slots used to store data can vary according to the needs.

The information that is archived should also be filtered taking into account presence of exceptional events during the day and actual operating service scheme.

4.3 PT Service Plan

Description of Contents

This Data Store is used within the Manage Public Transport Operations Area. It contains the complete description of the schedule public transport services.

As a minimum the Data Store includes the detailed description of the service routes, time tables, frequencies, validity, driver scheduling, variants etc. as needed. Also included may be details about temporary services which are planned/booked in advance (e.g. car-pooling and car-sharing) should be included with their availability for additional passengers.

4.4 PT Route Static Data

Description of Contents

This Data Store is used within the Manage Public Transport Operations Area. It contains data about the inter-urban and urban road networks for use by the Manage Public Transport Area. The data in the Store will be used to enable new or revised services and schedules to be planned.

Typically, the Data Store may contain data about some or all of the following items:

- road network geometry:
  - road network link (segments) relationship (what connects to what),
  - bus lane present indicator,
  - turning movements at junctions,
  - obstructions (by link, showing narrow road/lanes, bridges/tunnels) giving low clearance, bridges with weight restrictions, etc.),
  - controlled junctions (with bus priority available indicator);
- current bus stop locations:
  - road link identity,
  - location name,
- access details (e.g. stairs, lifts, ramps, narrow doors, disabled toilets, baby changing facilities, waiting rooms, etc.),
  - local special locations served by stop (e.g. tourist attraction, sports stadium, work place, entertainment place, etc.),
  - etc.;
- other mode interchange locations:
  - road link identity,
  - location name,
- access details (e.g. stairs, lifts, ramps, narrow doors, disabled toilets, baby changing facilities, waiting rooms, etc.),
  - type of other mode (e.g. are, heavy rail, ferry, etc.),
  - local special locations served by stop (e.g. tourist attraction, sports stadium, work place, entertainment place, etc.),
  - etc.;
- other information.

There will be one of these databases for the road network served by each Traffic Management System within which the Public Transport System operates. The data for each of the databases will be provided by the relevant Traffic Management System. It may be amended

and enhanced by the Public Transport Operator.

5.1 Historical Visibility Data

Description of Contents

This Data Store is used within the Provide Advanced Driver Assistance Area. It contains data required by Functions in the Provide Advanced Driver Assistance Systems Area. It will contain all data concerning the objects around the vehicle (distance, speed, angle, etc.) at the present instant.

The contents of each of the three parts of the Store data defined above are as follows:
the driver: -the data is related to the current driver status, e.g. fatigue, health condition, etc.;
the vehicle: -the data is related to its dynamic conditions (speed, acceleration, etc.) and the actual driver commands;
the traffic scenario: -the data is related to the "image" of the driving area including other near-side road users plus possibly traffic signs and lights.

6.1 General Trip Preferences (GTP)

Description of Contents

This Data Store is used within the Provide Traveller Journey Assistance Area. It contains the personalised data store needed to support the Traveller during all of their trips. The support is provided both during the trip planning, as well as during the trip execution. The Store is also used to prevent cumbersome and error prone input of the same information by the Traveller. It serves as a memory to assist the Traveller during all of the trip, for all travel modes, during every phase of the trip.

A special feature of the data in the Store to support the Traveller is the "trip skeleton". The trip skeleton is used in two ways:
(1) as the start of the search for alternatives during trip planning;
(2) as the fixed part of the trip if the trip has to be retained for future reuse.

The core part of the "skeleton" is the origin-destination combination and presumably a date/time combination for the start or the arrival and possibly a number of intermediate locations. In both cases, trip preferences are part of the trip skeleton for trip planning purposes.

Obviously, for the latter interpretation, a lot of the information coming from the trip performed has no relevance any more; bookings, payments, perturbations, etc. Although booking information (e.g. hotel) can be retained as a trip preference, it cannot be a booking anymore in the skeleton.

The information in this Data Store is defined below. It represents an elaborate version of the Data Store, but reduction of the information is certainly feasible. The Data Store may therefore consist of some or all of the following items:
- pertinent data: the traveller’s identification, driver licence, passport etc.
- language to be used during communication with the traveller;
- financial transaction information (if desired);
- private features: eventual disabilities and possible consequences for trip planning and performance, including those aspects that are relevant during driving;
- features of vehicle or cargo: HGV and further description of the cargo, freight, size,

weight, coach trip (number of passengers), PT, emergency, etc.
- prime trip planning criterion (criteria);
- default departure location(s) and destination(s) (all departure locations can be destinations and vice versa);
- level of detail desired of trip itinerary (e.g. maps) and on-trip update, selection criteria for en-route information;
- bank account, credit card etc. information for payment and refund purposes;
- road toll payment method;
- vehicle breakdown assistance information;
- trip costs and trip planning costs control parameters;
- transmission of traveller's ATP;
- way of communication while on-trip;
- route guidance facilitation parameters; · travel preferences: travel modes and classes, airline operator, hotel(s) (or hotel chain(s)), car rental organisation(s), type of car, (non)smoking compartment, etc.; the preferences can be ranked;
- trip skeletons (fashionable results of trips planned on earlier occasions).

6.2 Private Trip File

Description of Contents

This Data Store is used within the Provide Traveller Journey Assistance Area. It contains data that is the result of the trip planning process. This data is retained for the prime purpose of supporting the traveller during the trip. The most notable requirement is to react to the consequences of perturbations in the situation(s) existing during trip planning. All the considerations that resulted in production of the trip itinerary are included in this Data Store.

Some or all of the following information can be stored:
- information extracted from the GTP which is used during trip planning
- the trip skeleton (the information supplied by the traveller describing the prime conditions for the trip, like origin/destination, arrival time, route and whatever the traveller deems necessary to feed into the planning process as unconditional constraints);
- the route, which is the outcome of the planning process and the corresponding schedule(s) (a route can also be determined by the traveller as part of the trip skeleton or as the result of an earlier trip);
- the bookings that are performed during the trip planning process (with all pertaining data);
- the payments that are performed with refund conditions, the preferences expressed by the traveller during the trip planning process and not found in the GTP;
- the perturbations that are considered during trip planning, notably schedule and road traffic perturbations;
- car park information.

7.1 Rules Store

Description of Contents

This Data Store is used within the Provide Support for Law Enforcement Area. It contains all the rules and the types of fraud (violation) associated with each rule. The data covers the use of the road network (urban and inter-urban) and all of the connected services. The contents of the Data Store are organised by the identity of the rules. For each rule, one or all of the following data is stored:
- rule identity
- area of road network to which the rule applies

- description of the rule
- types of fraud (violation) that can be associated with the rule.

For each type of fraud, some or all of the following data may be stored:
- level of seriousness,
- authority responsible for enforcement,
- enforcement procedure,
- potential sanction

7.2 User's Registration Store

Description of Contents

This Data Store is used within the Provide Support for Law Enforcement Area. It contains information about registered vehicles and users. It is used in the processing of frauds (violations) detected by the System. The contents of the Data Store or organised so that the data is classified by vehicle. The data for each vehicle includes some or all of the following elements:
- vehicle ID,
- type (Freight, Public Transport, Emergency, Private, etc.)
- owner ID,
- driver ID,
- operator ID (if relevant and not the same as the owner ID),
- clearance (max authorised weight, max authorised speed,…),
- user ID (if not the same as the owner, driver or operator ID's)
- ID of other vehicles used by the user (if any)
- operations allowed for the vehicle
- period of validity of registration
- level of pollution produced by the vehicle

8.1. Consignment

Description of Contents

This Data Store is used within the Manage Freight and Fleet Operations Area. It contains all recorded information for freight operations. The data categories that are stored may include the following:
- freight transaction
- customer need and order
- customer proposal and contract
- freight centre invoice
- customer payment
- fleet suppliers and availability status
- freight centre need and order
- fleet supplier proposal and contract
- fleet supplier invoice
- freight centre payment
- customs declaration request and acknowledgement
- hazardous goods transport declaration and acknowledgement
- official transport documents
- cargo status
- optimisation study
- storage area transaction.

8.2 Resources

Description of Contents

This Data Store is used within the Manage Freight and Fleet Operations Area. It contains all recorded information for fleet operations. The data categories that are stored may include the following:

- fleet transaction
- freight centre need and order
- fleet supplier proposal and contract
- fleet supplier invoice
- freight payment
- operational transport documents
- trip description
- route description
- cargo status and transport conditions
- optimisation study
- vehicle identification, description and schedule
- drivers identification, description and workload
- maintenance schedule
- fraud detection
- applicable global regulation
- safety status
- incident identification
- on board payment acknowledgement
- law violation consequence
- result of safety or transport condition analysis.

8.3 On board

Description of Contents

This Data Store is used within the Manage Freight and Fleet Operations Area. It data store contains all information that is recorded on-board a freight vehicle during trip. The data categories that are stored may include the following :

- transport orders with associated event log
- tasks with associated event log
- statutory documents
- description of trip resources:
  - driver ID and characteristics
  - vehicle ID and characteristics
  - list of cargo and characteristics
  - list of equipment and characteristics
- log of date/position
- log of resource event
- log of regulation event
- log of incident
- log of emergency
- log of driver data
- log of vehicle data
- log of cargo data
- log of equipment data
- log of regulation data

- log of payment operation
- log of fraud detection and fraud notification.

4. Example of a System Specification

4.1 Introduction

The following pages contain an example of a System Specification. Its purpose is to illustrate what should be included in a System Specification. The Specification has been produced for the Urban Traffic Management "example System", P30. This "example System" is described in section 5.2 of Annex 1 to the European ITS Physical Architecture Document (D 3.2).

4.2 System Specification Example

P30 Urban Traffic Management System – System Specification

1. Overview Description

The System shall provide facilities that enable the management of road traffic that is using the urban road network. In addition to facilities for actual traffic management, the System shall include additional facilities for the maintenance of the physical road network and the equipment used by the System in the management of traffic. Emergency Vehicle priority shall be provided using equipment on-board the Vehicle. This equipment shall have links to local System equipment that shall be located at the roadside. There shall be links from this System to other Systems. These shall enable the co-ordination of traffic management with organisational covering adjacent travel areas.

2. Component Parts

The System shall consist of the component parts described below. Each part shall be called a Sub-system:

2.1 Centralised Urban Traffic Management

Overview The Sub-system shall provide all of the centralised functionality for urban traffic management. This shall include the selection and implementation of the most appropriate management strategy in some or all of the road network and the preparation of data for use in the prosecution of traffic regulation offences. It shall be possible for different traffic management strategies to be implemented in different parts of the road network. The Sub-system shall also include facilities that enable the storage and collation of traffic and road use data. This shall be both for use by itself and by other Systems. The preparation of data concerning traffic regulation offences shall be limited to ensuring that the all the required data is included. This data shall be sent to an appropriate law enforcement agency in such a way that it can legally be shown that the integrity of the original data has not been compromised.

List of Modules The Sub-system shall consist of the following Modules:

Central Urban Traffic Management

Central Urban Traffic Maintenance

Central Urban Offenders Prosecution

User Needs in Groups 2-10 The System shall comply with the following European ITS User Needs: 2.1.1.3, 2.1.2.1, 2.1.2.2, 2.1.2.3, 2.1.3.1, 2.1.4.1, 2.1.4.2, 2.2.0.1, 2.2.0.3, 2.2.0.5, 2.2.0.6, 2.2.1.1, 2.2.2.1, 2.2.2.2, 2.2.2.3, 2.2.3.1, 2.2.4.1, 3.1.0.1, 3.1.0.2, 3.1.0.3, 3.1.0.4, 3.1.0.5, 3.1.1.1, 3.1.1.2, 3.1.1.3, 3.1.1.4, 7.1.2.1, 7.1.2.2, 7.1.2.3, 7.1.2.4, 7.1.2.7, 7.1.3.1, 7.1.3.2, 7.1.3.3, 7.1.3.5, 7.1.3.6, 7.1.3.7, 7.1.4.5, 7.1.4.8, 7.1.4.9, 7.1.5.1, 7.1.5.5, 7.1.5.6, 7.1.5.7, 7.1.5.8, 7.1.6.1, 7.1.7.4, 7.1.8.1, 7.1.9.1, 7.1.9.2, 7.1.9.3, 7.1.9.4, 7.1.11.2 7.1.12.1, 7.1.12.2.

User Needs in Group 1 The System shall comply with the following European ITS User Needs: 1.2.3, 1,2,4, 1.2.6, 1.3.2, 1.3.5, 1.3.6, 1.4.1, 1.4.2, 1.5.2, 1.6.1, 1.6.2, 1.6.3, 1.7.1, 1.8.1, 1.8.2, 1.9.1, 1.9.2, 1.9.3, 1.10.1, 1.10.4, 1.10.5, 1.11.1, 1.11.2, 1.11.3, 1.11.4, 1.12.1, 1.12.2, 1.14.1.

Other Requirements: in addition to the requirements specified by the two sets of User Needs, the Sub-system shall comply with the following requirements.

(a) Access to the System shall only be possible from between one and eight designated “user” facilities that can be provided by a Personal Computer or similar Windows based device.

(b) The devices used in (b) shall not include the device that is used to operate the System itself.

(c) It shall be possible for the device in (a) to be used for other activities in addition to System access.

(d) The other activities in (c) shall be limited to electronic mail, Word Processing, use of Spreadsheets.

(e) The activities in (d) shall be available regardless of whether the device is being used for System access.

(f) The activities in (d) shall not in any interfere with System access or with the operation of the System.

(g) If several users can have simultaneous access to the System, then it shall only allow one of them to be able to exercise control over its activities.

(h) The devices required by (a) shall be to a specification that is independent of the manufacturer or supplier.

(i) The device on which the System itself runs shall use the most appropriate Operating System and Software.

(j) The System shall keep a record of the activities of all users, when those activities affect the operation of the System.

(k) The System shall keep a record of its own activities where those activities affect the management of traffic using the road network.

(l) The System must enable the records collected in (j) and (k) to be archived and for this archive to be retained for at least ten (10) years.

(m) It shall be possible for a user to printout the records from (j) and (k) on a printer that is attached to the main System device – see (i) above.

(n) Traffic flow data collected by the System shall be archived so that it can be retained for up to five (5) years.

(o) Data collected about the violation of traffic regulations shall be stored in such a way that its integrity cannot be compromised in any way.

(p) If additional data is provided to that recorded in (o), then the identity, source, timing and reason of the addition must be clearly identified. This identification and the additional data shall be included with the original data, but in a separate part.

2.2 Roadside Urban Traffic Management Sub-system

Overview The Sub-system shall provide all of the roadside functionality for urban traffic management. This shall include the collection of traffic data for use by the Central Sub-system, response to local priority requests from Emergency Vehicles, the output of instructions to road users and pedestrians and the detection of the violation of traffic regulations. The instructions road users and pedestrians shall be provided by the Central Sub-system through the traffic management strategy that is currently being implemented. The detection of the violation of traffic regulations shall be such that it is possible to determine the identity of the vehicle committing the violation, the regulation that was violated, the location, plus the time and date when the violation occurred.

List of Modules The Sub-system shall consist of the following Modules:

Roadside Urban Traffic Monitoring

Roadside Urban Traffic Management

Roadside Urban Law Enforcement

User Needs in Groups 2-10 The System shall comply with the following European ITS User Needs: 2.1.1.3, 7.1.1.1, 7.1.1.2, 7.1.1.4, 7.1.1.5, 7.1.3.4, 7.1.4.3, 7.1.4.4, 7.1.5.2, 7.1.5.3, 7.1.5.4, 7.1.7.1, 7.1.7.2, 7.1.7.3, 7.1.7.5, 7.1.7.6, 7.1.10.1, 7.1.11.1.

User Needs in Group 1 The System shall comply with the following European ITS User Needs: 1.2.3, 1,2,4, 1.2.6, 1.3.1, 1.3.5, 1.4.2, 1.5.2, 1.6.2, 1.6.3, 1.7.1, 1.8.1, 1.8.2, 1.9.1, 1.9.2, 1.9.3, 1.10.1, 1.10.2, 1.10.3, 1.10.4, 1.10.5, 1.11.1, 1.11.2, 1.11.3, 1.12.1, 1.12.2, 1.13.2, 1.13.3, 1.13.4, 1.13.6, 1.14.1, 1.14.2, 1.14.3, 1.14.4, 1.14.5.

Other Requirements: in addition to the requirements specified by the two sets of User Needs, the Sub-system shall comply with the following requirements:

(a) It shall be possible for the devices used by this Sub-system to be located anywhere near the roadside.

(b) It shall be possible for the devices used by this Sub-system to be powered from either a local electrical supply, or if this is not available, by solar or wind power.

(c) It shall be possible for the solar or wind power devices in (b) to be located separately from the devices that they power.

(d) The outputs to drivers and pedestrians provided by the devices shall be clearly visible under all ambient lighting conditions, including direct sunlight.

(e) Forms of output other than visual shall be provided for pedestrians. These shall comprise but not be limited to audible and tactile.

(f) Where pedestrian access to the road network is managed, the length of access shall be such that the safety of those with restricted mobility is not compromised.

(g) The accurate detection of traffic regulation violations shall be possible under all lighting and weather conditions.

(h) The data collected in (g) shall be protected from any access before it is sent to the Central Sub-system.

2.3 Emergency Vehicle Sub-system

Overview The Sub-system shall be responsible for the generation of local priority requests from Emergency Vehicles. These requests shall be used to create priority for the Vehicles as they approach the control Module in the Roadside Sub-system. This Vehicle based Sub-system shall only be used when a priority route cannot be (or has not been) selected by the Emergency System and provided directly to the Central Sub-system.

List of Modules The Sub-system shall not consist of any Modules.

User Needs in Groups 2-10 The System shall comply with the following European ITS User Needs: 5.2.0.1, 5.2.0.4, 5.2.0.5, 7.2.1.1.

User Needs in Group 1 The System shall comply with the following European ITS User Needs: 1.2.3, 1.2.6, 1.4.2, 1.5.1, 1.5.2, 1.6.2, 1.6.3, 1.7.1, 1.8.1, 1.8.2, 1.10.1, 1.10.2, 1.10.4, 1.11.1, 1.11.2, 1.11.3, 1.11.4, 1.12.1, 1.12.2.

Other Requirements: in addition to the requirements specified by the two sets of User Needs, the Sub-system shall comply with the following requirements:

(a) The device used to provide this Sub-system shall be mounted on the Vehicle in such a way that it does not affect the performance of the Vehicle on the road network.

(b) The device used to provide this Sub-system shall be mounted on the Vehicle in such a way that it does not affect the operation of the Vehicle by the driver.

(c) The device used to provide this Sub-system shall be mounted on the Vehicle in such a way that it does not affect the performance of the Vehicle in emergency situations.

(d) The device used to provide this Sub-system shall only operate when the Vehicle is giving indications to other road users that it is on its way to an emergency situation.

(e) The device used to provide this Sub-system shall provide a signal to the Emergency Vehicle base that it is being operated. This signal shall be provided automatically and in a way that cannot be affected by anybody inside or outside the Vehicle.

(f) The data provided by the device to the Roadside Sub-system shall include the current location of the Vehicle, and its direction of travel.

3. System Requirements

In addition to the requirements specified above for each of the Sub-systems, the System as a whole shall meet the following requirements.

(a) Upon placement of a contract to supply all or part of the System, the Supplier shall produce a Customer Requirements Specification. This Specification shall define exactly what the supplier believes has to be provided.

(b) Agreement of the Specification in (a) by the Customer is a necessary pre-requisite for payment for any part of the System or any work done by the Supplier.

(c) When the Specification in (a) has been agreed by the Customer, the Supplier shall produce a Test Specification.

(d) The Test Specification shall define the Tests that are to be carried out to demonstrate that the System fulfils the Customer Requirements Specification.

(e) Each Test in the Test Specification shall clearly define the part of the Requirements Specification for which compliance is being demonstrated, and the conditions necessary for acceptance.

(f) All software and hardware developed for this System that is not generally available, e.g. software operating systems, standard hardware components, shall be documented in such a way that it can be easily maintained.

(g) The Customer shall be able to check the scope of the documentation in (f) and to inspect any part, or parts, at random.

(h) The Central Sub-system shall be provided with an Operators' Manual. This Manual shall describe all Operator commands, their input and the results that they will produce.

(i) The contents of the Operators' Manual shall also be available in the form of "On-line Help" through the Operator interface.

(j) No user documentation shall be needed by pedestrians and other travellers in order to use the Roadside Sub-system interfaces. Any instructions for pedestrians shall be clearly defined.

(k) All outputs from the Roadside Sub-system shall conform to current legal requirements and standards.

(l) All equipment for the Central and Roadside Sub-systems must be capable of operating from the local electricity supply where one exists. In the case of the Central Sub-system, this will be provided by the Customer to a specification to be agreed with the Supplier. However this specification must be for a type of electrical supply that is available as standard to offices and buildings in the immediate location of the place

where the Central Sub-system will be located.

(m) All equipment for the Roadside Sub-system must be given an identification comprising type and number. The number shall range from one (1) to the total being supplied as part of the System. This identification shall be located on the outside of the equipment and must be proof against vandalism

4.3 Concluding Remarks

The above System Specification is intended as an example, and identifies some of the areas that must be covered by a System Specification. As noted in the Main Document, this Specification does not attempt to cover aspects of procurement such as Legal Requirements, Payment Terms, milestones for the completion of certain activities, Penalty Clauses, etc. These have not been included as they are outside the scope of the KAREN Project. Also different standards and requirements for these parts of procurement documents will exist in each Nation, State, Province, Department, etc.

5. Template for the description of an “example System”

5.1 Introduction

This Chapter provides a template for the description of an “example System”. It is intended to be used when an “example System” is being produced as Physical Systems and follows the same structure that has been used in Annex 1 of the European ITS Physical Architecture Main Document. The methodology for producing an “example System” is described in Chapter 4 of the Main Document. The contents and use of each section in this template is described in Chapter 3 of the same Document.

5.2 Template

It is assumed that the sections in this template will be a Chapter in a Document that defines the “example System”. Therefore each of the section numbers has been identified as “n.m”, where, “n” is the number of the Chapter in the Document, and “m” is the section number within the template.

n <<insert System Name>> System

The “System Name” should be short and neatly encapsulate the prime purpose for which the System is being provided.

n.1 Overview

This contains a textual description of the System. What does it do, a brief overview of the ITS Services that it will provide. Background material about its origins and development can also be included.

n.2 System Context

Describe the context in which the System will exist. This is the World in which it will operate. The System will interact with the parts of that World. The Terminators that are defined in the European ITS Physical Architecture Main Document will be those that represent that World.

It is recommended that a Context Diagram should be provided for the System. This should only show those Terminators with which the System has interfaces. A template for this Diagram is provided in the Appendix to this Document. For comments on Diagrams see section 5.3 of this Annex.

The following table should be modified to suit individual Systems. It shows a list of all the Terminators with information about why all or individual actors in some of them have been used or excluded.

Table 1 <<*insert System Name*>> System - Terminator Deletions and Modifications

Terminator Name	Reasons for deletion or modification
Ambient Environment	
Bridge/Tunnel Infrastructure	
Consignor/Consignee	
Driver	Only the following actors in this terminator are required by this System: Private Driver, Emergency Vehicle Driver, Freight Vehicle Driver, Hazardous Freight Vehicle Driver and Public Transport Driver.
Emergency Systems	
External Service Provider	Only the following actors in this terminator are required by this System: Bookable Service Provider, Freight Storage Renting Agency, General Information Provider, Geographic Information Provider, Multi-modal Travel Information Provider, Planned Event Organiser, Vehicle Renting Agency and Broadcaster.
Financial Clearinghouse	
Freight Equipment	
Law Enforcement Agency	
Location Data Source	
Maintenance Organisation	
Multi-modal System	Only the following actors in this terminator are required by this System: Mutli-modal Crossing, Multi-modal Management System, Multi-modal Freight System.
Operator	Only the following actors in this terminator are required by this System: Fleet Operator, Freight Operator, Parking Operator, Public Transport Operator, Emergency Operator, Road Network Operator, Toll Operator and Traveller Information Operator.
Related Road System	
Road Pavement	

Terminator Name	Reasons for deletion or modification
Traffic	
Transport Planner	
Traveller	Only the following actors in this terminator are required by this System: Public Transport Passenger, Pedestrian, Cyclist, Car-pooler and Static Traveller.
Vehicle	Only the following actors in this terminator are required by this System: Private Vehicle, Emergency Vehicle, Freight Vehicle, Hazardous Goods Vehicle and Public Transport Vehicle.
Weather Systems	

n.3 Sub-systems

Define each Sub-system, including their names and descriptions. The descriptions should be brief but state what they will each do, in terms of the functionality that they will provide and the ITS services that they will deliver.

This section should include a System Diagram. This should show the Physical Data Flows between each Sub-system and to the Terminators. For comments on Diagrams see section 5.3 of this Annex.

n.4 How does it work

A description of how the System delivers the ITS services for which it is being provided. It should go into some detail so that there is no ambiguity or miss-understanding about what services are being provided and how this will be achieved.

n.5 Sub-systems and Functions

A brief overview of any Sub-systems that have not been split up into Modules.

n.6 Modules

A description of the Modules that are in each Sub-system. This section should be organised into sub-sections, one for each Sub-system that contains Modules. The Sub-systems will be those that have not been included in section “n.5”. For each Sub-system the Module descriptions should include the name of each Module and an overview of the functionality that each contains.

There should also be a Sub-system Diagram for each Sub-system. This should show the Physical Data Flows between each Module, plus the Data Flows that connect the Modules to other Sub-systems and to the Terminators. For comments on Diagrams see section 5.3 of this Annex.

n.7 Modules, Data Stores and Functions

This section should have a brief introduction followed by some tables. These tables should show only be provided when needed and comprise the following.

(1) a table of the Data Stores from the European ITS Functional Architecture that are used by each Sub-system and/or Module;

(2) the Functions that are used by each Sub-system and/or Module.

Blank copies of these tables (in both portrait and landscape form) are provided in the Appendix to this Document.

n.8 Physical Data Flows

A description of each Physical Data Flow. Each description should include the name of the Data Flow, its use and an overview of its contents, plus a list of an constituent Physical Data Flows. This can all be produced using the "Report" facility within the Microsoft Access Database in which the Data Flow details are stored.

n.9 Key Issues

There may some Key Issues that need to be resolved to enable the deployment of the Physical System that has been described in the previous sections. These Issues should be identified here.

n.10 System Specification

The System Specification should be included here. Its format and contents are defined in Chapter 3 of the European ITS Physical Architecture Main Document.

5.3 Diagrams

The diagrams in all of the European ITS Framework Architecture Deliverable Documents have been created using the VISO® Standard drawing package. This was chosen by the KAREN Project team when the Project started (mid-1998) because of its relative ease of use, low cost and wide availability.

In order to assist with the creation of the Diagrams for "example Systems" template Diagrams have been provided. Illustrations of these will be found in the Appendix to this Document and electronic copies will be provided on the European ITS Framework Architecture CD-ROM. The electronic versions should be opened with VISIO® and modified to suit the particular "example System" to which they apply. Alternatively a completely new diagram can be created using VISIO® or any other similar drawing tool.

6. References

(a) European ITS Framework Architecture Functional Architecture Deliverable Document (D 3.1), Issue 1, August 2000.

(b) European ITS Framework Architecture User Needs Deliverable Document (D 2.2), August 2000.

(c) European ITS Framework Architecture Overview Deliverable Document (D 3.6) , Issue 1, August 2000.

The above Documents are available on the European Commission Web Site at: http://www.trentel.org, by following the links “Transport->Deployment Information->System Architecture->System Architecture Library. They are also available on the CD-ROM containing the European ITS Framework Architecture that has been produced for the European Commission by the KAREN Project.

Appendix 1 Diagram and Table Templates

A 1.1 Introduction

This Appendix contains Diagram and Table templates for use in the creation of the descriptions of "example Systems". They are for those "example Systems" that are Physical Systems, rather than Architectures.

A 1.2 Diagram Templates

The following are Diagram templates for the "example System" diagrams. There are three and they comprise the following:

(1) a Context Diagram template;

(2) a System Diagram template;

(3) a Sub-system Diagram template.

If the VISIO® Standard drawing package (Version 4 or later) is installed on the PC from which this Document can be read electronically, then it should be possible to "click" on each of the Diagrams and it will be "opened" in VISIO®. It should then be saved with a new file name before being modified to suit a particular "example System".

Figure 1 Context Diagram Template

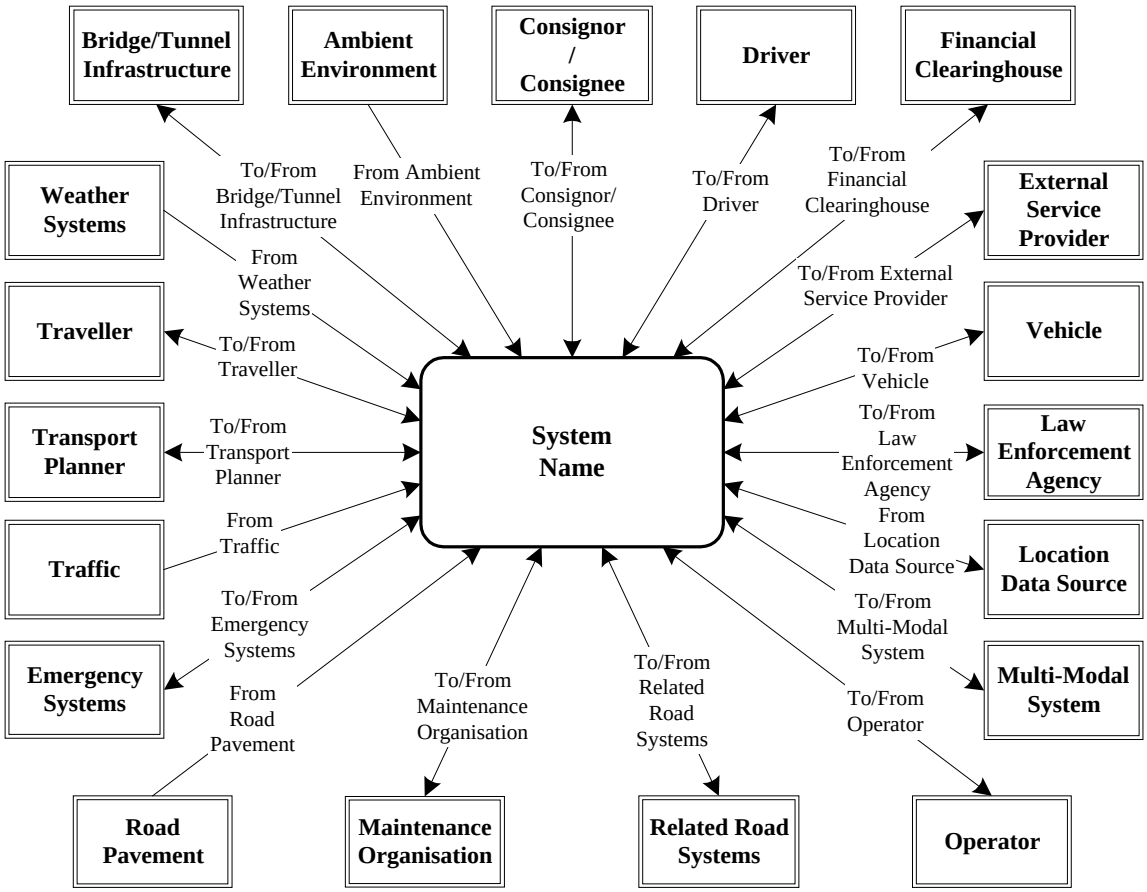


Figure 2 System Diagram Template

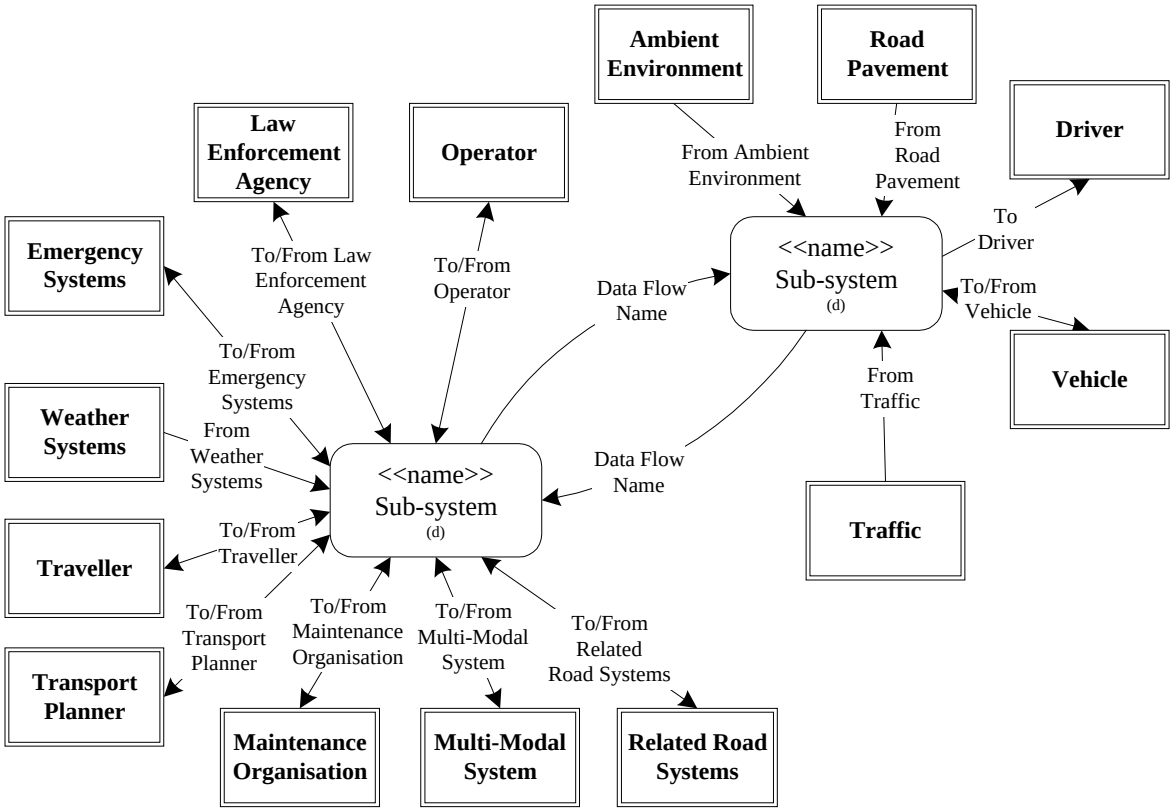
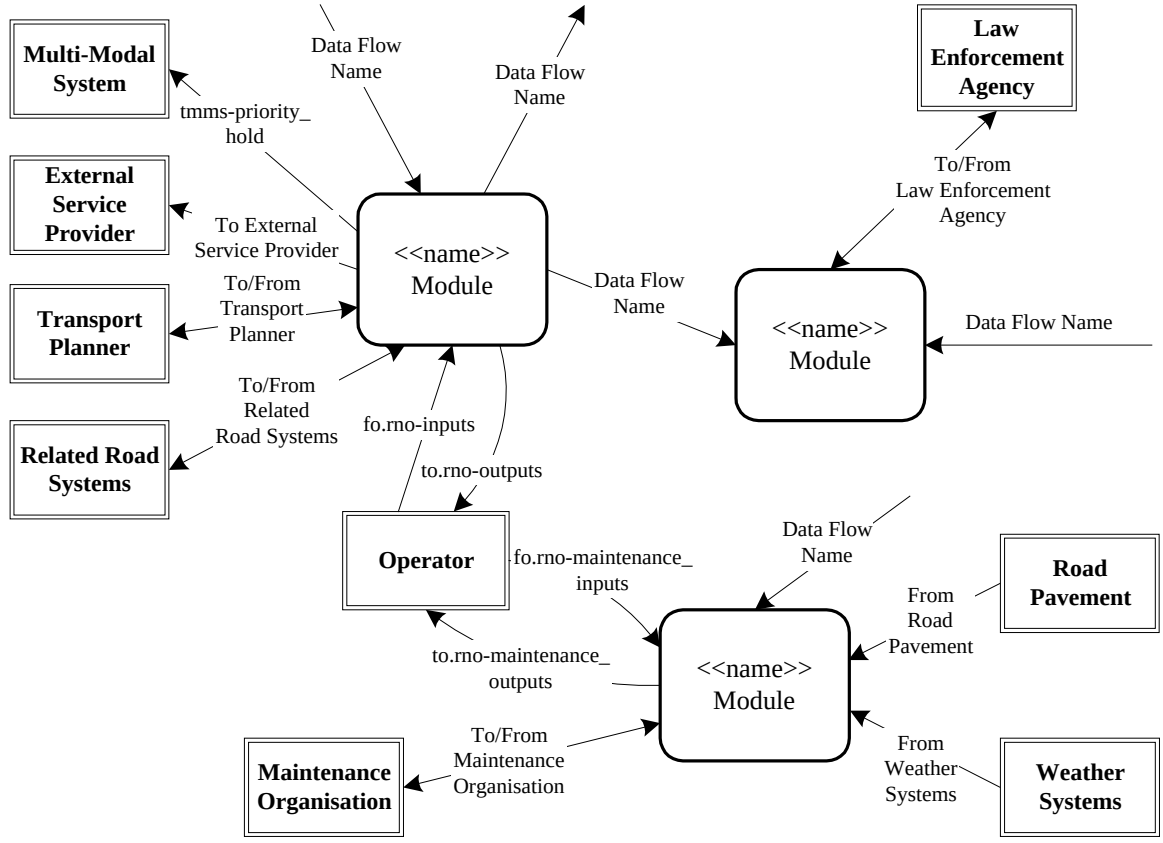


Figure 3 Sub-system Diagram Template



Notes: (1) The "<<name>>" in each box should be used for the Sub-system or Module names as appropriate.

(2) The "(d)" beneath the names for the Sub-systems is used to indicate that there is a Diagram showing the Modules that are included in the Sub-system. If there are no Modules in the Sub-system then this should be omitted.

(3) The "Data Flow Name" should be used for a meaningful name. If possible, include some prefix letters to identify the Sub-system, if the Data Flow only exists within that Sub-system. Avoid using the same Data Flow Names in different Sub-systems, unless prefix letters are used.

(4) The Context Diagram should be modified to remove Terminators that are un-used by the System.

(5) Only those Terminators that have direct connections with Modules within the Sub-system should be shown in Sub-system Diagrams. Those used by other Sub-systems should not be shown.

A 1.3 Table Templates

The following tables provide templates for those that will be needed for the "example System" descriptions. There are three and they comprise the following:

(4) a Sub-system, Module and Data Stores template;

(5) a Sub-system and Functions template;

(6) a Sub-system, Module and Functions template.

It should be possible to copy the table from this Document into the document in which the System is being described. Although numbers for each Sub-system and Module have been included, they are optional. If necessary, adjustments can be made to the table column widths to suite the limitations of the Sub-system and Module Names.

Table 2 Sub-system, Module and Data Store Table Template

Sub-system			Module		Data Store	
No.	**Name**	**Location**	**No.**	**Name**	**No.**	**Name**

Table 3 Sub-system and Functions Table Template

Sub-system			Function		
No.	**Name**	**Location**	**No.**	**Name**	**User Needs**

Table 4 Sub-system, Module and Function Table Template

Sub-system			Module		Function		
No.	**Name**	**Location**	**No.**	**Name**	**No.**	**Name**	**User Needs**

This table is shown in “landscape “ format because it has been found that it is almost impossible to create it using the more normal “portrait mode of page presentation. Almost all the similar Tables in the “example System” descriptions provided in Annex 1 of the European ITS Physical Architecture Document are in this format. Changing to “portrait” format is therefore not recommended.

Notes: (1) The “Name” columns in each Table should be used for the Sub-system or Module name as appropriate. These names should be the same as those that appear on the Diagrams produced from the templates in the previous section of this Annex.

(2) The Function Numbers, Names and User Needs, plus the Data Store Numbers and Names should be copied from Chapters 2 and 3 of this Annex.

(3) In the Tables produced for some “example Systems” in Annex 1 of the European ITS Physical Architecture Document, some of the cells appear to be of unequal height. This is an illusion and has been achieved by merging some cells.