SEVENTH FRAMEWORK PROGRAMME

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"Sustainable Knowledge Platform for the European Maritime and Logistics Industry"

SKEMA Consolidation Study

Practicalities in using the ETIS Base

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1. Introduction

1.1. Background

Strategic transportation planning is a complicated process which requires extensive data and analysis, detailed travel demand forecasting, environmental assessment and strategic/policy evaluation methodologies. A number of software packages seem to support individual tasks of the strategic transportation planning process. However, it has been understood that an integrated computer environment to facilitate planning and to provide seamless data exchange is needed.

Environment Transport Integrated planning System (ETIS) is a state-of-the-art system, supporting the integration of all tasks of a transportation planning process, i.e. travel demand forecasting, development of infrastructure and policy scenarios, impact assessment, cost-benefit analysis and comparison of alternative scenarios among others.

Strategic Planning of Urban Transport Infrastructure Development has always been a critical issue for decision makers since it involves:

- Analysis of land use and transport infrastructure development relationships
- travel demand forecasting and modeling
- development of transport infrastructure development scenarios
- impact assessment of the scenarios vis-à-vis traffic and environmental conditions of the study area
- evaluation of alternative solutions

Transport Planners usually deal with time consuming and respective tasks, which involve:

- handling of big volume of data (i.e. socio-economic data, land use data, transport cost data etc.) used for Traffic modelling and forecasting,
- creation of transport infrastructure supply inventory (including all spatial / geometrical and operational characteristics of the Road and Public Transport network)
- specification of alternative solutions, (sets of road and Public Transport Infrastructure with all the operational characteristics the planner desires to test on them)
- calculation of indices for assessing the impacts of alternative proposals,

Since the different types of data involved in the Transport Infrastructure Planning process follow a spatial distribution i.e. refer to geographical entities such as links, nodes, areas (zones), the application of GIS technology for developing an Integrated Transportation Planning Tool with special attention to the Environmental Protection is more than evident.

1.2. ETIS objectives and strategic aspects

The objectives of ETIS reference database are:

- To contribute to the building of a consensus view of the reference pan European transport modeling data set.
- To develop an open methodology to generate a version of such a set from existing international and national sources.
- To produce a first compilation of the data set by applying the ETIS methodology

This base consists of four elements, namely:

- The Data Element,
- An analytical modelling element
- The GIS Element , and
- The User Interface Element.

ETIS is a database that integrates goods flows from various sources in order to support decision makers. ETIS was supported by EU Funds from 2002 to 2005 under the "Competitive and Sustainable Growth" Programme (1998-2002). The motivation for developing ETIS is to provide policy makers and policy analysts the capability to monitor all those developments that are relevant to the transport field with real and up-to-date data and to participate in developing international transport policy. Additionally, central to the ETIS project is the development of a methodology for generating pan-European reference databases, based on data both from national and other sources . ETIS was scheduled to run a pilot of this database in order to assess the results and the usability in terms of user access, retrieval and use of data from multiple and dispersed sources for monitoring and assessing policies. The result of this effort was the creation of the tree modules of ETIS called ETIS- Base, ETIS-Link and ETIS-Agent.

ETIS reference database support various series of TEN-T policy issues and enables data mining of transport performance and impacts (environmental, economic) as well as the traffic at specific nodes or links of the networks. The database structure allows data aggregation in order to get a compact view of transport performance (vehicle-kms etc) and effects (emissions level, energy consumption by mode etc).

The ETIS database is incorporated in the ETIS software tools – ETIS AGENT. The two most important outputs of the reference database development that serve as input to the system tools being developed are:

- The metadata concerning indicators and data sources,
- The final reference ETIS database.

The ETIS reference database project, ETIS promotion and external contacts project and ETIS software tools project have come up with a common and better harmonized focus during meetings from November 2003 up to January 2004 in order to be able to come

up at the end of the three projects with one consistent and unique ETIS product. This product is a pilot and it is expected that EU will support and continue the maintainance development of the ETIS tool to the interest of the European transport policy.

2. The ETIS Architecture

2.1. In General

ETIS is a computer environment integrated with ArcInfo (Geographical Information System), EMME/2 (Traffic Modeling Software), and PAL (environmental pollution model) software modules supporting:

- Planning of Transport Infrastructure, and
- Management of transport operations in urban areas.

ArcInfo deals with geographical and descriptive data as well as data related with geometrical and operational characteristics of the Public Transport and Road Network. Additionally, it supports the evaluation of the traffic and environmental results for each scenario of the transport infrastructure development scheme and the comparative presentation of these results. EMME/2 supports the modeling and forecasting and finally, PAL calculates emission rates for each major air pollutant and emission concentrations on the study area.

EMME/2 and PAL modules have their own internal database structure, so that the integration of them with ArcInfo was based on the development of an Integrated Data Base Management System with specific interfaces.

The ETIS database structure (Figure 1) comprises from:

- An external database (ASCII files, DBASE files etc.)
- ArcInfo Database organized in layers (Road Network, Public Transport Networks, zoning systems, infrastructure development scenarios, etc)
- EMME/2 database including network descriptive statistics, public transport transit lines, functional characteristics, O/D demand matrices, traffic forecasting,
- PAL database including spatial data, weather conditions data, summary of network descriptive data, emission and concentration pollution level prediction models,
- Geographical database of results

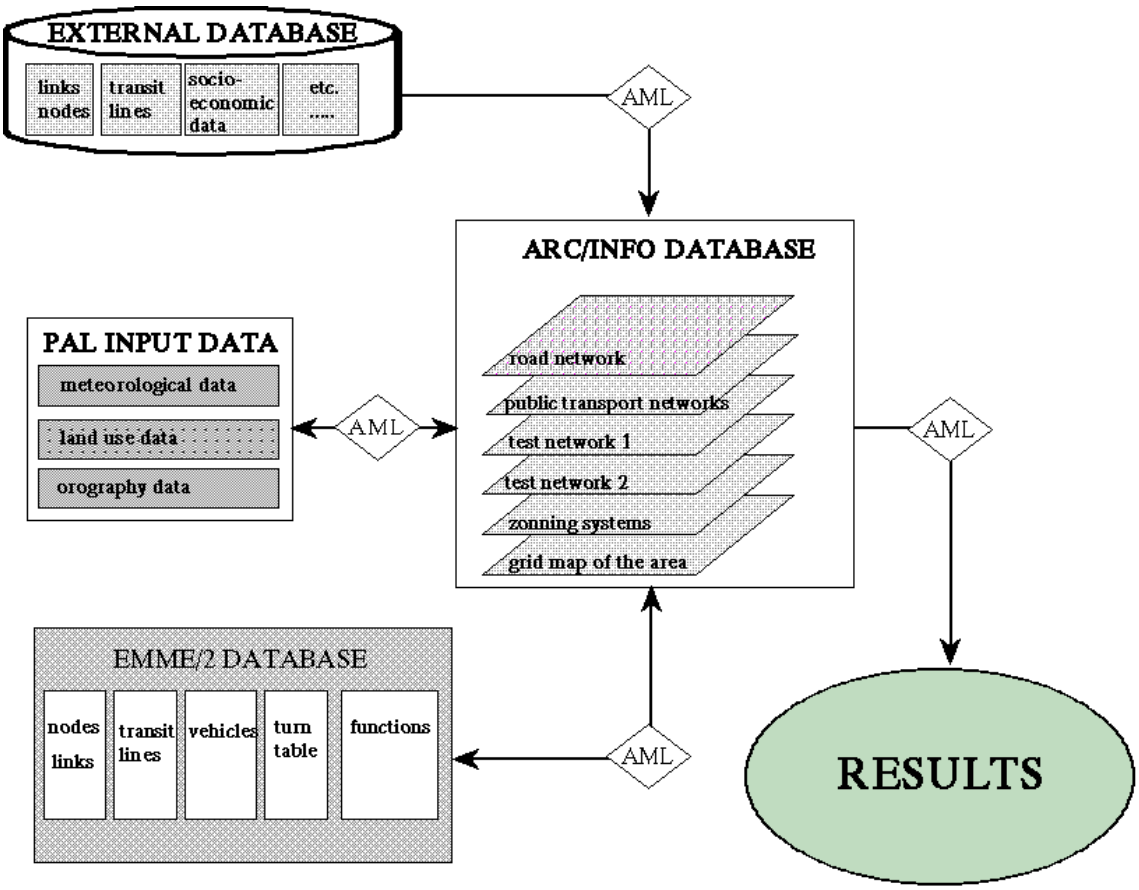

Figure 1 - ETIS Architecture (Aifandopoulou, Nathanail and Panayotakopoulos 2007)

ETIS BASE functional modules include:

- Network Manager: dealing with data manipulation for automatic creation of test networks (alternative sets of Road and Public Transport Proposals),
- ArcInfo to EMME/2 interface: transforming data stored in the ArcInfo data base and creating input files for EMME/2
- EMME/2 Traffic Modeling and Forecasting module
- EMME/2 to ArcInfo Interface converting the EMME/2 output files in ArcInfo format (graphical format)
- Environmental Conditions estimation module calculating emission rates and noise level by link
- Test Network Evaluation module

2.2. Additional ETIS Modules: ETIS LINK & ETIS AGENT

ETIS is based on a framework (Figure 2) involving the various stakeholders that are needed to devise a common, EU wide basis of metrics and statistics.

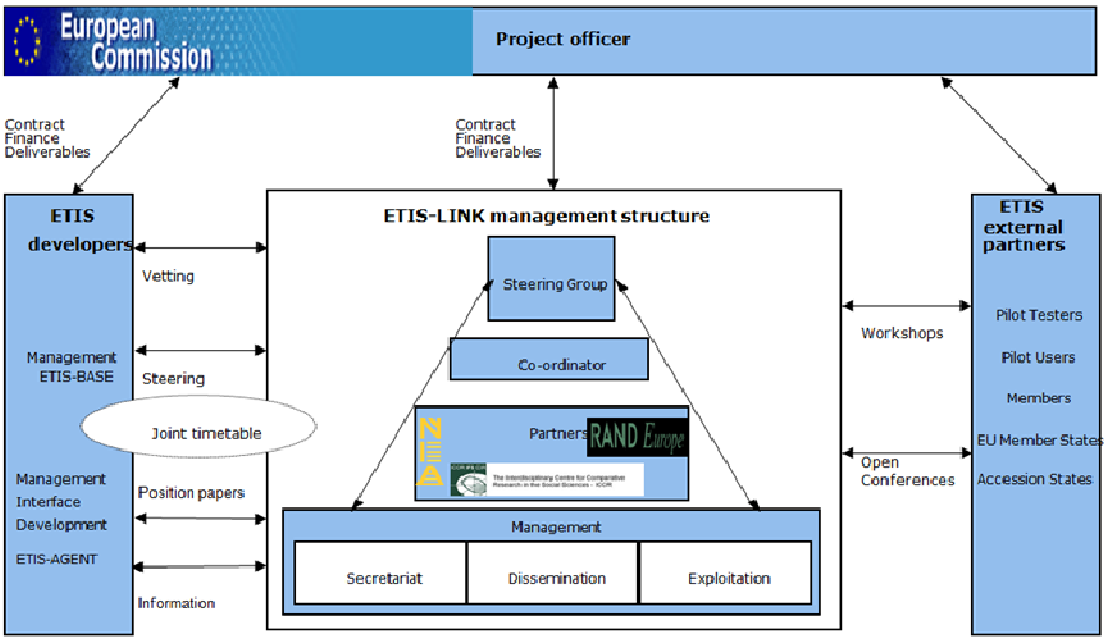

Figure 2 - The ETIS Framework (Dr. Adnan Rahman 2004)

Among the most important issues for the development of ETIS is the ETIS-LINK. ETIS-LINK is the front end platform for the development and launching of ETIS. It is a thematic network created for the promotion of ETIS concept to potential users in the European Commission, in Member States and in Accession States and to steer the development of ETIS. ETIS-LINK was created in order to support the creation of this database and to participate in developing the interface of the system. Under this principle, the user community will also participate in the development and maintenance of the interface.

ETIS-LINK aims at reducing complication and increasing usefulness. This will give the ability to the user community to have an easier access to the data of ETIS and to ensure the quality of data by offering uninterrupted and updated information. Additionally, ETIS- LINK should care about offering data that are compatible with the needs of the users and will be technically correct. Considering the above, the system must be in close relation with Base and Agent. ETIS-LINK has broken down its objectives at three levels: workshops, input, pilot testing.

ETIS Agent is a tool for accessing the various ETIS data sources and aims at communicating data to various information systems. ETIS Agent facilitates users to access and exchange information and data concerning the transport domain. More specifically, ETIS Agent will be used for selecting and retrieving transport data and related metadata from external to the ETIS sources, i.e. European regional, national or international transport and socio-economic databases, formatting, merging and organizing them into consistent data sets. ETIS Agent supports openness, automation and re-use of the transport data that integrates. It also utilizes the concept of intelligent static and dynamic datasets as the core technology to identify, collect and

translate the data as well as for achieving the required openness and scalability of the ETIS-AGENT, through an object-oriented approach.

3. ETIS BASE

3.1. ETIS BASE Data

ETIS-BASE assumed the development of the reference database, the core element of the European Transport policy Information System (ETIS). The main goal for this European database is to cover statistics for the EU 25 group and become a pivotal reference database for European strategic modeling and TEN-T policy issues. This was achieved by populating ETIS BASE with consistent and updated databases covering:

- socio-economic data,
- freight transport demand data,
- passenger transport demand data,
- European transport network data,
- freight transport service and cost data,
- passenger transport service and cost data, and
- external effects data.

ETIS BASE provides not only a suggested methodology for building up a consistent and detailed database, but also provides the reference database per se, in order to assist the Commission in putting into action TEN important policy issues. Additionally, this methodology aims at helping stakeholders and interested parties move from strictly EU policies (TEN) to a wider set of transport policies involving more countries and more business groups.

Adaptability is considered very important for the smooth operation of the ETIS-BASE, since the conditions created by not only EU geographic extension but also by an ever-changing business environment are constantly developing. It has to be noted that ETIS BASE builds up on the TEN-STAC study, thus common access to the relevant data was approved.

3.2. Relationships between TEN-T policies and ETIS Indicators

The ETIS pilot focuses on the TEN-T policies, in particular through the capability to provide a harmonized transport database and a policy assessment tool. Several EU Projects specifically related to the TEN-T policy issues (INDICATORS, TEN-STAC to name a few) were the basis of the identified list of policy areas that are needed to address important TEN-T policy issues as presented in Table 1.

Policy query	ETIS domains
I. Are the frequencies and delays along the	Mobility

	corridors sustainable?	
II.	Are the TEN-T corridors effectively utilized?	Optimal use of capacities
III.	Are the TEN-T infrastructure facilities sufficient?	Intermodality/interoperability
IV.	Is accessibility at the TEN-T network viable?	Accessibility
V.	Can the transport social costs be evaluated?	Economic viability
VI.	Can the environmental and safety impacts along the TEN-T corridors be estimated?	Environment and safety
VII.	Is road freight traffic growing more rapidly than rail? And is this true for the whole of TEN?	Modal balance

Table 1 - TEN-T policy query and the corresponding ETIS domains (NEA Transport Research and Training BV 2005)

Each policy area in the ETIS database is supported by a set of related performance and supporting indicators. A descriptive example is shown in Figure 3.

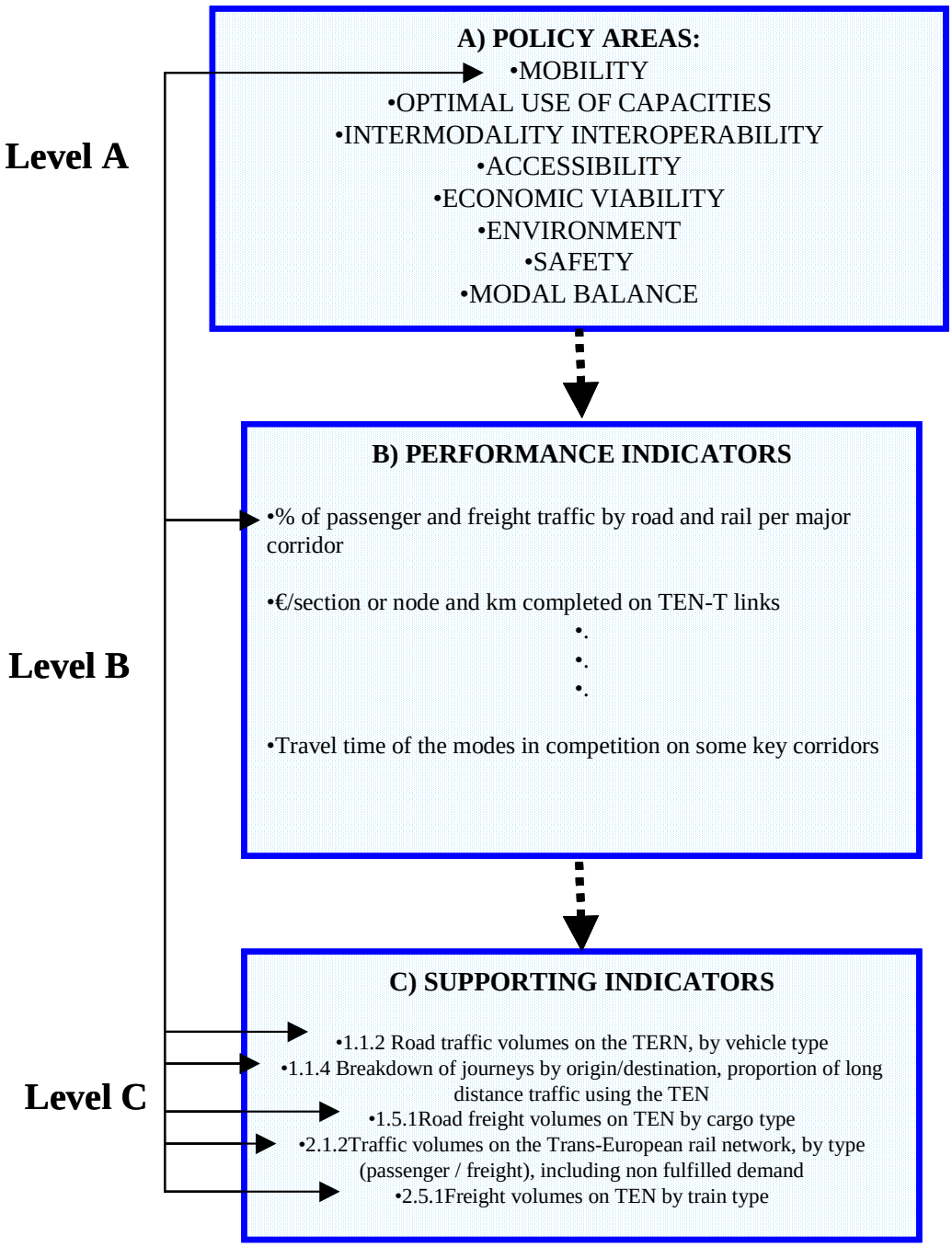

Figure 3 - Example of relationships between policy analysis and the TEN-T indicators collected in the ETIS reference database (NEA Transport Research and Training BV 2005)

3.3. ETIS' Variables

As described above, ETIS addresses the following two important issues:

- Geographical coverage of the assessment of the transport flows: the proper assessment of the TEN-T projects requires an analysis of the transport flows at least in 27 countries (EU 25 in addition to Norway and Switzerland) in order to have an overall picture of transport flows on the scale of the enlarged European area

- Data specification at network level and at narrow spatial scale: the assessment of the TEN-T projects and policies requires the estimation of the overall potential impacts

This information is described in Table 2 and Table 3.

DATA SCOPE	SOCIO ECONOMIC	FREIGHT DEMAND	PASSENGER DEMAND	EXTERNAL EFFECTS
Geographical scope	Core countries (*), Pan European scope (**) and rest of the world, depending on the variables to be analyzed	Core countries (*) in relation with the Pan European scope (**) and the rest of the world for OD relations	Core countries*, all modes with Pan European scope** Rest of world: specific passenger routes	Core countries (*)
Regional detail	NUTS 2 for the core countries, Nuts 0 for the Pan-European scope and per geographic group for the intercontinental destinations.			
Modes	Road, Rail, Inland navigation, Air, Sea***			
Time reference	Year as close as possible 2000 or time series depending on the variable under examination	Year as close as possible to 2000 or time series depending on the variable under examination	Year as close as possible to 2000 or time series depending on the variable under examination	Year as close as possible 2000

Table 2 - Main elements of the data scope by ETIS data areas (I/II) (NEA Transport Research and Training BV 2005)

DATA SCOPE	NETWORK DATA	FREIGHT SERVICES AND COSTS	PASSENGER SERVICES AND COSTS	EXTERNAL EFFECTS
Geographical scope	Core countries (*), Pan European scope (**)	Core countries (*) and connection with Pan European Countries (**)	Core countries (*)	Core countries (*)
Regional detail	NUTS 2 for the core countries, Nuts 0 for the Pan-European scope and per geographic group for the intercontinental destinations.			
Modes	Road, Rail, Inland navigation, Air, Sea***			
Time reference	Year as close as possible to 2000 or time series depending on the variable under examination	Year as close as possible to 2000	Year as close as possible 2000 (for some variables only current 2003/4 values possible)	Year as close as possible 2000

Table 3 - Main elements of the data scope by ETIS data areas (II/II) (NEA Transport Research and Training BV 2005)

(*)Core countries: EU 25, Norway, Switzerland

(**)Pan-European scope: Rumania, Bulgaria, Turkey, Bosnia & Herzegovina, Croatia, Serbia & Montenegro, Albania, FYRO Macedonia

(***) For passenger transport "Inland navigation" and "Sea" are not considered as a specific mode

3.4. Data Collection

Table 4 summarizes the most important data suppliers by data sets per type of supplier indicating the most important or prevalent data suppliers.

Type of supplier	Socio economic data	Network data	Freight transport services and costs	Passenger transport services and costs
Institutional	EUROSTAT MEDSTAT WORLD BANK	GETIS EUROSTAT (GISCO)	EUROSTAT (including GISCO) Internet sites EU Projects	Internet sites ICAO
Private		Eurogeographics/ EuroGlobalMap	Freight industry	

Table 4 - Main data suppliers by ETIS data sets (NEA Transport Research and Training BV 2005)

The four data sets are based on institutional bodies, which implies easier accessibility to information. However, this accessibility depends on the specific spatial dimensions.

Table 5 presents the statistical sources.

Socio economic data	Network data	Freight transport services and costs	Passenger transport services and costs
EUROSTAT (NEW CRONOS, REGIO, COMEXT, GISCO)	EUROSTAT (GISCO	EUROSTAT (GISCO)	Timetable for passenger ferry services
EUROGEOGRAPHICS (SABE)	EUROGEOGRAPHICS (SABE)	Transport companies,	SABE database
Corine land cover	UN-ECE	Ports and Terminals,	UIC network
World Bank Data & Statistics	UIC	Business directories.	EUROCONTROL

Socio economic data	Network data	Freight transport services and costs	Passenger transport services and costs
IMF STATISTICS DOTS-Direction of Trade Statistics.	Internet websites of national governments	Project results including RECORDIT, SPIN and GBFM Freight Modelling Project (UK)	ICAO
WTO World Trade Organisation	Official Airline Guide (OAG)		HAFAS
OECD Main Economic Indicators	Eurocontrol		Official Airline Guide (OAG)
Worldfact Book (CIA database)	Tariff database of a consolidator (air tariffs)		Tariff database of a consolidator for air tariffs, MkMetrik
Project results including SCENES	Flight booking systems		International rail timetable
	ICAO-database		Internet websites of rail and ferry companies
	EU project results like GETIS and TEN-STAC		

Table 5 – ETIS statistical sources (NEA Transport Research and Training BV 2005)

Data availability is shown in Table 6.

	SOCIO ECONOMIC	NETWORK DATA	FREIGHT SERVICES AND COSTS	PASSENGER SERVICES AND COSTS
Geographical scope	Core countries (*), Pan European scope (**) and rest of the world, depending on the variables to be analysed	Core countries (*), Pan European scope (**)	Core countries (*) and connection with Pan European Countries (approximately 30 countries)	Core countries (*)
Geographical level	Country level NUTS 2 level NUTS 3 level NUTS IV-V level	Link level O/D path	Link level O/D path	NUTS 2 level
Time reference	Year as close as possible 2000 or time series depending on the variable under examination	Year as close as possible to 2000 or time series depending on the variable under examination	2002/2003 for GIS data and freight services, 1998-2004 for rail –road freight costs	Year as close as possible 2000 (for some variables only current 2003/4 values are possible)

Table 6 – ETIS data availability (NEA Transport Research and Training BV 2005)

(*)Core countries: EU 25, Norway, Switzerland

(**)Pan-European scope: Rumania, Bulgaria, Turkey, Bosnia & Herzegovina, Croatia, Serbia & Montenegro, Albania, FYRO Macedonia

3.5. Data Gaps And Solutions

Filling data gaps is a very sensitive issue for ETIS since the complexity of specific data sets and the difficulty in obtaining data increase the issue of data analysis. These methods are type of data specific and no homogeneous a priori approach was implemented. The methodologies for data collection strictly depend on the specific data set characteristics.

The most severe data gaps addressed by ETIS are the following:

- UNECE data gaps

- No modal split data
- Classified or no data at all for various countries
- No link related demand data for rail at the European level
- No central data source for all needed maintenance and development costs
- No central data source for statistical information (e.g. port statistics).

As far as the data combination for setting up cost models is concerned, cost data on road and rail freight services were collected and combined for setting up cost models. This has been achieved by building all of the data integration and most of the modeling steps into a single software module. ETIS had to address the issue of lack of reliable information allowing the comparison of costs and competitiveness of road carriers in all member States at the same time. Comparing "average cost structures" between countries is a risky approach since cost dispersion within a given country is higher than cost dispersion between the "average levels" observed in the various member States.

Finally, data combination for generating supporting data uses road network models, e.g. GISCO road network, for passenger travel times road calculation among European NUTS 2 regions in an unloaded road network. Additionally, an alternative method used by ETIS is "out-of-pocket costs", i.e. costs for fuel consumption and road charges for the generation of direct user costs for passenger road transport. The estimation of fuel costs country-specific data on average fuel consumption of the passenger car fleet and country-specific shares of diesel engines were also taken into account, as far as data was available.

Conclusively, ETIS data sets had to mitigate the following gaps:

- Gaps arising from data not collected before or on a structural basis
- Non harmonized EU wide data
- Non data availability

With reference to the socio-economic, network data, freight and passenger services and costs data sets, the following different methodology approaches can be distinguished:

- Methodologies based on the geographical characteristics of statistical units (NUTS) and on the use of raster techniques (as in the case of socio-economic data set)
- Methodologies for combining different network model data (as in the case of network data)
- Methodologies for filling missing data through the creation of new data base, using as input external data bases, models and information drawn out from reports, statistics, projects, etc (as in the freight services and costs data set)

- Methodologies based on statistical analysis (regression functions) in order to estimate data and updating of existing network models in order to cover the TEN-T geographical space

Table 7 presents the methodologies used to identify data gaps observed and possible solutions for filling the gaps.

	Socio Economic data set	**Network Data set**	**Freight services and costs data set**	**Passenger services and cost data set**
Data gaps observed	In particular cases, with reference to specific indicators, the NUTS level can be different for a same country or between CEE countries and candidates. Relevance of NUTS regions, the area of nuts regions is very different for each country The years available are heterogeneous	Data gaps in network databases (e.g. UNECE traffic count data) No calculation network (networks, which are included in GETIS cannot be used) Dispersed data availability	A European Costs/price freight transport database does not exist Data relating to the reliability of intermodal transport on specific links and routes	Direct users travel costs for road and rail Passenger travel times road
Methods	Data harmonisation among NUTS levels and use of techniques for data estimation at spatial level	Establishing connections between GETIS and networks which will be used for assignments Set up network modelling and finding input from other areas, i.e. port statistics Set up network modelling Use models which are available in consortium (model used in TEN-STAC)	A Transport Network Data Model (TNDM) a Generic Cost Model (GCM) developed for road, rail, waterways, short sea shipping	Modeling, statistical analysis (regression analysis); Updating of rail and road network model in order to fill the gaps

Table 7 - Methods for filling data gaps (NEA Transport Research and Training BV 2004)

4. CONCLUSION

ETIS is a tool towards the right direction in using a homogenous EU wide data. ETIS has defined a process of data collection, the type of data suppliers and procedures for data acquisition. Statistical sources are available to a good extend with a good degree of

accessibility and ETIS' geographical coverage is also extensive including NUTS 2 level and in some data sets where appropriate NUTS 3.

Methods for combining data in order to fill the gaps have been designed; however, these methods do need elaboration in order to achieve greater adaptability. To this extend, ETIS has to achieve repeatability of the methodology.

At this point, it has to be noted that ETIS' integration of specialized application has achieved the following:

- Exploitation of the advantages of each software package through their integrated use
- Faster examination and evaluation of a big number of alternative infrastructure development sets by the user in the form of scenarios
- Automatic transformation of data sets in the format of input files required by each software application used in the Integrated Environmentally friendly Transport Planning Process
- Increase user friendliness
- Real life actual zoning systems to provide more reliable planning
- Easy and efficient update of core database.

Although ETIS is a promising tool that provides data availability, the objectives do not appear to have been fully achieved up to now (April 2009). This is apparent by a number of observations, as follows:

- Certain data sets (e.g. for highways and roads) are not available in a single database for all countries, which might compromise data integrity.
- Data harmonization is an issue at the multi-national level, due to diversity, complexity, polymorphy and the data flow.
- Some data sets are considered confidential (e.g. by highway operators) where even national authorities are not able to provide these data
- Data collection management and data dissemination policies (commercial data, confidential statistics, enterprise related data, etc) are not yet cleared
- Data integrity and responsibilities in case of wrong / unreliable data
- Intellectual Property (IP) rights including modelling tools and databases
- Attrition policies for data suppliers that are not in place
- ETIS data updating and data re-processing are currently on an ad-hoc basis
- ETIS has not developed a quality control system
- There are significant publication issues for monopolies, i.e. it is legally forbidden to publish data in market with less than 3 players.

Conclusively, ETIS concentrates on providing robust data to improvement decision making in the Mobility, Capacity, Safety, Intermodality and/or Interoperability, Accessibility, Economic Viability, Environmental Issues and Modal Balance sub domains as follows:

- As far as the mobility sub - domain is concerned, it is expected that ETIS will support Level of Service decisions of TEN Infrastructure. Moreover, ETIS will identify bottlenecks and capacity issues on existing infrastructure so as to be eliminated. Optimization of modal split along international corridors for road and rail as well as the measurement of infrastructure investment according to Trans-European guidelines is aimed.
- Regarding the capacity sub-domain, ETIS encourages optimal use of TEN-T corridors for long-distance and international traffic. Additionally, seaports and short sea shipping stakeholders may improve their value offerings.
- Under the safety sub - domain, ETIS identifies the critical TEN places and facilitates policy making vis-à-vis relevant improvements.
- ETIS encourages unitisation and containerization of freight by improving the Intermodality / Interoperability options of the stakeholders as well as the accessibility to an integrated intermodal transport system.
- As far as the Economic Viability sub – domain is concerned; ETIS provides data to support the optimal resource allocation as well as the evaluation of the various proposed projects.
- Regarding, the Environmental sub – domain, ETIS focuses on providing enough data to assist in decisions regarding decreasing atmospheric pollution around TEN links through improved modal balance and reduced bottlenecks. It reduces energy consumption and CO2 emissions at network-level and it minimizes effects of transport in environmentally sensitive areas.

5. Bibliography

- Aifandopoulou, Georgia, Teti Nathanail, and Demetrios Panayotakopoulos. "ETIS : A GIS technology based tool for supporting strategic environmentally friendly planning of urban transport infrastructure development ." 2007.
- Dr. Adnan Rahman. The ETIS framework. RAND Europe, 2004.
- NEA Transport Research and Training BV. "D5 main report: ETIS-Database methodology development and database user manual – synthesis report." 2004.
- NEA Transport Research and Training BV. "D6 main report: ETIS-Database methodology application by data set: socio-economic, transport networks input data, freight transport service and costs, passenger transport services and costs." 2005.

ANNEX

ANNEX I. ETIS Performance Indicators

	to be calculated in ETIS pilot (restrictions)	Possibility of automatic calculation (using querying function of GIS or database application)
MOBILITY		
Travel time of the modes in competition on some key corridors	Yes (average times, corridor as OD)	Yes (for specific link – simple GIS query; for corridor – combined (GIS) query)
Frequencies on key corridors	Yes (rail, ferry, air, corridor as OD)	Yes (GIS query,) direct retrieval of frequency variable)
Proportion of delayed trains	No	No
Average minutes at cross border points/equivalent transport unit (split by passenger and freight rail traffic)	No	No
Actual Demand/Capacity (%) for each mode on each infrastructure	Yes (road)	Yes (simple (GIS) query)
Days per year where capacity limits are exceeded (>90% of hourly design capacity) on a TEN link or node	Days - No TEN objects with the highest demand/capacity ratio-Yes (road)	Yes for ratio (simple (GIS) query) No for days
% of passenger and freight traffic by road and rail per major corridor	Yes (as in OD matrices)	Yes (combined (GIS) query)
€/section or node and km completed on TEN-T links	No	No
OPTIMAL USE OF CAPACITIES		
Proportion of traffic making journeys over a threshold distance (e.g. 200 km).	Yes (flows)	Yes (complex query)
Long distance international traffic units/Total traffic units on network	Yes (no urban traffic)	Yes (complex query)
Equivalent transport unit (TEUs) by shipping type (in % of total ETU capacity)	No	No
Number of operating days per year due to climate, strikes, etc.,	No	No
Demand/capacity measures for road and rail links to seaport	Yes (road)	Yes (simple query and display area around port in GIS)
€/km by key ITS service	No	No
% of network covered by ITS services	No	No
% of Inter-City trains with on-board electronic passenger information systems	No	No

	to be calculated in ETIS pilot (restrictions)	Possibility of automatic calculation (using querying function of GIS or database application)
% of dedicated freight lines on total rail network	No	No
INTERMODALITY INTEROPERABILITY		
Proportion of freight that is unitised (containers, swap-bodies, piggyback)	Yes (No subdivision in loading units, potential only)	Yes (combined query)
% of container traffic/total freight	No (only unitized as in ind. 18)	No
Number of interchanges/km or number per capita for rail	Yes (railway terminals by region)	Yes (complex query)
Tons at rail interchange	Yes (at selected ports only)	Yes (direct retrieval of tons variable)
Terminal throughput of the number of units transferred	Yes (for selected ports not at terminal detail, TEU)	Yes (direct retrieval of units variable)
% increase in terminal throughput over the previous year	No	No
% of train km with compatible power supply, signaling, track gauge, loading gauge (clearance), axle weight limit.	Yes (only power supply, signaling)	Yes (combined query)
% of train-Km of foreign or non-national railway operating on TEN	No	No
Rail passenger or freight market share of the largest national rail operator	Yes	Yes (complex query)
ACCESSIBILITY		
Demand/Capacity measures for road and rail links to airports	Yes (road, replaced by access/egress time and costs variables for major airports)	Yes (simple query and display area around port in GIS)
Average travel time from airport to city centre by rail, bus & car	Yes	Yes (simple query)
Public transport frequency from airport	No	No
Best travelling time, frequency of services, destinations taken into account and weighting of the parameters by O/D relation	Yes (multimodal traveling times not from Sup. Ind.)	Yes (combined query)
For freight, average speed (including transshipments etc) in km/day and average cost euros/tonne-km,	Yes (multimodal traveling times not from Sup. Ind.)	Yes (combined query)
For passengers average trip speed, including waiting and transfer times (km/h) and trip costs (euros/pass.km).	Yes (for specific ODs)	Yes (combined query)
Aviation: Population or GDP in the	Yes	Yes

	to be calculated in ETIS pilot (restrictions)	Possibility of automatic calculation (using querying function of GIS or database application)
vicinity of an airport constrained by a specific travel-time or distance (for example population reachable within 60 minutes from an airport)	(raster method)	(complex query)
Aviation: Percentage of people living in a NUTS1-region who can reach an airport within a specific travel-time	Yes	Yes (complex query)
Average number of services per day by sea and air, OD related	Yes (no sea for passengers, for air per week)	Yes (simple query)
Average travel times on pan-European corridors linking major centres to islands, by air, road/sea and rail/sea	Yes (partly for aviation only)	Yes (combined query)
ECONOMIC VIABILITY		
Current and forecasted ratio: volume/capacity, by mode along corridor	Yes (for only road in reference year, no forecasting in ETIS)	Yes (simple query)
% of social marginal costs coverage through user charges per mode and freight/passengers	No	No
Impact of new TEN-T infrastructure investment on Traffic growth	No (application of scenarios is beyond the ETIS scope)	No
Impact of new TEN-T infrastructure investment on Impact on the modal split	No (application of scenarios is beyond the ETIS scope)	No
Impact of new TEN-T infrastructure investment on Cost-benefit analysis (including external costs)	No (application of scenarios is beyond the ETIS scope)	No
Impact of new TEN-T infrastructure investment on Return on investment	No (application of scenarios is beyond the ETIS scope)	No
ENVIRONMENT		
Kg. of emissions per vehicle-km by major link for passenger and freight	Yes	Yes (simple query)
Million tonnes of oil equivalent (Mtoe) per equivalent transport unit (TEUs) by mode for passenger and freight	Yes	Yes (simple query)
Tonnes of annual CO2 emissions for passenger and freight	Yes	Yes (simple query)
Km. passing through natural protected areas	Yes	Yes (combined query)
Area covered by transport infrastructure (km2)	Yes	Yes (complex query)
Fragmentation of potential natural	No (or limited)	Yes

	to be calculated in ETIS pilot (restrictions)	Possibility of automatic calculation (using querying function of GIS or database application)
areas		(simple query)
Impacts on cultural environment	Yes	Yes (simple query)
Number of settlements affected, number of designated buildings, conservation areas and designated landscape areas touched by transport infrastructure.	Yes	Yes (combined query)
SAFETY		
Accidents / traffic units (billion vehicle-km) on TEN per year	No (or limited)	Yes (simple query)
Number of locations on TEN (either single points or stretches of network up to 1 km) where target number of repeated accidents occur (e.g. over 5 injury or fatal accidents per year based on a moving average of the last 3 years)	No (or limited)	Yes (simple query)
Number of black spots per 1000 km of TERN [ ]	No (or limited)	Yes (simple query)
MODAL BALANCE		
Market share of non-road modes per corridor	Yes (corridor defined as OD)	Yes (combined query)
Annual passengers-km/passenger seat-km	Yes (rail, air)	Yes (simple query)
Change in passenger demand over previous years	No	No
Travel distance and travel time on corridors for rail and air	Yes (corridor defined as OD)	Yes (simple query)
Annual tonne-km by rail or waterways/total freight demand for distance > X Km	Yes	Yes (complex query)
Volume / line capacity	Yes (volume/link or corridor for rail and inland water)	Yes (simple query)
Number of operating days on waterways	No	No
SOCIO-ECONOMIC		
Socio-economic indicators	Yes	Yes (simple query)

ANNEX II. ETIS supporting indicators

Domain	ref.	Definition
Mobility	1.1.2	Road traffic volumes on the TEN, by vehicle type
	1.1.4	Breakdown of journeys by origin/destination, proportion of long distance traffic using the TEN
	1.5.1	Road freight volumes on TEN by cargo type
	2.1.2	Traffic volumes on the Trans-European rail network, by type (passenger / freight), including non fulfilled demand
	2.5.1	Freight volumes on TEN by train type
	4.1.2	Freight volumes on the inland waterway network
	3.1.4	Airport to airport traffic
	5.1.1	Port throughput (passengers, freight)
Network size	1.1.1	Total length of TERN, by road type
	2.1.1	Total length of Trans-European rail network, by line type
	3.1.3	Air space description
	4.1.1	Total length of navigable waterways forming the TEN-T
Capacity	1.1.3	Maximum number of vehicles which can be accommodated on a link type, per unit time
	2.1.3	Maximum number of trains which can be accommodated on a link type, per unit time
	3.1.1	Capacity of airport system as part of the Trans-European network
	4.1.3	I/C factor of bridges and locks (intensity versus capacity) (waiting time)
	5.1.2	Maximum ports throughput (passengers, freight tonnage)
	6.1.2	Maximum traffic volumes accommodated at the intermodal terminal
Utilisation	3.1.2	Actual air traffic throughput divided by capacity
	6.1.1	Traffic volumes served at the terminal
Availability	4.1.4	Average number of operating days per year without closure due to ice, low water, flood, lock repair, etc
	5.1.3	Average number of operating days per year without closure due to ice, low water, storms, etc
Safety	1.2.1	Accidents per vehicle km by accident type

Domain	ref.	Definition
	2.2.1	Accidents per passenger-km, tonne-km (for freight) and train-km (for all train types) by accident type
Network safety	1.2.2	Number of high accident locations / sections (black spots)
Energy consumption	1.3.1	Estimated / measured energy consumption on roads
	2.3.1	Estimated/measured energy consumption on railways
	4.2.1	Estimated/Measured Energy Consumption on waterways
Transport emissions	1.3.2	Estimated /measured road transport emissions
	2.3.2	Estimated /measured rail transport emissions
	3.5.1	Estimated /measured air transport emissions in the vicinity of airports
	4.2.2	Estimated /measured Inland waterway transport emissions
Transport noise	1.3.3	Noise levels generated by road transport
	2.3.3	Noise levels generated by rail transport
	3.5.2	Noise levels generated by aircraft in the vicinity of airports
Investments and return on capital	1.4.1	Investment made in the development and maintenance of the road infra.
	1.4.2	Investment in road telematics (ITS infra.)
	2.4.1	Amount of investment made in the development and maintenance of the rail infrastructure
	3.2.1	Amount of investment made in the development and maintenance of the airports
	3.2.2	Amount of investment made in the development and maintenance of air traffic control
	3.3.2	Operating profit before interest and tax divided by total capital including debt
	4.3.1	Amount of investment made in the development and maintenance of the waterways

Domain	ref.	Definition
	5.2.1	Amount of investment made in the development and maintenance of the seaports
Interoperability	2.1.4	Current level of application of rail interoperability recommendations and standards (%) (track gauge, electric power supply, train safety)
Level of service	1.6.1	Passenger travel times road
	2.6.1	Passenger travel times rail
	3.6.1	Passenger travel times air
	5.6.1	Passenger travel times short-sea shipping
	2.6.2	Freight and passenger services frequency (including intermodal)
	2.6.3	Rail transport delays
	1.6.2	Direct passenger travel costs road
	2.6.4	Direct passenger travel costs rail
	5.6.2	Direct passenger travel costs short-sea shipping
Socio-economic	1.7.1	Inhabitants, Cohesion, Employment, Balance of payments, Public budget, Motorisation,Cars per inhabitant, Stock of vehicles, Registration of vehicles

ANNEX III. List of variables considered in ETIS

Freight service and costs data area	
Data Set	Variables
Nodes/Interchanges	Identification (wrt GIS database) Type of Interchange (road/rail, road/rail/sea etc) Operating Days/Times Operator Size (hA, quay metres, length of rail sidings) Commodities handled Equipment (e.g. cranes) Employees
Links	Identification (wrt GIS database) Length

Freight service and costs data area	
Data Set	Variables
	Capacity Gauge (e.g. rail)
Services	Schedule information (Frequency, node-to-node times) Equipment (vessels) deployed Frequency Operator Tax/subsidy Ports/terminals served
Vessels	Dimensions (e.g. length, beam, draft) Loading Units (e.g. bulk, containers, trailers, tractor + trailer combinations) Speed Gross weight Cargo capacity (e.g. tonnes, TEU) Operator Year of build Crewing Tax/subsidy Load factor

SOCIO-ECONOMIC VARIABLES
- Age by 5 year age class
- Purchase power - as Index across Europe or in Euro
- GDP for the 3 main sectors (industry, service, agriculture) in Euro
- GDP by other sectors:
- Employment rate (percentage of persons/inhabitants employed)
- Number of households
- Number of single housholds (households with just 1 person)
- Average household size (number of persons in the household)

- Motorization (number of cars in the region)
- Average net income in Euro
- Fuel prices for unleaded fuel and diesel
- Square meter price of land
- Number of emigrants
- Distribution of emigrants (emigrants listed in proportion to their original home country)
- Age by 5 year age class
- Purchase power - as Index across Europe or in Euro
- GDP for the 3 main sectors (industry, service, agriculture) in Euro
- GDP by other sectors:
- Employment rate (percentage of persons/inhabitants employed)
- Number of households
- Number of single housholds (households with just 1 person)
- Average household size (number of persons in the household)
- Average temperature in winter (degree Celcius)
- Average temperature in summer (degree Celcius)
- Seaside (region allows swimming/... at the sea, beach available)
- Mountain (region allows climbing/walking in the mountains)
- Ski (region allows winter sport, yes/no)
- Average snow level in cm
- Languages spoken (e.g. Luxembourg = FR, NL)
- Barrier-River (river is restricting access resp. a border of the region, yes/no)
- Barrier-Sea (sea is restricting access resp. a border of the region, yes/no)
- Barrier-Mountain (mountain is restricting access resp. a border of the region, yes/no)
- Vectorized cards for NUTS-3 borders
- Maximum hight above North Sea level in theregion in meter
- Minimum hight above North Sea level in the region in meter
- Schengen country (region signed the Schengen treatment)
- Administration (region is a center of administration, yes/no)

External effects data area	
Data Set	Variables
Emission/ consumption factors Road	Annual traffic amounts (vet-km per vet. Class Vehicle speed Road characteristics (type and gradient) Fleet composition for micro categories Temperature Average load Average trip length per vehicle class Average occupancy Fleet composition
Noise factors for reference traffic conditions Road	Hourly vehicle flows % of heavy vehicles % uphill gradient vehicle speed
Safety Road	Traffic amounts (vet-km) per macro – categories Average occupancy Population in urban and country areas Road types Risk factors, single or meeting accident urban or non-urban Statistical exposure values
Emission/ consumption factors Air	Annual traffic amounts for aircraft types and trip ranges Emission consumption factors per vehicle classes and operating conditions Characteristic operating condition distances for each section length
Noise factors for reference traffic conditions Air	Hourly traffic flows (LTO cycles) for 3 aircraft classes) LTO cycles operating conditions Noise factors
Safety Air	Annual traffic amounts (departures) for pass/freight flights Accident risk values per passenger and freight traffic

External effects data area	
Data Set	Variables
Emission/ consumption factors Rail	Annual traffic flows for 3 train categories Maximum and average speeds Weight/ seat or weight /freight Route characteristics (length, elevation changes, No of stops) Engine type for train categories Consumption factors Emission factors
Noise factors for reference traffic conditions Rail	Hourly traffic flows for disc braked and thread braked trains Train speed Split between diesel and electric locomotives Noise factors
Safety Rail	Annual traffic amounts (pass/freight trains-km) Pass-km and tonne-km Risks factors
Emission/ consumption factors Water	Annual traffic amounts (average working days for each ship/engine type and each operating mode) Fleet composition Gross tonnage Emission factors based on energy and fuel consumption % Load emission factors sulphur content
Safety Water	Annual traffic amounts (pass/freight ship-km) Pass-km and Tonne-km Pass ship km Freight ship-km Risk factors