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Executive Summary

HEAVEN (Healthier Environment through Abatement of Vehicle Emission and Noise) is a research project co-funded by the Information Society Technologies Programme of the European Union. In the project consortium, valuable expertise in the field of transport and environment of research institutes, the private sector (leading industry and supporting consultants), and the public sector is combined.

It is the high-level goal of the project to demonstrate a Decision Support System (DSS) which can evaluate the environmental effects (air quality and noise quality - both emissions and dispersion forecasting) of Transport Demand Management Strategies (TDMS) in large urban areas. The EU cities of Berlin, Leicester, Paris, Rome, and Rotterdam as well as the CEEC city of Prague serve as the demonstration sites of the project.

The demonstration in these cities provides a concrete sustainable development perspective and improves the quality of life in European cities by reducing transport-related noise and air pollutant emissions through the innovative combination of efficient TDMS and integrated environmental Information Society Technologies (IST).

Workpackage 8 is the demonstration phase of the HEAVEN project. Within this workpackage, the partner cities aim to work together to meet three key objectives: the demonstration of the DSS for evaluating the mobility related pollution in relation to implemented and planned TDMS; the demonstration of noise emission forecasting related to mobility strategies; aid national-local pollution strategies in compliance with EU directives on air pollution. This document details the planning and implementation associated with the demonstration phase in Prague.

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1 Introduction

1.1 Guide to the reader

This document is a comprehensive guide to the demonstration plan for Prague. It details how the objectives for WP8 will be met and the TDMS options that will be explored. The first chapter provides background information to the HEAVEN project and the context of workpackage 8 and the second chapter details the Prague system description. The third chapter provides information relevant to the demonstration site. The fourth chapter discusses the lessons learnt from workpackage 7 in terms of the verification results obtained and any necessary system modifications that need to be made. The fifth chapter sets out specific details of what will be involved in the implementation at Prague.

1.2 Objectives

The project objectives can be considered on varying scales - on a HEAVEN basis, on a workpackage basis and on a site basis and each of these will now be discussed briefly.

1.2.1 By project

The project's high-level goal is to demonstrate a decision support system (DSS) which can evaluate the environmental effects (air quality and noise quality - both emissions and dispersion forecasting) of Transportation Demand Management Strategies (TDMS) in large urban areas.

This goal has been translated into a concise set of high-level project objectives:

- Improve the basis for decision-making through integrated and real time information on key pollution factors;
- Inform key actors (including the public) on the state of air pollution levels;
- Identify the concrete benefits of these measures for sustainable urban development and the quality of life in cities;
- Draw conclusions for the implementation of local air action plans.

1.2.2 By workpackage

In WP8, the main objectives are as follows:

• To demonstrate the DSS for evaluating the mobility related pollution in relation to implemented and planned TDMS;

• To aid in the compliance with EU directives on air pollution, national-local pollution strategies.

1.2.3 By site

Prague wants to test new methodologies and systems for decision making to reduce transport related emissions to assist in achieving compliance with EU Directives on air quality pollution strategies. Air quality modelling, near real-time prediction and 24/48hr forecasting have already been developed. The integration of air quality and live traffic data is being further enhanced.

Key objectives of Prague within this project are:
· to assess a methodology for Local Authority response to the EU Directives on air quality;
· to assess the impact of traffic derived pollution on the production of air quality management plans;
· to assess TDMS with regard to their impacts for reducing traffic derived pollution;
· to improve information dissemination and consultation with the public in cross-boundary scenarios;

1.3 Project structure

The management structure of HEAVEN, as depicted in Figure 1 and Table 1, includes the following roles: The Steering Group is formed by executive level representatives of the principal contractors and is responsible for providing strategic guidance and in charge of steering of the project.

The Technical Management Committee is formed from all Local Site and Workpackage Managers and the Project Manager. The Committee meets regularly to review technical progress on overall and site level and identify needs for corrective actions; reports regularly to the Steering Committee via the Project Manager.

The Project Manager (STA) is the single contact point for the European Commission Project Officer and has overall responsibility for the day-to-day management and all regular reporting according to the contract (e.g. tri-monthly progress reports, Annual reports, Annual Review Report), representing the Co-ordinating Contractor The Project Manager has specific responsibility for administrative and financial management and quality control and assists the Steering Committee and prepares and follows up on its decisions. The project manager is in charge of the organisation of frequent partner meetings and discussion forums, as well as continual communication via email, fax and telephone conferences in order to ensure the necessary flow of information.

The Technical Manager (Heich Consult) is responsible for the day-to-day management of the project, co-ordination of the various tasks and work between the sites and WP Leaders according to an overall project workplan, organisation of frequent technical meetings and information exchange between sites and partners via e-mail, fax, in order to ensure the necessary flow of information. The Technical Manager's responsibilities encompass workpackage supervision, interfacing with workpackage leaders, and overall co-ordination of deliverable production. Additionally, the Technical Manager is in charge of co-ordinating the participation in programme level clustering and ensuring a high level of evaluation.

The Workpackage Leaders have the key task to co-ordinate activities on site and at project level for the duration of a workpackage, assist the Technical Manager during the active period of their workpackage and co-ordinate production of the deliverables of the workpackage.

The Local Site Managers co-ordinate all contributions to the project from their respective local partners (especially during the demonstration and exploitation phase). They are the single contact point for their sites towards the project consortium.

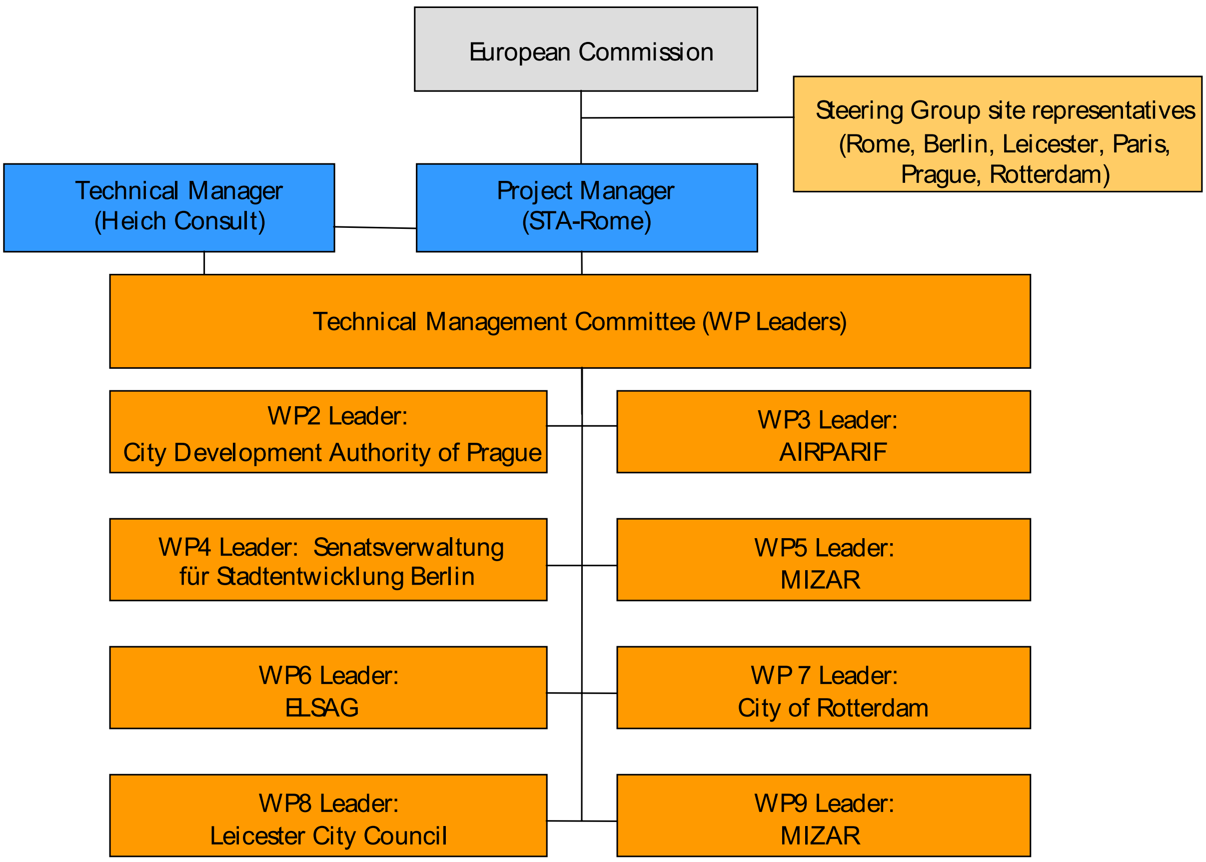


Figure 1: Management Structure of the HEAVEN Project

Table 1*:* Responsibilities per Site

	Rome	**Berlin**	**Paris**	**Rotterdam**	**Leicester**	**Prague**
Steering Committee Representative	Maurizio Tomassini, (STA)	Martin Lutz (SenStadt)	D. Gombert (Airparif)	Dr. Frank van Vliet	Nick Hodges	Maria Kazmukova
Local Project Manager	Fabio Nussio, (STA)	Rainer Voigt(IVU)	Fabrice Guilleux (Mercur)	Cleo Pouw	Nick Hodges	Maria Kazmukova
Local Evaluation Manager	Luca Persia, independent consultant	Harald Fietz (EA.UE)	Fabrice Guilleux (Mercur)	Peter van der Mede (GC)	Samantha Harris	Eliska Bradova
Local WP 2 Leader	Carlo Gentile, (STA)	Hanns-Uve Schwedler (EA.UE)	Bernard James (VdP)	Cleo Pouw	Nick Hodges	Petra Doleckova
Local WP 4 Leader	Claudio Baffioni, (STA)	Kai Tullius (IVU)	Gildas Baudez (CBC)	Cleo Pouw	Joanna Simpson	Martin Calek
Local WP 5 Leader	Carlo Di Taranto, (MIZAR)	Ingher Hoffnmann (IVU)	Gildas Baudez (CBC)	Tjongcho Wang	Nick Hodges	Jiri Ctyroky
Local WP 6 Leader	Andrea Teschioni (ELSAG)	Lutz Trostoff (IVU)	V. Moutal (DREIF)	Peter van der Mede (GC)	Nick Hodges	Jiri Ctyroky
Local WP 7 Leader	Michela De Palo (STA)	Gabi Zink (B+SU)	V. Moutal (DREIF)	Cleo Pouw	Samantha Harris	Jan Macoun
Local WP 8 Leader	Fabio Nussio (STA)	Bernd Milde (SenStadt)	Peter Rapp (CBC)	Leo Hermans (DCMR)	Nick Hodges	Jiri Lavic
Local WP 9 Leader	Carlo Di Taranto, (MIZAR)	Tilman Bracher (IVU)	D. Gombert (Airparif)	Menno Keuken (TNO)	Helen Jenkins	Maria Kazmukova
Technical Support	Hermann Heich, (HC)	N/a	N/a	N/a	N/a	N/a

1.4 Summary of WPs

1.4.1 WP1: Project Management

The project management consists of the continuous co-ordination and monitoring of the project's progress, paying attention both to end goals and interim goals. Because of the complexity of the project, the management will be divided into administrative management and technical co-ordination.

1.4.2 WP2: Dissemination

The goal is to disseminate the outcomes of the project and form consensus on the approach used in HEAVEN. The major milestones are an interim technical workshop and a final conference both to be organised at the European level. Contribution to Key events organised by the Commission and to European and World conferences dealing with the HEAVEN research will be ensured. The outcomes of the project will also be made available through a project website. The feasibility of organising a temporary web site for user group consultation and discussion will be examined.

1.4.3 WP3: Validation Co-ordination

WP3 will assist both the verification and the demonstration stages of the project. Firstly, a draft validation plan will be developed, in close co-operation with the local evaluation managers, who are responsible for performing the actual evaluation in WP7 and WP8. Secondly, the local evaluation work, both for the verification and the demonstration phase, will be guided through advice and direct assistance. Verification of systems will be done in WP7, evaluation of the demonstration's impacts in WP8. WP3 is responsible for co-ordinating the results from the verification and demonstration phases and for incorporating them into a Final Evaluation Report.

1.4.4 WP4: User Requirements and Implementation Framework

This WP focuses on a detailed analysis of the needs of the different DSS and Information system users: decision makers, system operators and end-users. The draft user requirements will form an input to WP5 for the design of the DSS and Information system and to WP3 for the preparation of the draft validation plan.

1.4.5 WP5: Functional Specifications/System architecture

WP5 will develop the specifications for DSS and Information systems on the basis of the requirements captured by WP4. The work will be performed in each site according to local particularities and constraints, and following a common and structured approach, which help to identify commonalties between sites. The underlying purpose of this work package is to design the functions and architectures suitable to support tasks presented above.

1.4.6 WP6: Build Integrated Systems

Starting from the functional architectures and the systems design provided by WP5 and based on the actual existing implementations, WP6 will identify the set of components and actions to be undertaken in order to grant the implementation of the DSS and Information System. WP6 will include the identification of the components required to fulfil the specifications provided by WP5; the selection, validation and improvement of the environmental models; and the detailed specification of the central Decision Support System (DSS).

1.4.7 WP7: System Verification

At first, the operating performance of the system will be assessed by focussing on indicators like number of breakdowns, log-files and speed of the system.

Secondly the acceptance by users interviewed in the context of WP3. Users will be asked if the system meets their requirements and if the information supplied is clear.

Thirdly, a user panel consisting of a small group of citizens will give its opinion on the information provided to the general public.

In this stage, some changes to be made to the systems before the large-scale demonstration within work package 8 can be indicated.

1.4.8 WP8: Large Scale Demonstration

The on-site implementation and real-life operation of the systems of both the DSS and the information platforms will occur in Workpackage 8. All the system component integration will also occur (traffic monitoring, environmental monitoring, emissions and dispersion models, etc.). The demonstration will reflect modifications made in response to the verification phase (WP7), both in terms of technical performance and in terms of the outputs (content and form). Additional minor adjustments will proceed during the demonstration period, according to the milestone schedule. Once the system is in operation, the DSS will be used to evaluate a host of TDMS strategies implemented and/or planned for the different sites, including road pricing initiatives, express roads, traffic calming measures, etc. During this stage, the evaluation of the system performance and impacts will occur.

1.4.9 WP9: Exploitation and Business Planning

This workpackage will assess the added value and the exploitation possibilities of the suite of HEAVEN end products, in particular the DSS for evaluating TDM strategies, the information integration platform, and any of the refined models incorporated into these end products. This workpackage will provide a detailed Exploitation and Business Plan for the industrial partners, identifying what market possibilities they identify for the developments completed in this project.

Figure 2 displays how each work package inter-relates with the others.

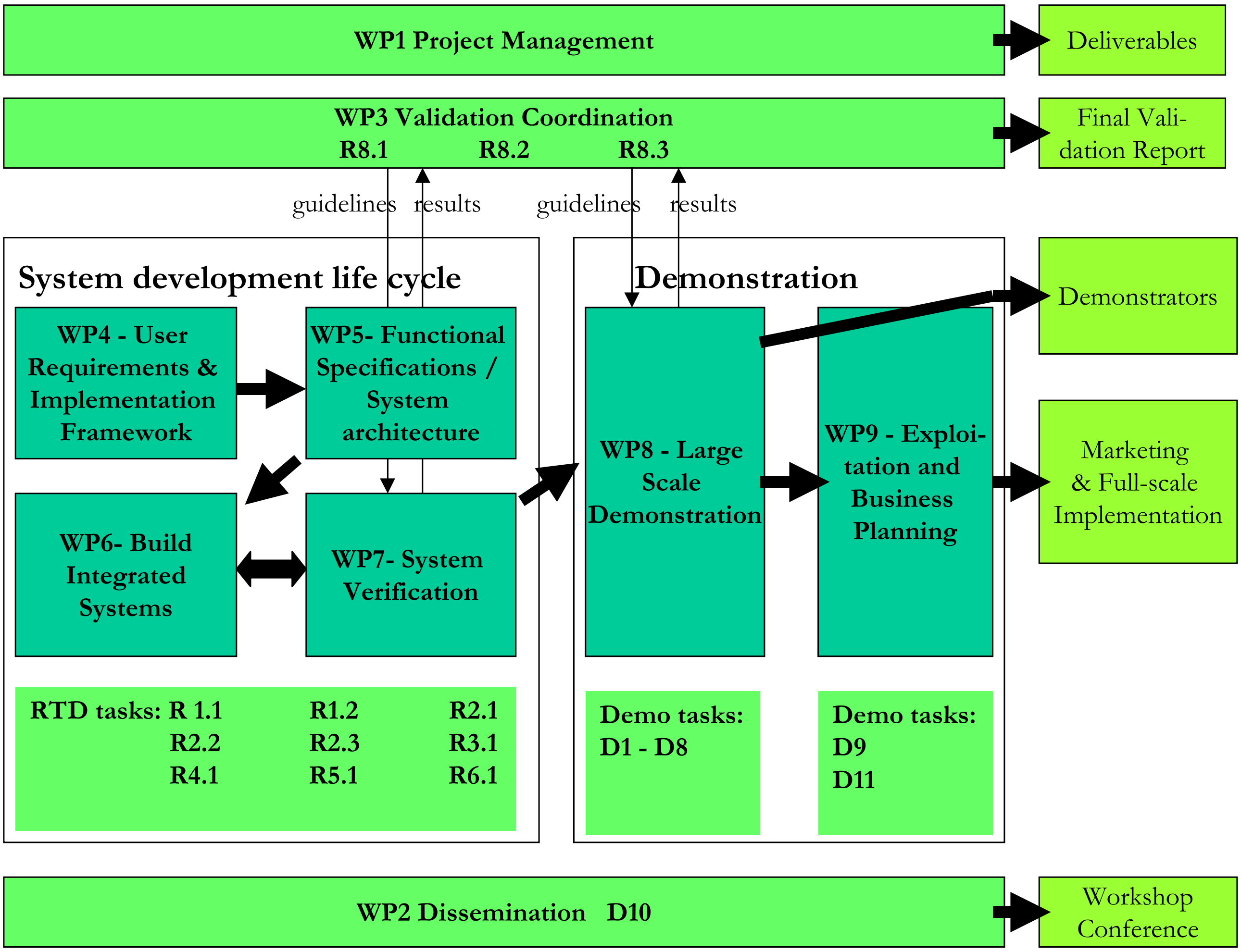


Figure 2: Interrelations between workpackages and RTD and demonstration tasks

1.5 HEAVEN System Concept

The HEAVEN DSS combines near real-time traffic flow information into emission models so as to analyse the contribution of mobile sources to air quality and noise. In order to estimate emissions based on current traffic levels and on planned demand management scenarios, the system can operate on-line, based on current traffic and environmental information, and off-line, based on planned traffic and environmental conditions and pre-defined TDMS.

The diagram in Figure 3 shows the dynamic data processing and modelling chain that supports the on-line operation of the system. The near real-time input information concerning traffic, air quality, noise and meteorological conditions is processed and archived for use during off-line operation.

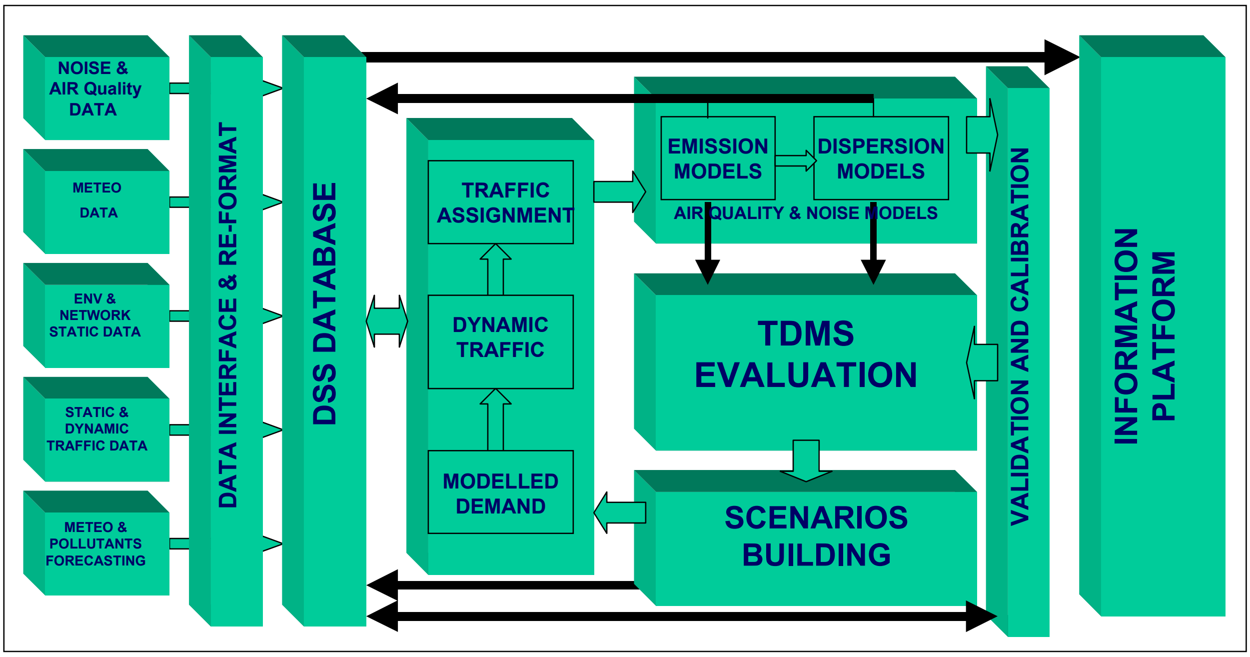


Figure 3: The dynamic Data Processing and Modelling Chain of the HEAVEN DSS

The main operational characteristics of the HEAVEN DSS emerge from the processes drawn in the diagram above.

i. Data exchange from external sources to the DSS models

The input data for the DSS come from several external sources:

- Near real-time dynamic Traffic, Air Quality, Noise and Meteorological data come from specific infrastructures and monitoring systems. Type of data, spatial and time resolution, accuracy, etc, depend on the features of the monitoring systems. The data exchange is performed on-line to ensure near real-time data processing.
- Static and infrequently updated data - such as data representing the traffic network, the land use, the built environment, statistics and forecasts concerning traffic, pollution and meteorological conditions, the model configuration parameters, etc – are provided by specialised institutions, bodies and data bases. This data exchange is performed off-line.

In general, specific interfaces are required to interact with the different data sources and to hide the possible complexity of the on-line connection with the monitoring systems. The storage of data in the HEAVEN data base is normally performed after manipulation, pre-processing and reformatting of raw data. Dynamic data are fed into the DSS modelling chain only after validation.

ii. Dynamic traffic data processing

- The (validated) dynamic traffic information is employed to update in near real-time the traffic status in the monitored network and to improve the traffic demand model. Traffic assignment in the whole network represents the last element of the traffic models chain.
- Also the output of the traffic models undergo validation procedures both to ensure consistency of the information for the subsequent models chain, and to contribute to the traffic models calibration and tuning.
- Near real-time and modelled traffic data are then fed into the environmental models for emissions estimation.
- Finally, the monitored traffic conditions contribute to the evaluation of the impact of the TDMS under analysis and constitutes one component of the TDMS application scenario.

iii. Dynamic Air Quality and Noise data processing

- The (validated) dynamic air quality, noise and meteo data are employed to compute the traffic related emissions in near real-time, and so to feed the pollutant dispersion estimation and the noise levels computation. Concentration of pollutants and noise levels are then computed for key points and areas in the network taking care of background dispersions possibly modelled through specific models.
- Also the output of the Air Quality and Noise models undergo validation procedures both to ensure consistency of the information produced, and to contribute to the environmental models calibration and tuning.
- Finally, modelled emissions and measured and modelled Air Quality and Noise levels are the main information for the evaluation of the impact of the TDMS under analysis.

iv. Information exchange between the DSS Data Base and the Information Platform

- All the input information and DSS model results are stored in the system data-base. The entire or a part of this set of information can be transferred to the Common Information Platform and disseminated according to user related access restrictions.
- Dissemination is performed through several format (tables, maps, etc)

v. Scenarios building

- Through the scenarios building, the operator can define the context for the off-line evaluation of new TDMS in the view of optimising the environmental impact of the traffic.
- Scenarios are also built by the system automatically by recording the contextual conditions where the TDMS is currently actuated.

vi. TDMS Evaluation

- The evaluation of the performance of a TDMS in the context of a planned or actual scenario is made through the comparison between the traffic, emissions, air quality and noise modelled output based on this scenario and the traffic, emissions, air quality and noise modelled output based on a reference situation.
- This process bases on automatic and manual procedures for data collection, selection and computation but the system operator plays a key role to set the operational conditions to perform the evaluation. The system operator steers the evaluation process through a specific Operator Interface.

These processes are asynchronous and each of them is driven by the frequency of the input information updating and by the expected updating frequency of the output.

The characteristics of the site DSS' reflect the general characteristics of the HEAVEN DSS, although duly customised according to the peculiarities of the site (availability and type of the data sources external to the system, models adopted, operational constraints, etc).

2 System Description in Prague

2.1 System Architecture

Whilst a common concept of the HEAVEN DSS exists, each site will have different variations to account for site specific details. The DSS will now be discussed in the context of Prague and the characteristics can be summarised as follows:

2.1.1 Operation and Function of the DSS

The input to the air quality models is dependent on the real-time traffic and meteorological conditions data capture. On-line modelling of air quality is achieved every hour. During the demonstration phase, the air quality modelling covers selected receptors on the main street network in Prague.

2.1.2 Data exchange from detectors/sensors and models

Data exchange is made on-line for the monitoring of meteorological conditions, background pollution, traffic and air quality. Manipulation, processing and reformatting of raw data are required to facilitate the data exchange between monitoring systems and models. Data from sensors is not only necessary as input to models but also for the validation of model output and assessment of changes in traffic and air quality resulting from TDMS actions. Data from the traffic control centre in Prague (SBH system) provides traffic flow values on a 15minute basis from approximately 120 detectors in the city. Weather data is taken from the meteorological measurement station and background pollution is taken from 14 measurements station in the outskirts of Prague.

2.1.3 On-line data exchange from air quality model and information receivers

Processing of model outputs into a format suitable for visual display is a key component of the HEAVEN system and an essential element of the dissemination process. Output from the air quality model updated every hour is presented to users to aid decision making. Software has been developed which allows the transfer of data.

2.1.4 Air quality modelling

The application for air quality modelling, result evaluation and data management in Prague is the Airviro modelling suite. In terms of modelling, the emission and dispersion modelling is provided by the system. The Airviro system contains emission, dispersion and diffusion modelling modules.

2.1.5 Traffic modelling

The traffic modelling within HEAVEN is based on a VISUM software platform. VISUM is the off-line model built on O/D matrix calculation and calibration with surveyed traffic.

The model is developed for scenario analysis and long-term forecasting, however, the results from VISUM will serve also as the input for on-line air quality forecasting.

The hourly traffic load variations for each day type will be modelled for the demonstration area and used as traffic input for air quality modelling. The air-quality nowcast will be based directly on measured traffic data.

2.1.6 Receiver interface

By providing a visual and conceptual dissemination of information, the operator finds it is easy to understand the characteristics of traffic and pollution distributions across the network along with their inter-relationships. This therefore aids problem solving and scenario management.

2.1.7 Information platform

The HEAVEN system will be disseminated through two websites, at the City of Prague and at the Czech Hydro-meteorological Institute website.

The HEAVEN website at the City of Prague will be an upgrade of the existing City of Prague website. The part of this site, PREMIS offers information on the existing on-line environmental situation at Prague. The detailed on-line information is provided to the professional users and city administration. The information for the public is verified through professional procedures before it is made available to the public, therefore avoiding any confusion and misunderstandings .

The same approach is applied at the website of the Czech Hydro-meteorological Institute.

The results of the user acceptance by professional users and by the general public contributed to the adjustments and unification of the contents and structures of both the HEAVEN websites. The data content, graphical presentation and layout have been unified so as to enable the same access routes to the information for all users.

2.2 Main actors and appraisal groups

The appraisal groups refer to those people that are affected by the impacts of the HEAVEN project applications. The advantages and disadvantages of the project will be evaluated by the opinions of the most relevant appraisal groups, who should reflect the main future market of the application. The predominant users of the HEAVEN system have been identified as:

- operators of the applications
- intermediate users of the application like providers of information, and
- end users of the applications.

These users have been identified and are listed as authorities (traffic and transport departments, environmental departments, health departments, and urban planning departments); decision makers in urban development, traffic/ transport, environment, and health; and public/interest groups (for example citizens, residents of “hot spot” areas, patient groups, NGOs, research institutions, chambers of commerce, public transport operators).

2.2.1 Identification of Users

- **Primary or direct system users:**

- Department of the Environment of the City of Prague:
- Executive body of the City Council responsible for air quality protection and environmental policy
- Department of Transportation of the City of Prague:
- Executive body of the City Council in the field of transportation. Responsible for traffic policy.
- Technical Administration of the Street Network
- Owner and technical administrator of the Traffic Control Centre, responsible for the implementation of traffic demand management policies
- Police of the Czech Republic at Prague
- Responsible for direct traffic control. Collects real-time traffic demand data. Its role in HEAVEN is essential due to its direct influence on traffic control.
- Institute of Hygiene, Prague

- **Secondary users –interested in the system application outcomes and system administrators:**

– City Development Authority (URM)
  Municipal town planning authority. Defines development strategies and policies and town planning principles. Creation and maintenance of the Master Plan is of major importance. URM is planning to create a HEAVEN transportation matrix database centre and environmental modelling centre for long-term planning assessment. It is assumed that a second Airviro system will be installed here. The VISUM model has been operated for traffic demand modelling (lately unified with UDI). URM is the HEAVEN DSS administrator for the 1st phase of the project.

– Czech Hydro-meteorological Institute (CHMU)
  Major Czech meteorological institute provides weather and air quality measurements, weather modelling and weather forecasting. In the institute, data is collected and analysed from meteorological measurement stations and Automated Immissions Monitoring stations. CHMU is planning to create a HEAVEN forecasting centre for Prague and install the Airviro programme, as well as being the DSS administrator for the 2nd phase of the project.

– Institute of Transportation Engineering of the City of Prague (UDI)

Collects traffic demand data, prepares control schemes for crossings and has recently begun traffic demand modelling (VISUM), namely for the traffic demand database.

- Institute of Municipal Informatics of the City of Prague (IMIP)
  Municipal data centre maintaining environmental digital data, the digital model of terrain and digital cadastral map of Prague. Also of major importance, is its role as a public information and municipal web dissemination centre.

3 Demonstration Site

The Prague DSS consists of two sub-systems: DSS for urban planning (offline) and DSS for on-line environmental modelling. The demonstration areas have been defined separately for each sub-system. For the DSS for urban planning, the demonstration (modelling) will be provided for the whole Prague area. However, the core application for Prague, from the point of view of technology and system architecture is the on-line DSS system. The demonstration area for the on-line DSS system is Holešovice, Prague 7.

3.1 Areas and maps

For the first phase of the HEAVEN project, the evaluation of the environmental impacts of different long-time traffic demand management strategies on air quality levels will be undertaken in the demonstration area. The second phase of the project will use part of the street network related to the demonstration area.

For the second phase, the area of Prague 7 - Holešovice has been chosen. The area represents an important traffic centre, located in the valley of the Vltava river with a high occurrence of inversions and poor conditions for pollution ventilation.

3.1.1 Description of demonstration area

The demonstration site is situated in the Holesovice's meander of the river Vltava (Figure 4), an area about 4.9km^2 (41,750 in.). The location in the bottom of the valley is renowned for bad ventilation and poor air quality. This area is considerably affected by traffic because it is crossed by a key road connection from the northern parts of Prague and a region to the south. The heaviest traffic loads are monitored, particularly at the streets Argentinská, U Výstaviště, Veletržní, Bubenská and Milady Horákové. Transit creates a major part of the traffic in the demonstration area. 26 junctions are equipped with traffic light signals, controller by SignalBau Huber and loops. All the controllers, as well as the loops are connected on-line to the Main Traffic Control Centre.

Requests regarding preference of public transport have been implemented into the controlling measures. Public transport operating in the area covers mainly tram lines and metro stations. Bus transportation is concentrated to the Nádraží Holešovice metro station, where both bus terminals for municipal transportation, as well as for regional routes are located. Nádraží Holešovice is also the main Prague railway station for international train transport.

The demonstration area of 5km^2 is highly developed with a ratio of the area covered by buildings and constructions of 84%. Recent plans state that the area is to be used as a residential area or area of mixed structure with some space for recreational activities, and for transportation and highly saturated communications with frequent congestion. There is also some land allocated for development. The future development will aim to create more job opportunities in place of the former railway station Bubny. The area will be directly influenced by the planned construction of the inner ring.

Figure 4: Map of Prague with the demonstration area

Recent figures show that about 40,000 inhabitants live in this demonstration area. The ambient air quality is influenced by poor ventilation conditions and high traffic volumes which have negative impacts on the health of the residents and those that work there.

The area of Holešovice is well equipped with TDMS technology (induction loops co-ordinated from the Traffic Control Centre, availability of P+R etc.) (Figure 5). The strategies for the priority of public transport (trams, buses) have already been implemented.

Figure 5: Demonstration area with junctions with traffic light signalisation

The automatic monitoring station and a manual measurement of air quality are situated close to the area. The main traffic management problems in the area are similar to problems at other parts of the centre of the city, i.e., overloaded communications, transit, main road crossing, etc. The area is also connected with the other means of transportation, as metro, buses and trains. There are possible solutions within a complex transportation system.

3.2 Monitoring and modeling

All of the models used in Prague have been previously completely described in D 6.1. A summary table of the modelling tools used in Prague is enclosed in Annex B. Other applicable information regarding monitoring and modelling will be discussed below.

3.2.1 Air pollution

3.2.1.1 Monitoring

The background pollution in Prague is monitored by the AIM (Automated Immissions Monitoring) system. The AIM system provides measurements across a network of 14 stations in Prague. Substances measured are SO_2, NO, NO_2, NO_X and PM_{10}. Selected stations also provide measurements of CO, O_3, benzene and toluene every hour.

The data from the AIM system is stored in the Airviro time series database and is used for calibration and serves as input for dispersion calculations for the enhancement of result quality.

Figure 6 represents the AIM network system in Prague. Table 2 details information on which pollutants are measured and what method is used for their measurement in Prague.

Source: ČHMÚ

Figure 6: Network of AIM system monitoring stations in Prague

Table 2: Air quality monitoring stations of AIM system in Prague

District	*Station*		*Measurement techniques*							
	Name of station	*Code of station*	SO_2	NO_x	PM_{10}	NO	NO_2	O_3	CO	BTX
Praha 1	nám. Republiky	771	UVFL	CHML	RADIO	CHLM	CHLM	UVABS	IRABS	
Praha 2	Riegrovy	772	UVFL	CHLM	RADIO	CHLM	CHLM			

	sady									
Praha 4	Braník	773	UVFL	CHLM	RADIO	CHLM	CHLM			
Praha 4	Libuš	774	UVFL	CHLM	RADIO	CHLM	CHLM	UVABS	IRABS	GCH-VOC
Praha 5	Smíchov	1459	UVLF	CHLM	RADIO	CHLM	CHLM	UVABS	IRABS	GCH-VOC
Praha 5	Mlynářka	775	UVFL	CHLM	RADIO	CHLM	CHLM		IRABS	
Praha 6	Santinka	776	UVFL	CHLM	RADIO	CHLM	CHLM			
Praha 6	Veleslavín	777	UVFL	CHLM	RADIO	CHLM	CHLM	UVABS		
Praha 7	Výstaviště	778	UVFL	CHLM	RADIO	CHLM	CHLM		IRABS	
Praha 8	Kobylisy	779	UVFL	CHLM	RADIO	CHLM	CHLM	UVABS		
Praha 8	Lyčkovo nám.	1300	UVFL	CHLM	RADIO	CHLM	CHLM			
Praha 9	Vysočany	780	UVFL	CHLM	RADIO	CHLM	CHLM	UVABS	IRABS	
Praha 10	Počernická	804	UVFL	CHLM	RADIO	CHLM	CHLM			
Praha 10	Vršovice	805	UVFL	CHLM	RADIO	CHLM	CHLM			

Measurement techniques
AAS - atomic absorption spectrometry
CHLM - chemiluminescence (NO_x, NO, NO_2)
CLM - coulometry
GCH-MS - gas chromatography - mass spectrometry - PAHs
GCH-VOC - gas chromatography - VOCs
GRV - gravimetry
IRABS - IR absorption spectrometry
RADIO - radiometry - beta ray absorption
TLAM - triethanolamine spectrophotometry
UVABS - UV absorption
UVFL - UV fluorescence
WGAE - spectrophotometry with TCM and fuchsin (West-Gaeke)
XRF - X-ray fluorescence

3.2.1.2 Emissions calculation

Emission data is stored in the Airviro system emission database (EDB). Emissions from both static and dynamic sources are calculated during dispersion calculations in Airviro by the dispersion module. That means that there is no independent emission calculation module providing the pure emission concentrations in the Prague DSS. All types of sources are calculated and appropriate emissions are calculated for each pixel in the model grid.

Emission sources are of four types:

- Point sources
- Area Sources
- Road (mobile) sources
- Grid layers

3.2.1.3 Point sources and area sources

Sources generating atmospheric pollutants are monitored on a nationwide scale, in the so-called Air Pollution Sources Register (the corresponding Czech acronym is REZZO). There are four categories of atmospheric pollution sources in the REZZO Register. The first three categories (REZZO 1 - 3) comprise of stationary sources, the fourth one contains mobile sources. Only data from REZZO 1 - 3 are used in the EDB (see Table 3). The conversion from the REZZO into the EDB is part of the human interface functionality. The database is maintained by CHMU and an update of the static EDB is intended yearly.

Table 3 : Categorization of air pollution sources

REZZO 1	large sources combustion processes with heat-generating capacity above 5 MW and very significant technologies
REZZO 2	medium sources combustion processes with heat-generating capacity 0,2 - 5 MW and significant technologies
REZZO 3	small sources combustion processes with heat-generating capacity under 0,2 MW and less significant technologies

Point source data is taken from REZZO 1 and REZZO 2.
Area source data is taken from REZZO 3. Several more vast REZZO 2 sources are also used. The area sources are used for description of spatial patches of specific homogeneous distribution and regime of exhaustion. Usually, a residential zone contains a large amount of low-powered chimneys, university areas and hospitals without a central stack, etc.

3.2.1.4 Road sources

The emissions from road sources are assumed to be evenly distributed along a line at a height of two metres above the ground. The description of road sources has been shown above.

The road sources are used to describe traffic emissions, consequently traffic intensity will be the quantitative measure for each individual road source. All roads must be linked to a road type, which consists of tables describing the composition of the traffic intensity throughout the year and over the day. All time variations are normalised in order to ensure that the yearly average traffic intensity is as specified.

3.2.1.5 Grid layers

Grid layers are used to describe background emission levels or to generalise many small emission sources. Several grid layers can be specified. A grid layer consists of some common information and information that is contrary for different grid boxes. An emission is described in the same way as for area sources except that fuel definition cannot be used. The emissions from a grid layer are assumed to be evenly distributed over a grid at a height of two metres above the ground

3.2.1.6 Summary of air pollution including exceedances, etc

Over the last decade, remarkable progress has been achieved in controlling air pollution in Prague. Winter smog has become a phenomenon of the past. The most tangible progress has taken place in industry, small business and combustion, due to more stringent emission limit values in legislation. Despite tightened emission standards for vehicles and requirements for cleaner fuels, pollution from traffic has become more predominant.

The paragraphs below give a summary assessment of the air quality in Prague.

Sulphur dioxide (SO_2)

- no problem anymore

The sulphur dioxide situation in Prague during 2000 can be seen from maps of the fields of annual arithmetic means and 95th percentiles of sulphur dioxide concentrations presenting values measured at the stations.

The air pollution with SO_2 is significantly below the limit values. Annual arithmetic mean of SO_2 concentrations are around 10 µg.m^{-3} at any of the AIM stations, i.e. they are below one fourth of the limit value. The highest daily concentrations do not reach the limit values at any of the AIM stations. The trend of significant decrease of SO_2 is expected to continue.

Suspended Particulate Matter

- severe problem – excess of Czech day/year limit value (60/150 $\mu g.m^{-3}$). (significant excess of the EU-limit value for 2005, widespread excess of the EU-limit value for 2010)

One part of the centre of Prague belongs to one of the most affected areas in the Czech Republic. On the other hand the remaining parts of Prague, and namely the uptown ones, record relatively low levels (below one half of the annual limit value). The locations where the annual limit is significantly exceeded are generally situated in highly exposed localities where there is a direct impact of traffic. The daily limit values of PM_{10} fraction were exceeded in more than 35 cases per year at the AIM Station Vršovice (station code 805). The SPM air pollution in Prague is comparable with that of the previous year. Certain AIM stations record a slight increase in PM_{10} concentrations.

Nitrogen Oxides

- serious problem - excess of day limit value. Day limit value 100 $\mu g.m^{-3}$ must not be exceeded in more than 5 % of measurements annually.

The City of Prague, in particular the city centre, reported the highest values of NO_x in the Czech Republic in recent years, as a result of the ever growing traffic density. The city centre recorded higher NO_x concentrations than the outskirts also due to the higher share of densely built-up areas and poor ventilation.

Ground-level ozone

- serious problem – significant excess of the EU-limit value for 2010 (120 $\mu g.m^{-3}$ max. daily 8h moving average)

Ground-level ozone has been observed in the AIM monitoring network since 1992. In 2000, a total of five monitoring stations were in operation in Prague: nám. Republiky (s.c. 771); Libuš (s.c. 774); Veleslavín (s.c. 773); Kobylisy (s.c. 779); and Vysočany (s.c. 780). In December 2000 the new ozone measuring instrumentation was installed at the Station Smíchov (s.c. 1459). The valid 8-hour limit value for ozone 160 $\mu g.m^{-3}$ is exceeded at all of the monitoring stations.

Carbon monoxide

- Problem – excess of Czech day/half-hour limit value (5000/10000 $\mu g.m^{-3}$).

Carbon monoxide is measured at ten AIM stations. The ground-level concentration of CO limit values lawful for the Czech Republic are established as the 24-hour ground-level concentration limit (IH_d) of 5,000 $\mu g.m^{-3}$, and the half-hour ground-level concentration limit limit (IH_k) of 10,000 $\mu g.m^{-3}$. The daily limit value IH_d is exceeded at two stations of the Public Health Service.

In 2000, the IH_k limit value was exceeded at four Prague stations. The highest frequency when the limit was exceeded was recorded at the Public Health Service Station Svornosti, Prague 5 (absolute 1112 cases, relative 6.70 %). In every limit exceedance case, the values were measured at Public Health Service Stations in Prague.

The high relative frequencies of cases when IH_d was exceeded result from the location of the stations and the direct impact of traffic emissions on the stations. The high relative frequencies of cases when IH_d and IH_k of CO was exceeded also correspond with those of NO_x and SPM at the same stations.

Aromatic hydrocarbons

With the increasing intensity of automotive transport, the monitoring of aromatic hydrocarbons has becoming more important. The decisive source of airborne emissions of aromatic hydrocarbons – and namely benzene and its alkyl derivatives – are above all flue gases from petrol motor vehicles. Another source is the losses due to evaporation at handling, storage, and distribution of petrol types. Mobile pollution sources emissions account for approx. 85% of the total aromatic hydrocarbons emissions, while the prevailing portion goes to flue gas emissions. It is estimated that the remaining 15% of emissions come from stationary pollution sources while the major portion comes from processes producing aromatic hydrocarbons and processes where such compounds are used for the manufacturing of other chemicals. The monitoring data shows that aromatic hydrocarbons represent 20–40% of the total amount of non-methane hydrocarbon emissions in the air of European cities.

The aromatic hydrocarbons, namely benzene, toluene, o-, m- and p-xylenes, and ethylbenzene, are measured at seven stations in Prague, but only two of them are AIM stations (Libuš station, s.c. 774 and Smíchov station, s.c. 1459). Both of them use gas chromatography for measurements. The other five stations are managed by the Public Health Service. Their measurement technique consists of 24-hour sample collection into special sampling canisters once every six days. The comparison of the weekly and diurnal courses of benzene concentrations at the above localities demonstrates the prevailing share of mobile sources emissions. Simultaneously it demonstrates the difference in traffic regimes on working days and at weekends.

3.2.2 Traffic

In Prague, traffic is monitored by the traffic control centre. This Management Centre collects online traffic data and provides other relevant information on transport such as CCTV and P+R data. The “Urban Road Traffic Control System” will continue to be implemented in 2001. The main traffic control centre (TCC) is installed in the building of Public Transport Central Control (Centrální dispečink MHD) in Na Bojišti street. It is administered by Prague Road and Street Authority (TSK hl. m. Prahy) and operated by Police of the

Czech Republic (Správa hl. m. Prahy). TSD control systems VRS, MIGRA and ADT as well as the tunnel control KERBERUS are in operation in the control centre.

27 TSDs from area 1 - Holešovice have been connected to the VRS 2100 control since the end of 2000 while in 2001 additional 14 TSDs from area 5 - Centre have been added. Currently, time-dependant signal plan selection is used; traffic-responsive control is prepared. All new signals have traffic-actuated control based on vehicle, pedestrian and tram demands. Data can be collected and archived from traffic detectors.

The MIGRA regional control serves the area 3 - Smíchov. Currently, 20 traffic signal junctions are controlled, with additional 18 TSDs considered to be integrated. So far, the traffic is controlled by time-dependant signal plan selection.

The ADT control processes 69 TSDs. Specifically, 51 of them are located in the city centre. Its control is performed by extending phases of the so-called structural signal plan by means of stopping points. Additional 18 TSDs comprise a co-ordinated group along the Evropská street.

The main traffic control centre is also responsible for the traffic control in the Strahov and the Těšnov tunnels.

The main traffic control centre also provides a TV monitoring of critical spots on the road network via rotary or stationary TV cameras. There are 76 cameras throughout the Prague network.

Also the P+R (Park and Ride) system on the western side of the city has been included in the main control centre network. The car-parking information system shows the number of vacancies available. One of the P+R sites is situated in the demonstration area.

Variable-message information boards (VMS) have been installed in several localities of the city (5 VMS are installed near the demonstration area Holesovice). These texts inform drivers of important current traffic changes in the area (congestion, accidents, traffic situation). Data and information are transmitted via the wire network of TSK.

The data from VRS 2100 (SBH system) is integrated into the Airviro time series database. Each loop represents the measurement station. The assignment of loop data to a particular road link is made using a simple cross-reference table. The calculated value of traffic load for each segment is then used for updating the value in the Airviro emission road database.

4 Outcomes from WP7

4.1 Actions to be taken after verification, Prague

- Indicator 2: Accuracy of roadside description, air models

The implementation of an upgraded street canyon model is needed for the verification of indicator 2. As soon as this upgraded street canyon model is transferred from Leicester and integrated into the Airviro AQ modelling system in Prague the indicator will be tested. Due to the organisational and financial restrictions the indicator will be tested outside of the demonstration area using a site where air quality monitoring equipment is available .

One of the criterion for the selection of the site will be the organisational and financial possibilities of monitoring equipment and its availability.

- Indicator 4: Testing processes of DSS interfaces

Both of the Prague DSS sub-systems: DSS for urban planning (offline) and DSS for on-line environmental modelling have been subject to the verification process.

The verification for urban planning (offline) will be tested again for a selected hot-spot area of Prague during the demonstration period.

The verification of the DSS for on-line environmental modelling has been carried out with a sample of on-line traffic data.

The on-line environmental modelling will be tested again with the on-line traffic data, as soon as the agreement on real time data transmission between the Traffic Control Centre and the Czech Hydro-meteorological Institute is reached.

- Indicator 5: Testing DSS modelling and forecast processes

The meteorological mast data are satisfactory substituted by data generated by a mathematical model.

The process of the selection of the location of the meteorological mast has been successfully completed.

The financial requirements will be agreed between the City Hall of Prague and CHMI.

Legislative agreement between the Department of Environment of the City Hall of Prague and Czech Hydro-meteorological Institute on the location, installation and data transfer of the meteorological station is envisaged for 2002-2003.

Indicator 6: Testing DSS operator interface and scenario definition process

This indicator has been tested with a sample of traffic data from the Traffic Control Database.

The on-line transmission of traffic data to DSS scenarios is technically completed.

However, the legislative and financial agreements between the Traffic Control Centre, the Czech Hydro-meteorological Institute and URM – City Development Authority are under process. As soon as the agreement on data transfer is reached, the DSS operator interface and scenario definition process will be verified again in a real on-line situation during the demonstration period.

- Indicator 7: Testing the functioning of the main system components and their interaction

The verification of the main system components and their interaction will be repeated during the demonstration period for both the sub-systems separately.

The criteria and time for regular testing of both sub-systems will be set according to the results of the verification and demonstration process.

- Indicator 8: User acceptance by professional users
- Indicator 9: User acceptance by the general public

Both the HEAVEN websites at the City of Prague and at CHMI have to be defined in a similar way and provide as many common user-friendly features as possible.

The upgraded websites will use the existing infrastructure in a more user friendly way as determined by the opinions of professional and public users.

At this stage the information on users opinions and the specification for the new websites are still open especially regarding the maps which will be incorporated into the websites.

4.2 Contingency/backup arrangements for supporting DSS output

The Airviro system is used for air quality modelling in Prague. If the Airviro system is unavailable then the ATEM model should be used in its place, but not for on-line air pollution modelling. The ATEM model should be used only for urban planning.

The online Airviro air quality modelling is dependant on the near real time traffic data from the Traffic Control Centre (from system SBH). This data allows the dynamic emissions from the road sources to be included in the concentration calculations.

If this near real time data is not available, then the hourly traffic loads are calculated from annual traffic measurements and daily and weekly variations of traffic flow in the historic emissions database, which will then only include static emissions from the road sources.

If meteorological data is unavailable for input into the Airviro system, then it is possible to manually select the appropriate weather conditions from the historic database.

The images with modelled air pollution will be manually accessible through the information platform even if there are problems, however only the most recent image and an accompanying statement supporting this fact will be available to the public through the website.

5 Implementation of RTD/Demonstrations on the Site

5.1 Detailed description of WP8

The common themes of workpackage 8 will now be discussed.

Task 1: Upgrade System

Based upon the results of the WP7 (Final Demonstration Specifications), the DSS demonstrators will be implemented having selected: the time (operational, short, medium and long term levels), spatial (area selected), and the TDMS scenarios to be evaluated.

Task 2: Conduct Site Demonstration

All sites will integrate real-time traffic and environment data with air quality modelling and demonstrate a decision support system for assessing, (for a range of pollutants over short, medium and long term horizons), the environmental impacts of a variety of traffic demand management strategies (TDMS).

In the creation of each site's DSS, the system architecture will be applied. Once the system is implemented, it will be possible to evaluate different TDMS scenarios, both planned and actual. This evaluation for planned TDMS will involve the modification of the input transportation data to identify how environmental indicators will change. Selected TDMS will be demonstrated.

The site-specific characteristics are described in detail by Annex A.

An information platform for real-time interoperable information on air quality and traffic flow will be provided.

The following demonstration objectives will be covered in this task: D2, D3, D4, D5.

Task 3: Evaluation of Demonstration Phase

Establish the extent to which the HEAVEN applications have improved air pollution and provide (limited) indication of likely health impacts.

The following demonstration objectives will be covered in this task: D7, and D8.

Table 4: High-level objectives and how they relate to RTD and demonstration goals of HEAVEN

High-level objectives	Overview of operational goals related to demonstration	Summary of operational goals related to RTD
Improve the basis for decision-making through integrated and real time information on key pollution factors.	D1: Demonstrate new monitoring technologies. *[To extend the existing monitoring infrastructure, i.e. extending the number of stations/ measuring more pollutants, e.g. PM10, PM2.5, benzene]**	R1.1:. Use DOAS-based measurements for validating and refining air models, and verification of the DOAS system
		R1.2: Develop online connections (interfaces & methods) between environmental monitoring networks and model suites.
	D2: Validate the improvements in forecasting quality of new air quality model	R2.1: Develop methods and interfaces for linking real-time traffic databases to the environmental modelling process.
		R2.2: Select and calibrate emissions, dispersion models.
		R2.3: Modify individual models and to adapt the overall modelling process.
	D3: Provide contents, operate and demonstrate the benefits of a comprehensive decision support system.	R3.1: Develop an integrated decision support system to evaluate mobility related emissions of TDMS
Inform key actors (including the public) on the state of air pollution levels and their effects on health.	D4: Implement an information platform on air pollution (and health-related information)	R4.1: Develop an integrated information platform on ambient air quality
	D5: Involve citizens in consultation processes and to raise their awareness on the effects of mobility decisions	R5.1: Develop models for local awareness raising & public consultation.
Identify the concrete benefits of these measures for sustainable urban development and the quality of life in cities.	D7: Evaluate the environmental effects of the demonstrations in the project.	
	D8: Analyse the socio-economic benefits and user impacts of the demonstrations in the project	R8.1: Develop a common validation plan for all project sites.
		R8.2: Further develop impact assessment methodologies (air and socio-economic impacts)
Generate commercial value out of the project.	D9: Commercially exploit the project end products.	N/A
Draw conclusions for the implementation of local air action plans.	D10: Identify best practice solutions and disseminate widely to other urban actors.	N/A

The list of operational goals related to demonstration that were derived from the high level objectives of the HEAVEN project will not necessarily apply to each site and Table 5 illustrates the different areas that the cities will be involved in during the demonstration phase.

Table 5: Operational goals for the demonstration phase for each site

	Demonstration site (code)					
Research/demonstration tasks	S1	S2	S3	S4	S5	S6
D.1 Demonstrate new monitoring technologies		x				
D.2 Validate the improvements in forecasting quality of new air and noise quality models	x	x	x	x	x	X
D.3 Provide content, operate and demonstrate the benefits of a comprehensive decision support system	x	x	x	x	x	X
D4 Implement an information platform on air and noise pollution		x	x	x	x	X
D5 Involve citizens in consultation processes and to raise their awareness on the effects of mobility decisions		x	x	x	x	X
D6 Provide valid data for health authorities		x			x	
D7 Evaluate the environmental effects of the demonstrations in the project	x	x	x	x	x	X
D8 Analyse the socio-economic benefits and user impacts of the demonstration work in the project.	x	x	x	x	x	X

Site Key:
S1= ROME, S2=ROTTERDAM, S3=BERLIN, S4=PARIS, S5=LEICESTER, S6=PRAGUE

5.2 Implementation in Prague

The HEAVEN project in Prague is focused on the enhancement of the existing system architecture, and the following diagram (Figure 7) highlights the areas of the Prague system that will be altered as a result of the implementation of the operational goals related to RTD and demonstration.

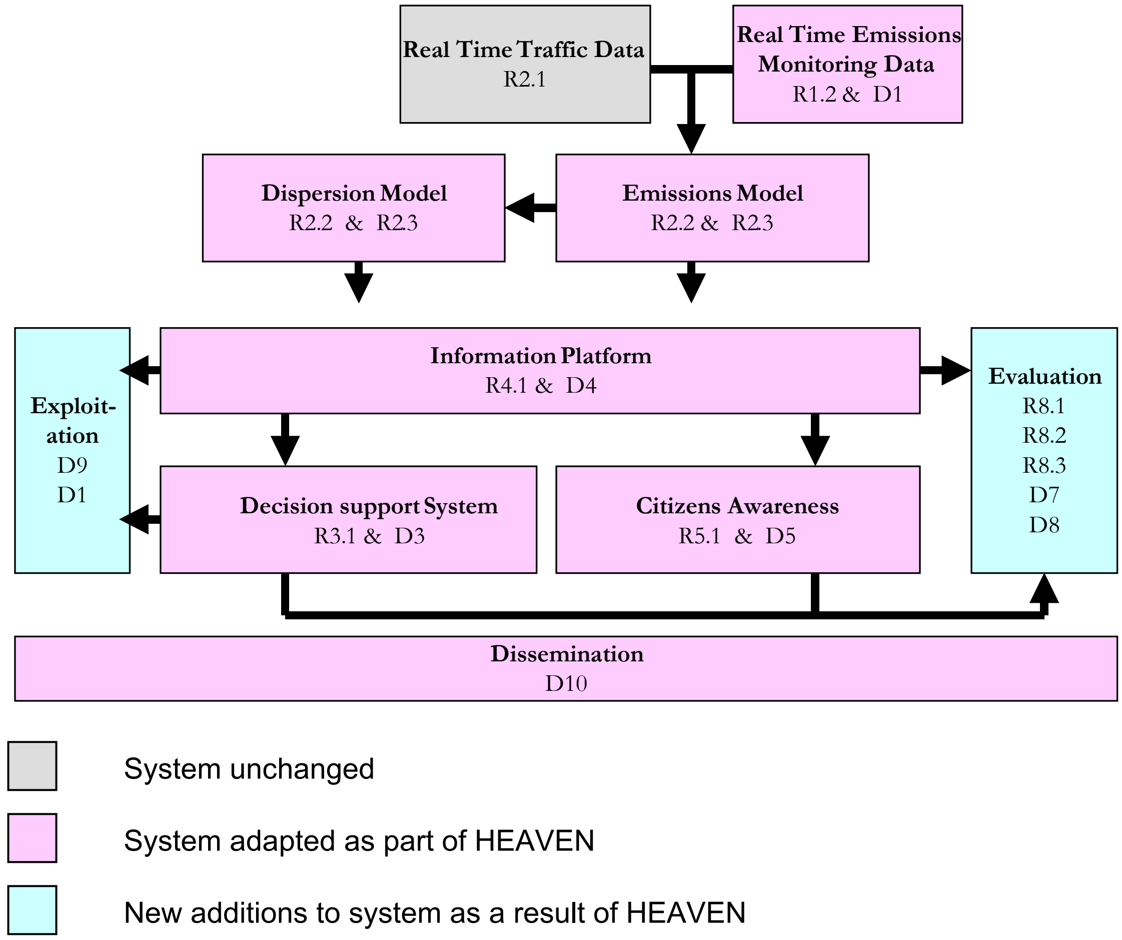


Figure 7: HEAVEN System Concept Tasks for Development & Demonstration

5.2.1 D2 – Validate the improvements in quality of new air quality models

Until HEAVEN, only average pollutants values could be calculated in an offline mode. Traffic data, which is the major input source, was provided each year and reflects average traffic values per day. Now the TCC (Traffic Control Centre) provides near real time traffic loads data from the selected area. The new enhanced model for emission and dispersion calculations – the Airviro system - can now calculate hourly emission and roadside pollution values for air pollutants.

5.2.2 D3 - Provide contents, operate and demonstrate the benefits of a comprehensive DSS

The developing DSS in Prague is focused on the assessment of ambient air quality levels in relation to traffic levels. The system is based on three pillars: the traffic and environmental monitoring, the sophisticated traffic and environmental modelling and the advanced data and informational platform. Whilst the roles of both the monitoring and information systems are seen mainly in the enhancement of existing data integration and data exchange, the substantial improvement of the modelling system is the main objective of HEAVEN at the Prague site. The development of the modelling system will be mainly based on the air quality dispersion model Airviro.
The new measures and scenarios for traffic control during elevated air quality periods will be developed and tested for efficiency through the use of the environmental modelling functions.

The main objectives of HEAVEN in Prague are as follows:

- to provide an environmentally oriented decision support system for city planning
- to provide an environmentally oriented decision support system for traffic management
- to provide traffic demand modelling based on local development plan data
- to provide environmental modelling based on traffic emission data, air pollution dispersion models
- to use and enhance the existing real-time traffic, air quality and meteorological measurements as an input for environmental modelling
- to develop flexible and reliable information links between data providers, the modelling centre and recipients
- to develop the historical environmental and traffic database, accessible by the DSS users
- to develop the flexible and easy-to-use interface that will provide the DSS outputs.

The demonstrator being implemented in Prague is based on the functional integration of Prague Traffic Control Centre, traffic network monitoring system (SBH), environmental monitoring system (AIM) and information system (PREMIS). Consequently, the DSS concept encompasses both functions properly connected to the decision support and decision processes and functions intimately related to network monitoring, environment monitoring and user information systems.
The system architecture described for Prague meets the general concept of the DSS described above. The variations naturally flow from the specific technical solutions already in operation.

5.2.3 D4 - Implement an information platform on air pollution

The on-line environmental characteristics and the air quality model outputs will be available at the: www.premis.cz website in the future (see Figure 8). The city administration will be equipped with the on-line outputs from the traffic monitoring system. Information meetings were organised for the experts and professional users.

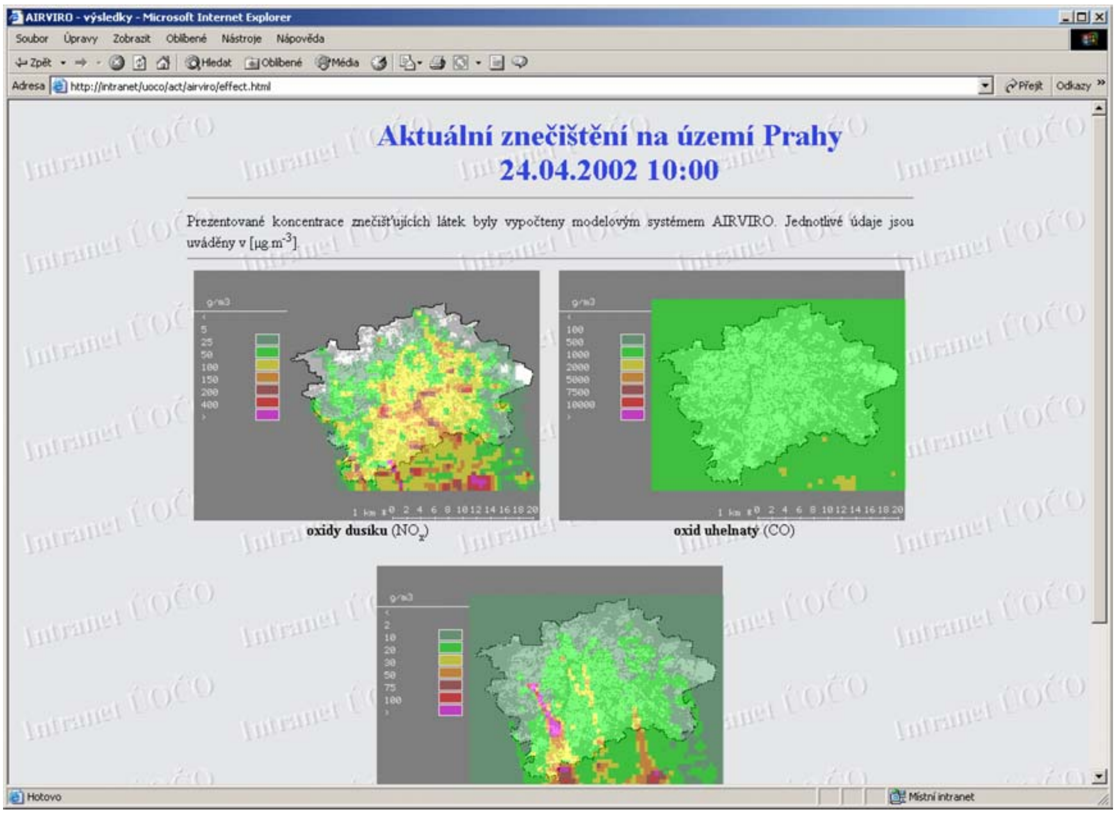


Figure 8: Prague information platform

5.2.4 D5 - Involve citizens in consultation processes and to raise their awareness on the effects of mobility decisions

From the beginning of the project, professional users and the public were involved in the development process of the HEAVEN DSS. This was done in different workshops during the user needs analysis and during the verification phase. The input given by the users in these workshops was taken into account when the final version for the demonstration phase was developed. The consultation process with the users will continue during demonstration.

5.2.5 D7 - Evaluate the environmental effects of the demonstrations in the project

The demonstration phase will run in parallel with the evaluation period. The Local Evaluation Plan has specified the common indicators to be applied in Prague as taken from the Final Evaluation Plan and adjusted them to allow for any local issues. The indicators that will be measured in Prague can be seen in Table 6.

The detailed plan of evaluation contains WP3.

Table 6: Evaluation by Indicator

Ind. Nr.	Indicator
Impact 1 : Enhanced Description of Current Environmental Situation	
1.1	Increased coverage of the traffic and roadside pollution network
1.2	Increased grid resolution
1.3	Accuracy of roadside description
1.4	Increased frequency of update intervals regarding air quality
1.5	Increased efficiency of air quality description
1.6	Increased frequency of update intervals regarding noise pollution
1.7	Increased efficiency of noise pollution description
1.8	Noise roadside emission : Length of network
Impact 2 : Enhanced Environmental Scenario Analysis	
2.1	Increased coverage of the traffic and roadside pollution network
2.2	Increased grid resolution used in modelling
2.3	Reduced time to produce environmental descriptions regarding air quality based on scenario analysis
2.4	Reduced time to produce environmental descriptions regarding noise pollution based on scenario analysis
Impact 3A : Improved Access and Quality of Environmental Information for Professional Users	
3A.1	Improved time resolution
3A.2	Reduced delivery time
3A.3	Increase in usefulness (interviews)
3A.4	Increased efficiency of daily/ weekly bulletin
Impact 3B : Improved Access and Quality of Environmental Information for Public Users	
3B.1	Improved time resolution
3B.2	Reduced delivery time
3B.3	Increase in usefulness (questionnaires)
3B.4	Increased efficiency of daily/ weekly bulletin

Ind. Nr.	Indicator
Impact 4 : Improved Institutional Co-operation	
4.1	Increased quality of co-operation (interviews)
4.2	Increase in time-efficiency of information exchange
Impact 5 : Increased Support of Urban Planning on an Environmental Basis	
5.1	Amount of data entered in common repository including quality of data structure and storage
5.2	Increased usefulness for urban planning

5.2.6 D8 – Analyse the socio-economic benefits and user impacts of the demonstration work in the project

The analysis of the socio economic effects is part of WP3 and will be reported in the evaluation report.

5.3 TDMS/Scenario modelling

The project aims to develop an integrated system to assess the environmental effects of TDM strategies in urban areas. The mitigation of vehicle related environmental issues through TDM strategies has been on the agenda of European cities for many years. The cities involved in the HEAVEN project are considering a wide variety of such measures and have already gained extensive experience in the implementation of such measures. It is not always easy to implement measures that potentially have positive effects on the environment because of political, legal and financial constraints. By means of the HEAVEN system it will be possible to assess the environmental effects of TDM strategies on the basis of scenario calculations without having the TMD strategies actually implemented. The results of such scenario calculations will serve as an excellent basis for decision making at city and regional levels. The TDM strategies under consideration comprise a wide range of measures including severe ones for traffic restrictions. The effect on the environment resulting from a certain TDM strategy will depend strongly on the nature of the strategy and the scope of the implementation. Since it is an objective of HEAVEN to develop a system to quantify the environmental impacts of TDM strategies, several measures will be selected and assessed in the framework of the demonstration phase of the HEAVEN project.

5.3.1 Sensitivity Tests

Within the HEAVEN project, two sets of scenarios will be implemented. The first set are common to all the cities and are termed the five sensitivity tests. These are listed in Table 7.

Table 7: Sensitivity tests to be modelled by all partner cities in the HEAVEN project.

No.	Scenario Description
1.	20%flat reduction of vehicle speed
2.	100%-0% reduction of Heavy Goods Vehicles (over 3.5 tonnes) without compensation
3.	100%-0% reduction of traffic
4.	100% of vehicles fulfil Euro5 emission standards

5.3.2 Site Specific Scenarios

The description of plans for site specific scenarios is in the Table 8.

Table 8: Scenario description

No.	Scenario Description
1.	Variants of the Master Plan, ring road of the city of Prague
2.	Closing of the Nuselsky bridge

In the first scenario two variants of the Master Plan will be compared (scenario J – Figure 9 and scenario SS –Figure 10):

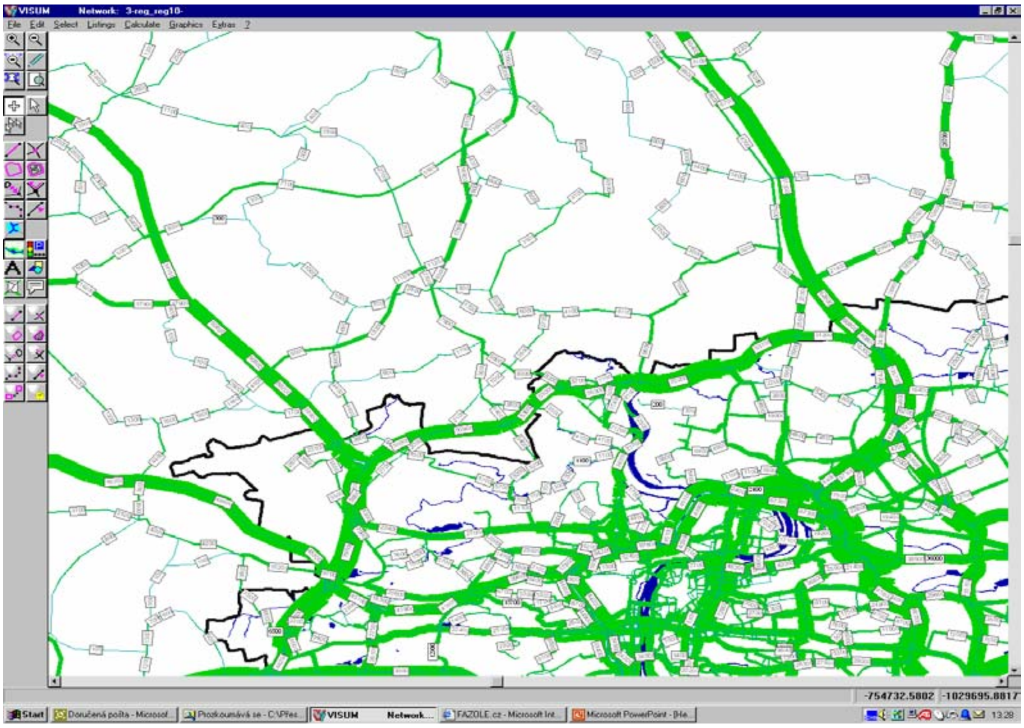


Figure 9: Scenario J

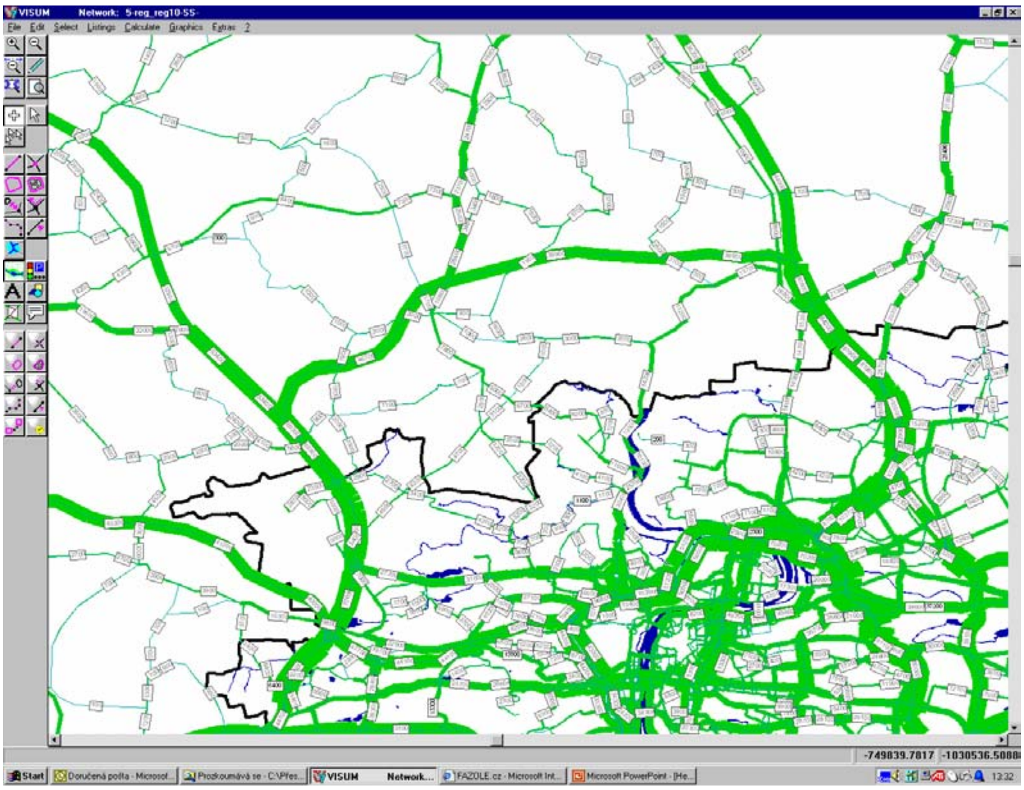


Figure 10: Scenario SS

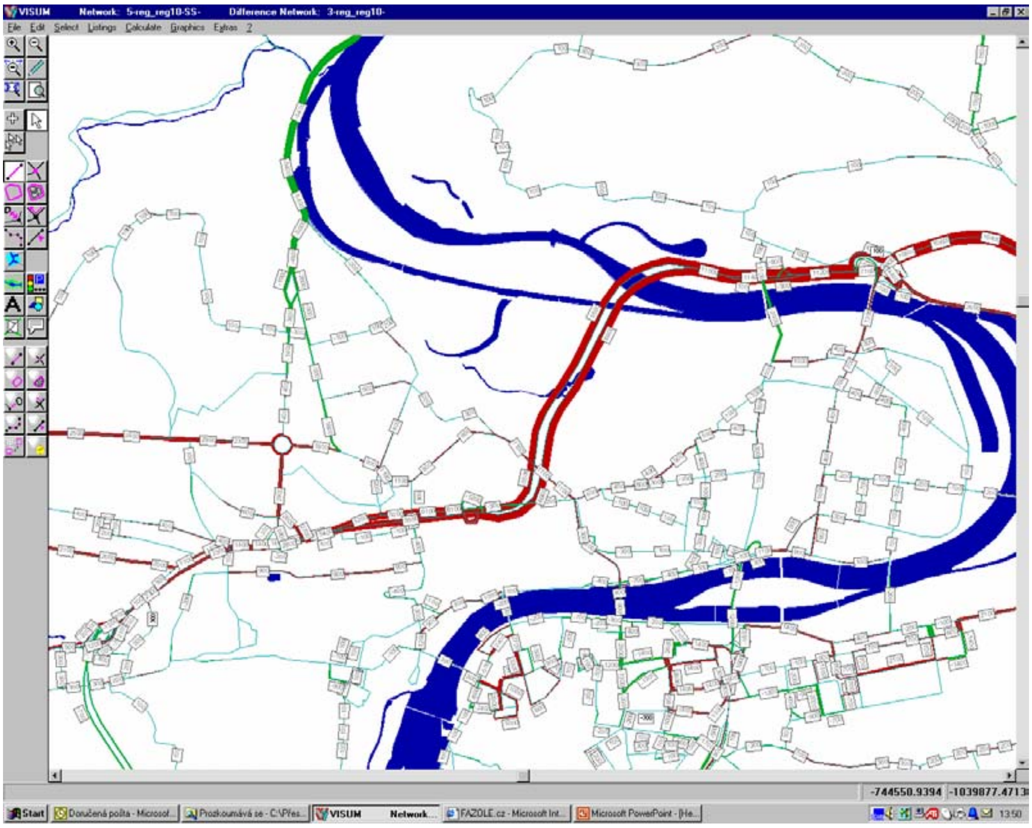


Figure 11: Differential traffic volumes between Prague ring road variants in the inner city

Figure 11 represents an increase in traffic loads in scenario SS. The use of the ring in scenario SS is about 50% lower then for scenario J. The increase in traffic loads was calculated to be on average 18%. For all scenarios, the modelling have been calculated using the VISUM model.

The next variant with the scenarios is the closure of the Nuselsky bridge (Figure 12), which is one of the most important roads built for through traffic with a high density of traffic (about 80 000 vehicles per day). The green colour represents a decrease and the red colour represents a growth of traffic load on the road network. The closure is possible in connection with the complete overhaul of the bridge.

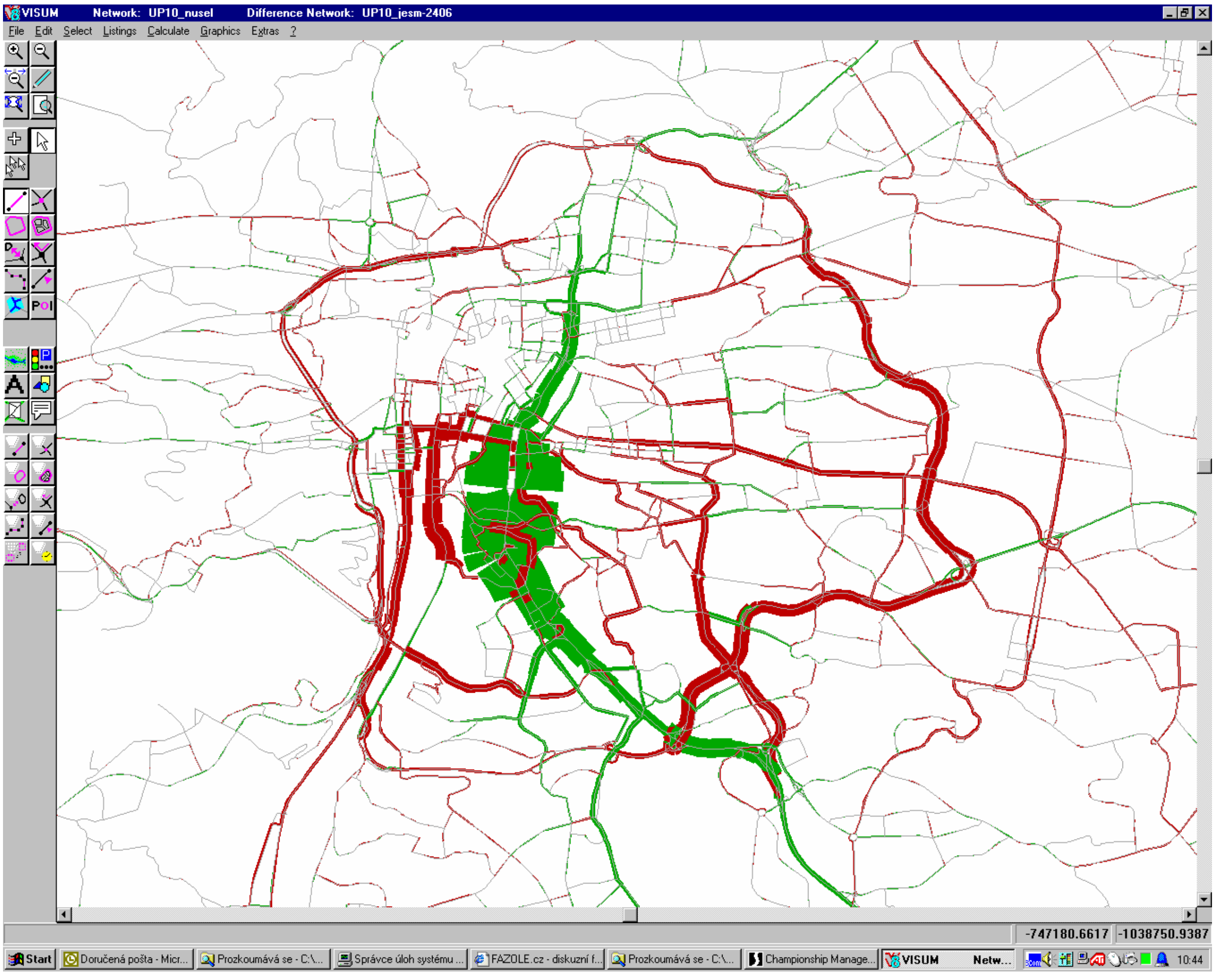


Figure 12: Closure of the Nuselsky bridge – change of traffic load on the road network

5.4 Timetable

5.4.1 Progress to date

Prague has progressed well during the project lifetime even if it appears that there have been speed differences in the development of particular system components. Tasks that have not yet been completed from other workpackages have an impact on the status of WP8.

The integration of the on-line AIM data and Meteorology data has been successful and in line with the workplan. Also the infrequently changed data preparation and implementation was finished without considerable difficulties.

The installation of the meteorological mast was accompanied by administrational obstacles and was eventually postponed beyond the HEAVEN horizon. However, the contingency plan was successfully adopted by the implementation of the virtual mast routine.

The integration of the on-line traffic data has not yet been completed, however both technical and legal aspects of the data export from the protected traffic system tasks have been resolved. The integration of the on-line data into Airviro is now enabled.

Preparation of the web presentation is under way, with completion expected in October.

As a result of this situation, Task 2 (Conduct component/module procurement) and Task 3 (Integrate component systems) from WP6 remain incomplete as well as Task 3 (Evaluation of verification phase) and Task 4 (Final demonstration specification) from WP7 and Task 2 (Evaluation of verification phase) from WP3.

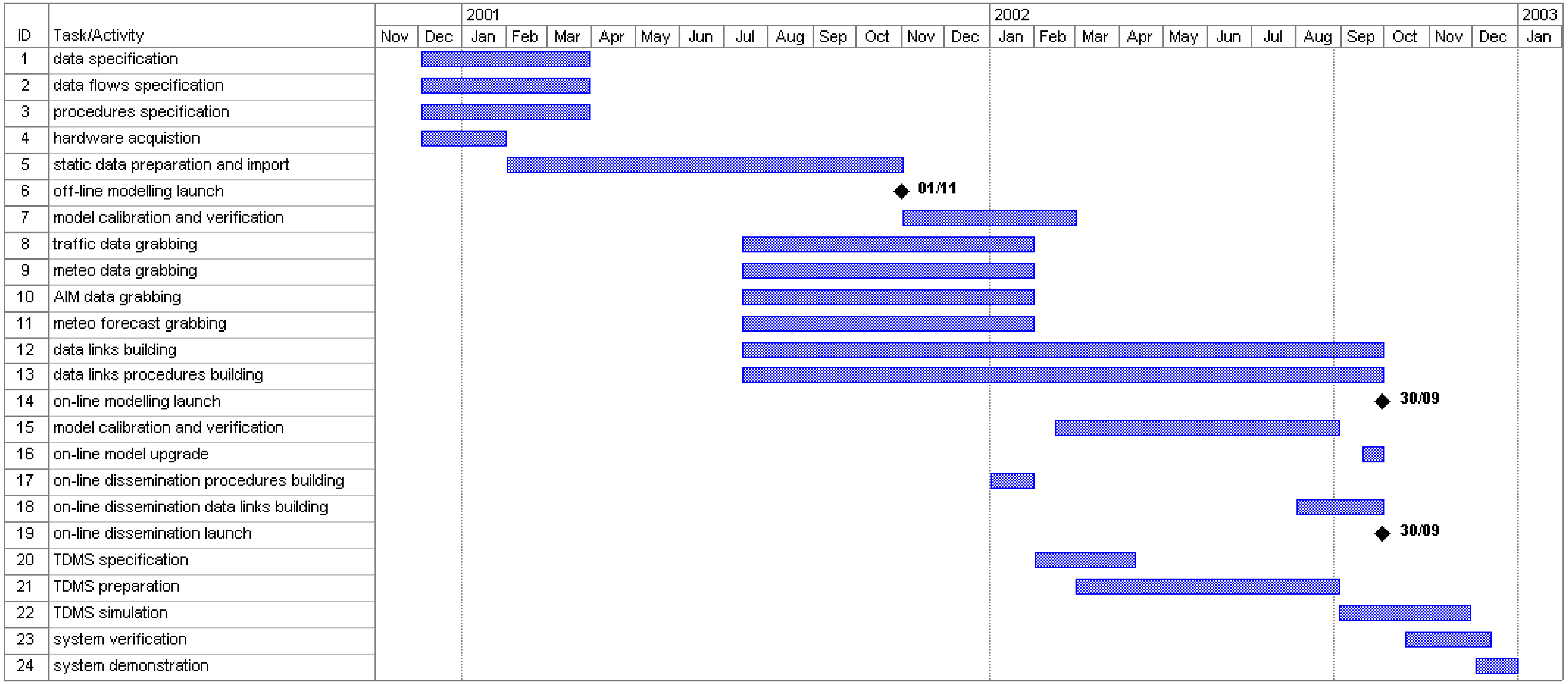
Obviously the incomplete integration of some applications means that parts of the verification process can not be completed for inclusion in the Final Verification Report (D7.1), which is due for submission in July 2002, and therefore the outstanding verification results will be included in the second set of WP8 deliverables.

5.4.2 Future progress

The demonstration phase runs in parallel with the evaluation phase. The demonstration period will contribute towards Task 3 (Evaluation of demonstration phase), and the results will be reported in Task 4 (Final evaluation report). The evaluation results will be sent to Rupprecht Consult in October 2002 and they will contribute towards the Final Evaluation Report to be published in January 2003. The demonstration and evaluation phases are now ongoing.

The demonstration phase also directly impacts onto the exploitation phase. Work on WP9 has started and Task 2 (Develop marketing and business plan) and Task 3 (Identify final recommendations), which require direct input from WP8, are running on schedule.

The Gantt chart below details the tasks to be completed.


2001
2002
2003
ID
Task/Activity
Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan
1 data specification
2 data flows specification
3 procedures specification
4 hardware acquistion
5 static data preparation and import
6 off-line modelling launch
01/11
7 model calibration and verification
8 traffic data grabbing
9 meteo data grabbing
10 AIM data grabbing
11 meteo forecast grabbing
12 data links building
13 data links procedures building
14 on-line modelling launch
30/09
15 model calibration and verification
16 on-line model upgrade
17 on-line dissemination procedures building
18 on-line dissemination data links building
19 on-line dissemination launch
30/09
20 TDMS specification
21 TDMS preparation
22 TDMS simulation
23 system verification
24 system demonstration

6 References

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ANNEX A

			Remarks
City	**Prague**		
Area	496	Km^2	
Population	1 181 126	Pers.	
Population density	2 381	$Pers./Km^2$	
Road infrastructure			
Total road network	3 366	Km	
Urban roads	3 282	Km	
Highways	84	Km	
Others		Km	
Traffic sensors	1 080	No.	
Public transport network			
-Rail	145	Km	
-Tram	136	Km	
-Underground	50	Km	
-Bus	813	Km	
Total Emission/Energy*			
CO	7538.9	T/a	
NOx	4535.2	T/a	
SO2	6258.0	T/a	
HC	2232.5	T/a	
PM	2433.3	T/a	
Energy	105000	TJ/a	
Share of Emissions/Energy from vehicle traffic			
CO	N/A	%	
NO_x	N/A	%	
SO_2	N/A	%	
HC	N/A	%	
PM	N/A	%	
Energy	N/A	%	
Vehicle fleet composition (Prague totals only)			
Passenger cars, with catalyst			
Passenger cars,	620 663	No.	total passenger cars

without catalyst			
Diesel			
Light duty vehicles	63 983	No.	total duty vehicles *)
Heavy duty vehicles			
Buses	3 016	No.	
Air quality monitoring			
Stations	13+25	No.	automatic+maual
Pollutants measured	minimum 3 (SO_2, NO_x, PM_{10})		individual for each station

* Reference year: 2000

*) broad classification: < 3,5 t ……… 53%

3,5 - 12 t ……. 26%

> 12 t …….. 21%

ANNEX B

Type of modelling	Type of model
Air quality modelling	▪ Airviro (Grid and Gaussian)
Meteorological modelling	▪ Czech Hydrometeorological Institute (model ALADIN – 48hours forecast)
Background pollution modelling	▪ Air Immission Monitoring data used for the calibration in Dispersion Modelling (Airviro)
Traffic modelling	▪ VISUM

ANNEX C

The following list details those bodies which use the outputs of HEAVEN in Prague.

- Prague City Hall
- Department of Transportation of Prague City Hall
- Department of Environment of Prague City Hall
- Institute of Transportation Engineering of the City of Prague
- Czech Hydro-meteorological Institute
- Police
- Universities
- Citizens