

ANNEX 1

Regional UNA reports

Contents

1	Berlin.....	1
1.1	User Groups	1
1.2	Objectives	3
1.3	Functionalities of the system	5
1.4	Transport measures which can be supported by the DS-System	9
1.5	Local Data Exchange Requirements.....	12
2	Leicester.....	18
2.1	Description of Existing System	18
2.2	User groups	19
2.3	Objectives	22
2.4	Functionalities of the System.....	23
2.5	Transport Measures, which can be supported by the DSS System	26
2.6	Description of Local Data Exchange Requirements	29
3	Paris.....	38
3.1	User groups	38
3.2	Objectives	41
3.3	Functionalities of the System.....	42
3.4	Transport Measures which can be Supported by the DSS System	44
3.5	Description of Local Data Exchange Requirements	47
4	Prague.....	49
4.1	User groups	49
4.2	Objectives	51
4.3	Functionalities of the system	52
4.4	Transport measures which can be supported by the DSS system	54
4.5	Description of Local Data Exchange Requirements	55
5	Rome.....	62
5.1	User groups	62
5.2	Objectives	64
5.3	Functionalities of the system	65
5.4	Transport measure which can be supported by the DSS system.....	68
5.5	Local Data Exchange Requirements.....	71
5.6	Pollution limits.....	79
6	Rotterdam.....	80
6.1	User groups	80
6.2	Objectives	82
6.3	Functionalities of the system	84
6.4	Transport measure which can be supported by the DSS system.....	86
6.5	Description of Local Data Exchange Requirements	91

1 BERLIN

1.1 User Groups

1.1.1 Description of user groups and method of data collection

There are two broad user groups in Berlin consistent with the user group categories identified by the project consortium. The first group is comprised of the various governmental administrations who will have access to both the Decision Support System (DSS) and the information platform component of the DSS. In Berlin, this group can be considered the ‘primary users’ of the DSS as they are directly and technically responsible for monitoring and responding to air and noise quality. They are also responsible for answering to and disseminating information to the public. These administrations, include both state and city district administrations for traffic, environment, health, and city planning. Furthermore, those departments within the state and city police, who are directly involved in traffic controlling and monitoring, will also have access to the DSS.

The general public and diverse interest groups form the second user group and can be considered ‘end users,’ as they will solely have access to the Information Platform of the DSS. This user group includes research institutions, organised citizens interested in issues of traffic-related noise and air pollution, environmental and traffic related organisations, as well as the chamber of commerce, the consumer advocacy organisation Stiftung Warentest, Local Agenda 21 representatives and the organisation for commercial goods transport.

Two separate workshops were held to inform each user group about the purpose and goals of the HEAVEN project and to explain and distribute the questionnaire. While all of the respective administrations at the state level were invited to the workshop only representatives from the traffic, health and city planning departments from the city districts in the potential demonstrations areas were invited. This was due to project time constraints and the breadth of the departments at the city district level. An exception was made for the environmental departments in which all 23 at the city district level were invited to participate. Only those that participated in the workshop received the questionnaire. There was a return rate of 56% for the administrations and 67% for the general public. Table 1.1 provides an overview of the user groups and a description of the method of data collection.[^]

1.1.1.1 Administrative roles in light of traffic-related issues, decision making and anticipated use of the DSS

Those administrations that responded to the questionnaire indicated that they dealt with questions of traffic-related air and noise pollution on a daily basis to several days a month. In general, it was not surprising to discover that the greater the geographical scope of the public administration the greater the frequency that the administration must directly address traffic-related pollution.

Regarding the role of the administrations in light of policy making, most of the departments at the city district level stated that they are active in several policy fields. For example, it was not uncommon to find that a city district planning department dealt with traffic and city planning policy or an environment department that dealt with traffic, health, city planning and environmental policy. However, most of the administrations in Berlin only advise or inform decision makers when decisions on traffic and environmental policies are being made. In the case of short-term decisions, only the state traffic department specified that they were authorised to make decisions whereas both the state traffic and city planning departments were authorised to make decisions in crisis situations.

The anticipated use of the DSS varied greatly by department and their current understanding of the capacity and potential for the DSS in Berlin. The state traffic department indicated that they would use the system on a continuous basis while the other departments varied from everyday use to only several days a year to never.

Table 1 User groups and method of data collection

User group	Method of data collection -> Questionnaire ->		Questionnaire			Work shop	Expert Meeting	n
			A	B	C			
	Method of administration ->		in-person	in-person				
DSS-users and information platform users	Traffic	(State) SenStadt Abt. IX	1	1		1	1	1
		(State) SenStadt Abt.VII D		1		1	1	1
		District of Steglitz		1		1		1
	Environment	District of Spandau		1		1		1
		District of Wilmersdorf		1		1		1
		District of Hohenschönhausen		1		1		1
		District of Reinickendorf		1		1		1
		District of Köpenick		1		1		1
		District of Tiergarten		1		1	1	1
		District of Wedding		1		1		1
	Health	(State) Landesamt für Arbeitsschutz, Gesundheit und technische Sicherheit (LAGeSI)		1		1		1
	City Planning	(State) SenStadt Abt. VII A	1	1		1		1
		District of Steglitz		1		1		1
		District of Tiergarten (Stadtplanungsamt)		1		1	1	1
		District of Tiergarten (Tiefbauamt)		1		1		1
	Police Department	Police President in Berlin, Dir. of LMSt		1		1		1
		Police President in Berlin, lower road traffic administration, LPVA IIIA		1		1		1
Other	S.T.E.R.N. Gesellschaft der behutsamen Stadterneuerung		1		1		1	
Decision Makers						1	1	
Information-users	General Public	various organisations			1	1	11	

Note: All traffic, environmental, health and city planning organisations at the state and city district level will have access to the DSS and information system. At the city district level, all 23 environmental departments were invited to participate in a workshop. Only the traffic, health and city planning departments from the three city districts where the demonstration area may be tested were invited to the workshops. Although many appeared at the workshop not all returned the questionnaire, only those listed above.

1.1.1.2 Organisational scope, scale of activities and anticipated use of the information platform

Clearly in the course of the project dissemination activities will take place to draw awareness to the information platform and DSS. The various organisations that participated in the workshop and responded to the questionnaire represent a small sample of particularly active organisations in the area of the environment, traffic and transport, and urban planning and were chosen as likely candidates who would provide substantive input and politically support the develop and testing of the information platform. Aside from the above mentioned organisational interests other areas included consumer protection, public transport, the development of environmentally sustainable traffic concepts, and commercial traffic and transport.

While some of the organisations that completed the questionnaire specified they carry out their activities at multiple scales ranging from the city district level to the international, most indicated they operate at the a regional and city district level. The organisational scale at which the organisation operates suggests

at what scale they will likely disseminate information obtained from the information platform to organisation members and to the general public. Consequently citizens who are on the distribution end of these organisations will indirectly benefit from the information platform or learn about platform through these organisations.

1.2 Objectives

1.2.1 Objectives of public administrations as user of DSS and information platform

The main objectives for the DSS and information platform for the administrations are listed in the table below (Table 2). Clearly all the administrations envisioned using the DSS if it were to support their daily work and if were capable of providing information about air and noise pollution for both the general public and government administrations. Beyond these basic objectives all departments expressed using the system to support policy makers in determining future transport policies and for modelling the environmental effects of temporary and long-term transport policies and measures, with the exception of the health and environmental departments who expressed no or only moderate interest in these system objectives. Respondents from the State Ministry for Urban Development, several respondents from district environment departments, and city district planning departments indicated that they would use the system for obtaining basic information for planning and carrying out pollution abatement strategies. Most notable was the lukewarm interest in using the system for health information. Only the environmental department expressed moderate interest and will consequently be noted as an additional objective.

Table 2: Objectives of the public administrations for DSS

Objectives	Public Departments
As a decision support system to facilitate daily work	SenStadt, T, E, H, CP, P
Information system on noise for the general public	SenStadt, T, E, H, CP
Information system on pollutants for the general public	SenStadt, T, E, H, CP
Information system on noise for the administration	SenStadt, T, E, H, CP
Information system on pollutants for the administration	SenStadt, T, E, H, CP,
Support for policy makers on future transport policies	SenStadt, T, CP, P
Help for modelling the environmental effects of temporary transport/policy measures	SenStadt, T, CP,
Help for modelling the environmental effects of long-term transport policies	SenStadt, T, CP
Basis information for planning and carrying out pollution abatement measures (e.g., traffic management strategies)	SenStadt, E, CP
Health information system	E
To support city logistic planning and management of freight transport/commercial truck traffic	E

Abbreviation key: SenStadt = Senatsverwaltung für Stadtentwicklung (State Ministry for Urban Development Environmental Policy Department and Traffic Management Department), T = City District Department of Traffic, E = City District Department of Environment, H = City District Department of Health, CP = City District Department for City Planning, P = Police Department

Overall many departments expected the system to provide the critical connection between collecting pollution data and implementing combative measures. Several representatives from environmental departments expressed the importance of having a tool that would support arguments that would pressure

decision-makers into taking action. Similarly, a city planning department representative stated the need for a system that had “easily accessible, up-to date basic data” which would lead to “(an) improved foundation for planning and quick decision-making possibilities.”

1.2.2 Objectives of the general public as users of the information platform of DSS

When asked for what purpose they could utilise the information platform of the DSS those that responded to the questionnaire envisioned the following objectives:

Table 3: Objectives of the general public for Information Platform of DSS

Objectives	No. of times mentioned
As an source for disseminating information to inform, advise and educate organisation members, impacted citizens or the general public	6
As an information source for preparing reports, statistical assessments and research articles	4
To assist in the management of commercial transport in relation to public transport and individual private traffic, e.g., route planning	2
To incorporate into long-term planning tasks	2
To use information to support political arguments and statements made by organisation	1
To influence changes in mobility behaviour by informing about alternative modes of transport with the goal of improving the environment	1
To use to pressure respective administration to respond to pollution	1
To know whether to avoid certain streets or areas in the city	1
To help make decisions as to what measures could be take to curb pollution	1

In addition to these objectives the users of the information platform indicated they would want to be informed when critical pollution levels have been exceeded in the form of a warning message. They also specified that it would be useful to have access to data records of historical pollution levels which would be in useful in supplementing organisational reports and research as well as assessing trends. The local Chamber of Commerce noted that the emissions and noise forecasts would be particularly meaningful for commercial traffic if it was coupled with traffic forecasts and information about traffic measures that might be implemented to curb pollution. Respondents stated they would like access to a dictionary of addresses with points of contact and respective responsibilities. Finally, the respondents also signified moderate interest in having access to traffic reports and updated traffic, emission, and noise forecasts.

The respondents not only delivered constructive requirements but expressed critique when asked to provide additional comments. In particular, one organisation warned, as did some members from several public administrations, that without concrete legislation forcing administrations to respond to noise and air pollution, the information provided by the information platform will not lead to any decisive use. Similarly, another respondent suggested that pollution had to be met with supportive structures for pollution abatement and planning, and that part of documenting a pollution problem includes identifying the source.

1.3 Functionalities of the system

1.3.1 Functionalities of the information system

1.3.1.1 Desired pollutants to be measured

The pollutants to be measured by the DSS are PM_x, CO, NO_x, and Benzene, all of which are legislatively required. PM 10 and NO_x measurements on Berlin roads have significantly exceeded EU guidelines whose limit values will be binding by the year 2005 and 2010 respectively. Projected pollution concentrations in the road network for PM 10 and possibly NO₂ are expected to pose the greatest future concern. Additional pollutants were frequently mentioned by the respondents, such as SO_x, Soot and Ozone (O₃). According to local experts, SO_x is not currently present in any significant concentration and may not be sensible for measurement.

Approximately 200,000 residents living along major roads are exposed to traffic noise about 55 decibels and approximately 35% of the residents living along secondary road networks. Modelled calculations predict an increase in noise pollution if efforts are not taken to reduce motorised individual traffic. EU or federal limit values for existing streets are currently unknown. It is to be expected, however, that either the city districts or the state will have to verify that measures have been undertaken when decibels greater than 70 or 65 during the day and 60 or 55 decibels at night have impacted large groups of residents or apartments.

The respondents of the questionnaire indicated they desired noise levels and the number of people affected by noise to be calculated by the DSS, and as an additional requirements the number of apartments and office places affected by noise.

1.3.1.2 Desired spatial aggregations

Almost all of the respondents stated that the DSS should provide pollution information at the street level and most particularly for highly impacted streets, and city district level. The health department indicated information should be provided for larger aggregations, which could be made possible as an additional requirement. Currently, however, laws for pollutants are required at the street level.

Although there is currently no law in place, the DSS should be able to provide noise decibel levels at the street segment level and for prevailing areas with closed urban structures in the inner city and openly developed urban structural areas in the city.

1.3.1.3 Desired time resolutions

How often pollutants are expected to be measured greatly varied by administration. The health department expected weekly measurements for CO, 6 hour updates for PM, daily updates for NO_x and benzene. The traffic department requested less detailed updates, specifically, differentiation between measured workday and weekend values for CO and PM, and the 98% value of every half hour yearly average for NO_x, and daily updates for benzene. Most of representatives from environmental departments specified hourly and every 6, 12 and 24 hour updates for all desired pollutants. The general public requested hourly and daily updates. The main user of the DSS, SenStadt requested that pollutant values are updated hourly during the day and every four hours in the evening which satisfies the requests of all respondents.

Dependent on the availability of traffic data noise measurements are expected to be updated during the daytime between 6:00 am – 6:00 pm, in the evening between 6:00 pm – 10:00 pm, and one night time

measurement between 10:00 pm – 6:00 am. Furthermore, yearly measurements are required for the previous and forthcoming calendar year. The following table summarises the desired user functionalities.

Table 4: Functionalities of the Information Platform

Air Pollutant	Spatial Aggregation	Time Resolution	Global Statistics
CO	street level, especially highly impacted streets and city district level. Larger aggregations as additional requirement	Daytime: hourly Night time: every four hours	Daily and yearly and according to EU guidelines. As additional function monthly and seasonal global statistics
PM			
NO _x			
Benzene			
Noise Pollution	Spatial Aggregation	Time Resolution	Global Statistics
noise decibel levels	street segment level, closed urban structures, openly developed urban structural areas, city district level	If traffic data is available: Daytime between 6-18: hourly Early evening 18-22: every four hours Night time 22-6: 8 hour measurement	Yearly for previous calendar year and forecast for forthcoming calendar year and according to EU guidelines
number of people impacted			
number of apartments impacted			
number of office spaces impacted (additional requirement)			

1.3.1.4 Information channels

All of the public administrations stated information should be displayed upon request and in the form of maps where appropriate. For example, it should be possible to request pollution level values at a certain time visualised for a particular street segment. Information should be made available via RDS/TMC, variable message signs, via the internet, displayed in public transport stations, in the form of video text networked with a navigation system, and via SMS/WAP messages for mobile phones. Radio broadcast was requested as an additional requirement.

All of the public administrations requested the availability of online help, access to historic data and the possibility to integrate meteorological information, information about the traffic situation, and traffic forecasts for different traffic situations and measures, as well as the effects upon neighbouring regions.

Respondents representing the general public requested that information be displayed on request and in the form of maps tables and graphics when appropriate via the internet, public displays and as additional requirements, in teletext form or over the radio. The general public also requested that warning messages sound when pollution limits have been reached, that they have access to data records, a dictionary of contact information, and information on temporary traffic measures and health information. Furthermore, they requested updates on the traffic situation, emission and noise forecast information.

1.3.2 Functionalities of the DSS

In accordance with the objectives for the DSS the public administration respondents, particularly the traffic departments, indicated the DSS could be used for the following:

- For policy makers as a support tool to model the environmental effects of long-term transport policies
- For policy makers as a support tool to model the environmental effects of temporary measures to reduce traffic
- For decision makers to optimise transport flows in the realm of traffic management

All administrations agreed to the following objective:

- For public administrations to assist them in daily work and to improve information flow

The ministry for Urban Development argued the DSS should additionally be used to protect sensitive areas from negative impacts of traffic.

The most useful functions, according to the respondents, including a specification of potential objectives, functional descriptions and expected impacts or benefits of these functions are detailed in the following.

1.3.2.1 Historic Data

Objectives

One basic function of the system is the provision of historic data in order to make comparisons between actual vs. historic values and to reveal trends. Such a function would also be used to analyse the impacts of traffic measures on pollutants and noise.

Data records on emission are already kept by the authorities; however, it is difficult to reveal trends or to evaluate measures on the basis of this data because the existing data is largely based on average values and data records are not kept on a day to day basis.

Description of function

Different information sources on pollution trends, etc. already exist. This is why the information provided by the DSS has to correspond to the available pollution concentration registry, noise map (Lärmkarte) and ongoing measurement at the measurement stations (Dauerzählstellen).

In addition to the raw measurement data, such as the concentration of certain pollutants on a given day is important but also information is needed on meteorological data (weather change, temperature, sun activity, etc.). A comparison between actual and historical data can only be correct if this additional data is available. Furthermore, long term data is required of the system to produce long term data trends.

In the context of the presentation of the results, the automatic generation of diagrams on trends or comparison values should be available.

Expected benefits

In general, this function can improve the data quality in terms of completeness and actuality. Long term developments and the development of pollutant concentration can be monitored. It is also expected that this function facilitates the evaluation of measures and thereby improve planning.

1.3.2.2 Alarm Levels

Objectives

Guidelines and regulations exist regarding emission levels. It was importance to all public authorities (Traffic, health, environment) to be immediately informed when actual limits are exceeded, including forecasts. This information would enable the authorities to respond with countermeasures.

Description of function

As soon as noise limits and air pollution limits have been exceeded on any street or area in the city, automatic warning tips should be created by the system for both, actual exceeded value and forecasts. The traffic departments would also like to be informed when traffic limits and truck traffic limits have been

exceeded on certain streets. In addition, the system should provide information on all existing pollution and noise limits for the European and national level.

Expected benefit

Up to date information and reliable forecasts will enable the authorities to respond to actual exceeded limits or when noise and pollution levels are expected to be exceeded. This is expected to help reduce pollution in the city. This information will also improve the planning foundation for the traffic departments.

1.3.2.3 Automatic Generation of Optimal Traffic Measures

Objective

When emission levels have been exceeded and when forecasts indicate a limit is expected to be exceeded in the near future, additional help to identify appropriate traffic measures is necessary, most particularly for the traffic departments.

Description of function

This function should automatically indicate optimal measures for a given traffic and environmental situation. These suggestions have to be checked by the decision makers who make the final decision as to which measure can be implemented. These measures will mostly be temporary to optimally deal with a given traffic situation. Such measures could include:

- introducing temporary speed limits
- reallocating truck traffic
- controlling signal patterns

However, the system should also take into account the impacts of the proposed measures upon adjacent areas. The reallocation of traffic might otherwise pose as a negative externality.

Expected benefit

Currently, there is no tool which helps decision makers to optimise traffic by taking environmental effects into account. This function should help to optimise traffic measures and influence traffic. However, optimising traffic in terms of pollution will normally lead to non optimal traffic flows.

Aside from, directly influencing traffic such a function can also serve as a basis for argumentation and support the need for increasing subsidies for environmentally friendly modes of transport.

1.3.2.4 Modelling to Evaluate Environmental Effects of Long-Term Transport Policies

Objectives

Next to optimising traffic in a short term, the system should also be capable of evaluating the environmental effects of short to mid term transport policies, such as speed limits, bans on trucks, etc. The system could be overwhelmed when working through long-term political traffic strategies (8-15 years) and should rather focus on short term policies. This function is needed by the traffic departments but also by the health and environmental departments to find support for argumentation in transport planning issues.

Description of function

The model should use EU guidelines for noise and air pollution. It should also include traffic prohibition strategies (e.g., during the evening, rush-hour). Actual vs. expected comparisons and processing of forecasts should also be integrated in the system.

Expected Benefits

The results can be used to support political traffic decision-making processes and highly improve the planning basis. This will help to reduce pollution for the mid-term in particularly impacted areas.

1.3.2.5 Health Information System

Objectives

The citizens are currently informed about pollution levels through periodic reports. The data gathered in HEAVEN can be used for preparing health-related reports, for health-related subsidies and health prevention.

Description of function

To prepare data with concrete statements about how health is impacted by different pollutants. This information has to be linked to the actual pollution situation in the city and give an answer to the following question: How does the current pollution situation affect health?

Expected Benefit

The major benefit would be to have better information for citizens regarding health risks caused by pollutants. An additional benefit includes raising more support and pressure from the general public by informing them about health risks based on real pollution values caused by traffic.

1.4 Transport measures which can be supported by the DS-System

1.4.1 Berlin's traffic situation

Most of the respondents representing administrations indicated they thought there was an environmental problem related to air quality in Berlin and perceived the general public thought so as well. Respondents suggested that noise pollution was of particular importance but was only moderately an issue in the eyes of the public. Some experts qualified their responses by stating air and noise quality was relevant to the main road network and to areas of the secondary network due to commercial vehicle deliveries. Most agree that the source of air pollution was related to motor vehicle traffic and long-distance commercial transport and less moderately related to air traffic and industry. With respect to noise pollution, respondents distinguished motor vehicle traffic as the main cause for noise pollution but also mentioned air and rail traffic.

The most mentioned traffic problems in the city were

- high amount of inner city through-traffic,
- high local truck traffic and truck traffic at night (lacking overall freight transportation concept),
- motorised job-related traffic,
- lack in parking space,
- the high dependence of long-distance traffic on a free-flowing city ring (A-100), and
- perceived lengthier travel times using public transport when compared to motorised individual traffic.

These problems were largely identified with the city center and sub-centers, main road axes, and particularly main axes with dense residential population. Nodes in commercial areas and freight transport centers were also mentioned.

The main traffic problems and the reasons behind the traffic problems were often conflated. For example, the delivery of goods, intensive use of the private car and insufficient policing of illegal parking were

mentioned as the main reasons behind traffic problems in the city. Other reasons, but to a lesser degree of importance, included insufficient parking space, insufficient road infrastructure, the absence of strict pollution regulations, insufficient speed control, and insufficient traffic management.

1.4.2 Description of potential measures for improving the situation

Numerous traffic management measures were specified as ways of improving air and noise quality in Berlin were mentioned including lorry bans, traffic calming, cycle routes and light rail transit system, noise reduction devices for vehicles and special noise retardant material for the roadway.

The actions or policies that are currently being practised based on air quality information by organisation are listed in the following table:

Table 5: Current traffic measures

Administration	Action/Policy
SenStadt	construction site coordination, sound smog alarm when necessary, federal emission standards, tax rebate incentives, inform general public
District Traffic Dept.	traffic re-routing, inform road-users, inform general public, speed restrictions, congestion management
District Environmental Dept.	inform general public
District Health	has no direct influence upon traffic
District City Planning Dept.	inform general public
Police	re-routing, inform road-users, inform citizens, speed restrictions, congestion management

The following table depicts the measures the respective administrations plan to implement over the next three years based on information on air quality:

Table 6: Potential traffic measures

Administration	Action/Policy
SenStadt	traffic re-routing, inform road-users and general public, speed restrictions, congestion management, truck route concept, expand public parking options
District Traffic Dept.	traffic re-routing, inform road-users and general public, speed restrictions, congestion management
District Environmental Dept.	traffic re-routing, inform road-users and general public, congestion management
District Health	None
District City Planning Dept.	traffic re-routing, inform general public, congestion management, logistic concept of freight traffic
Police	traffic re-routing, inform road-users and general public, speed restrictions, congestion management

1.4.3 Anticipated benefits from the system

The following table reveals the polices or actions that will be facilitated by the proposed DSS by administration:

Table 7: Facilitated traffic measures by the DSS

Administration	Action/Policy
SenStadt	traffic re-routing, informing road-users, speed restrictions, congestion management
District Traffic Dept.	
District Environmental Dept.	
District Health Department	same as the above plus access control and road pricing
District City Planning Dept.	same as the above plus informing the general public and logistic concept for freight transport
Police	traffic re-routing, informing road-users, congestion management

1.5 Local Data Exchange Requirements

Table 8 User Needs and Functions for Air and Noise Pollution Modelling

User Needs (WP4)				Functions (WP5)	
What?	Details	Time resolution	Spatial resolution	Sub-functions	Appropriate Model
Modelling of air pollution	CO	Hourly (day), every 4 hours (night)	street segment	<ul style="list-style-type: none"> Emissions traffic Other emissions Background pollution Concentration e.g., roads 	<ul style="list-style-type: none"> IMMIS em IMMIS net IMMIS cpb Further development
	NOx	Hourly (day), every 4 hours (night)	street segment	<ul style="list-style-type: none"> Emissions traffic Other emissions Background pollution Concentration e.g., roads 	<ul style="list-style-type: none"> IMMIS em IMMIS net IMMIS cpb Further development
	PM	Hourly (day), every 4 hours (night)	street segment	<ul style="list-style-type: none"> Emissions traffic Other emissions Background pollution Concentration e.g., roads 	<ul style="list-style-type: none"> IMMIS em IMMIS net IMMIS cpb Further development
	HC	Hourly (day), every 4 hours (night)	street segment	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
	Benzene	Hourly (day), every 4 hours (night)	street segment	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
	SOx	Hourly (day), every 4 hours (night)	street segment	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
	Soot	arithmetic yearly average	street segment	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
	Ozone	arithmetic yearly average	street segment	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
Modelling of Noise pollution	Noise pollution concentration	Hourly (day), updates between 6pm and 10pm, 10pm and 6 am	street segment	<ul style="list-style-type: none"> Traffic noise emission Noise pollution concentration at the building front 	<ul style="list-style-type: none"> IMMIS lärm Further development
	People impacted	Day – night	street segment	<ul style="list-style-type: none"> impacted people in decibel classes 	<ul style="list-style-type: none"> To be developed
	Impacted apartments	Day – night	street segment	<ul style="list-style-type: none"> affected apartments in decibel classes 	<ul style="list-style-type: none"> To be developed
pollution value exceeded	Automatic warning when value is exceeded	Automatically	Street segments	<ul style="list-style-type: none"> Warning when value is exceeded 	<ul style="list-style-type: none"> To be developed

User Needs (WP4)				Functions (WP5)	
What?	Details	Time resolution	Spatial resolution	Sub-functions	Appropriate Model
Statistics	daily/monthly/seasonal/ yearly for air	Daily and yearly	Street segments, aggregates	<ul style="list-style-type: none"> • Air pollution statistics 	<ul style="list-style-type: none"> • To be developed
	monthly/seasonal/yearly for noise	Yearly	Street segments, aggregates	<ul style="list-style-type: none"> • Noise statistics 	<ul style="list-style-type: none"> • To be developed
Decision support forecasts (dependent on developments in Traffic Management Center)	Forecast-module air pollution	On demand	Street segments	<ul style="list-style-type: none"> • Input traffic-forecasts from TMC 	<ul style="list-style-type: none"> • To be developed
				<ul style="list-style-type: none"> • Emissions traffic • Other emissions • Background pollution • Concentration e.g., roads 	<ul style="list-style-type: none"> • IMMIS em • IMMIS net • IMMIS cpb
				<ul style="list-style-type: none"> • Assessment of the difference between forecast and measurement (day after) 	<ul style="list-style-type: none"> • To be developed
	Forecast-module noise pollution	On demand	Street segments	<ul style="list-style-type: none"> • Input traffic-forecast from TMC 	<ul style="list-style-type: none"> • To be developed
				<ul style="list-style-type: none"> • Traffic noise emission • Noise pollution concentration at the building front 	<ul style="list-style-type: none"> • IMMIS lärm
				<ul style="list-style-type: none"> • Assessment of the difference between forecast and measurement (day after) 	<ul style="list-style-type: none"> • To be developed

Table 9 Needs and functions (User Interface)

User Needs (WP4)	Functions (WP5)	
What?	Module	functions
Internet	Internet-Client	<ul style="list-style-type: none"> • Internet-Client for information representation IS
(SMS/WAP)	(WAP-Client)	<ul style="list-style-type: none"> • WAP-Client for information representation IS (optional function to be decided at a later date)
Windows	Windows-Client	<ul style="list-style-type: none"> • Windows-Client for information, operation and simulation DSS (operator-interface)
Video Text		<ul style="list-style-type: none"> • TV stations have to use the Internet-Client
Variable Message Signs		<ul style="list-style-type: none"> • The respective environmental department has to receive and manage the environmental information in their system
Radio		<ul style="list-style-type: none"> • Radio stations have to use the internet-client
Displays at Public Transport Systems (BVG/S-Bahn)		<ul style="list-style-type: none"> • Public Transport Systems (BVG/S-Bahn) have to use the internet-client

The necessary data is differentiated between statistical data (temporal resolution ≥ 1 year) and dynamic data (temporal resolution ≤ 1 hour). For the modelling of air pollution, the necessary data is not differentiated according to pollutant (aside from the emission registry and background pollution). In table 4 the respective input parameters required for the modelling of air pollution and noise are given.

Table 10 System Needs and functions (System Modules)

The DSS also requires certain system functions that will not be directly accessed by the user. These, for example, include the transferring of data from a traffic management center, the acquisition of meteorological data, etc. The functions and data required for these purposes should also be incorporated and presented in table form.

System Needs (WP5)				Functions (WP5)	
What?	Module	Time resolution	Spatial resolution	Sub-functions	Required Data
Traffic data from the TMC (real-time)	Interface-Module TMC	See results UNA	See results UNA	Selection, testing, transferring into EM-data-bank	Traffic loads mode of travel
				Calculation / Update of traffic profiles	
				Update data-history	
Traffic data from the TMC (forecast)	Interface-Module TMC	On demand	See results UNA	Selection, testing, transferring into EM-data-bank	Traffic loads (forecast) Mode of travel (forecast)
Model - parameter from other sources	Interface-Module Others	Continual (dynamic)	Street segment	Input meteorological -data	wind directions wind speed
		Cyclical (yearly, static)	Street segment	Input population data, development	Number of residents position of building, height structure of the facade
		continual / cyclical	Street segment / hot spot	Input measurement data	Air (CO, Nox, PM) Noise
Calibration of models	Calibration Module	On demand	-	Comparison of modelling results and measurement data	Modelling results Measurement data (see above)
		cyclical	-	Improvement of the models (tuning)	-

Table 11 Required data (Environmental modelling)

Function (WP5)	Required data (WP5)	
Modelling air pollution	“Static” data (temporal resolution >= 1 year)	
	Emission data NO _x , CO, PM with spatial reference	
	<p>Area source: An arial source is always defined in quadrants (raster-cells) and lies parallel to an axes of a right angle coordinate system. This source is defined by: the coordinates of the lower left corner point the corner length die emission height The source height is consistent for all source groups. Die yearly emission is required for the 11 following source groups :</p>	<p>Car exhaust emission Truck exhaust emission Motorised vehicle evaporation emission Distribution of combustibles Solvent use Industrial combustion process Non-industrial combustion process Production process Crude oil processing industry Inland waterway transport Air traffic</p>
	<p>Point sources: Point sources are defined by: the coordinates of the smoke stack the height of the smoke stack the exhaust temperature the volume stream of the exhaust</p>	<p>The yearly emission of the three pollutants (NO_x, CO, PM). The point sources will not differentiate between source groups (see above).</p>
	Profiles (over time) of emissions for the individual source groups	
	Data for the main road network	<p>Coordinats of the road segment Gradient including whether a one-way street Traffic situation after HB-Efa (handbook of emission factors from Federal Environmental Administration-UBA) Site (residential area, city center, main radial) Height of the traffic lane Width of the traffic lane Number of traffic lanes</p>

Function (WP5)	Required data (WP5)	
		Capacity
	Data for road segments	Built infrastructure height, left-right Distances of built infrastructure Portion of gaps in built infrastructure left-right Site of the pollution concentration point (Measurement point)
	Data of regional background pollution	Yearly average value from measurement stations (NO _x , CO, PM) of the area surrounding Berlin Profile (over time) of background pollution
	“Dynamic” data (temporal resolution ≤ 1 hour)	
	Traffic data for the main road network	Traffic loads (sum) Portion of light use vehicles Portion of heavy use vehicles Portion of motorcycle portion of small motorcycles (mopeds, etc.) portion of busses portion of travel/tourism busses portion of vehicles in Stop & Go
	Meteorological data (Situation over roof-level)	Wind direction Wind speed Dispersion class
Modelling noise pollution (in addition to requirements for air-modelling)	“Static” data (temporal resolution ≥ 1 year)	
	Data about road segment	Type of road surface Type of tram track Data of tram frequency with profile (schedule) Classification of facade (reflection-types)
	“Dynamic” data (temporal resolution ≤ 1 hour)	
	Traffic data for the main road network	(see air pollution)

2 LEICESTER

2.1 Description of Existing System

Leicester City was the site of the first urban traffic control (UTC) system in the UK outside the metropolitan areas when it was installed in 1970. The system has been upgraded in 1988 and 1996 to incorporate the latest versions of the demand-responsive traffic signal control system, SCOOT (Split, Cycle and Offset Optimisation Technique). There are currently 13 SCOOT regions which offer not only optimisation to avoid congestion, but to consider air quality, bus priorities, car parking direction, etc. The SCOOT system includes the ASTRID database which stores limited historic data in a very time-aggregated format. The urban traffic control system controls over 300 signal installations within the City conurbation and with Area Traffic Control (ATC) controlling a further 250 installations in the surrounding counties of Leicestershire and Rutland. Off-line modelling is carried out using TRIPS, SATURN and TRANSYT. Traffic and Travel information is collated from all organisations whose activities affect the road network. This is disseminated to interested parties and broadcast via BBC Radio Leicester using RDS-EON. The European Commission (DGXIII) previously supported the Fourth Framework EFFECT (EN 1007), EMMA (EN 1005) and QUARTET PLUS/MATTISSE (TR 1044) projects to provide air quality and regional transport information for the public and planners. Although the European funding has now finished, the Council is committed to maintaining the facilities developed. The DGVII supported EUROTOLL/LERTS (PL 95216) project has led to a high quality Park and Ride site being built along with a dedicated bus lane and variable message signs. The on going European Commission Integrated Applications for Digital Sites supported project called EQUAL (IA 1004) is making the wealth of air quality, traffic and public information available to the citizens of Leicester, academics and business.

Within Leicester City the two systems in operation for monitoring traffic conditions are 'Count Sites', which has been in place since 1974 and SCOOT. The 'count site' system provides vehicle count data, collected at 5-minute intervals, while SCOOT provides real time information on occupancy, congestion and delays. The method used for data collection, by both systems, is induction loops. SCOOT has around 300 measurement points within the inner city and surrounding suburbs, while the 'count site' system has only 85 measurement points within the demonstration area, plus some infra red counters outside the area. Traffic is not modeled directly within Area Traffic Control, but through Leicester City Council Traffic Department and Leicestershire County Council, who use the TRIPS model for this purpose.

All legislative pollution limits monitored within Leicester City, are in line with European and National regulations. There is no Local/City legislation. The air quality monitoring system used in Leicester has been in place since 1994, although NO₂ tube surveys have been carried out since 1986. Pollutants measured by the current system include SO₂, NO₂, CO, PM₁₀, HC and Benzene. Modelling and forecasting of air pollution is carried out by Leicester City Council Pollution Control Group, using ADMS (Atmospheric Dispersion Modelling System) and AIRVIRO Modelling systems, providing information on all the pollutants mentioned, at regular yearly, hourly and 15 minute intervals. There are currently no noise measurements carried out and no Modelling system for forecasting and Modelling noise, within the city or demonstration area.

Leicester City Councils main objectives through Heaven are:

1. Response to Air Quality & Noise Directives
2. Impact of traffic pollution on Air Quality Management (AQM) plans
3. Traffic Demand Management Systems (TDMS) targeted at reducing pollution
4. System for predicting noise pollution
5. Dissemination/consultation with the public
6. Supporting a health cohort study

It is aimed to develop and improve the current pollution Modelling system AIRVIRO, by incorporating a health database, which will advance the information systems and provide better predictions regarding pollution levels and possible consequences. It is also planned to integrate a noise model (AVTUNE) into AIRVIRO, further improving the scope for pollution forecasting and Modelling. Improving traffic data to enable the system to model the impact of TDMS will develop the overall traffic management system.

2.2 User groups

The majority of use of the DSS will occur within Area Traffic Control (ATC) and Pollution Control at Leicester City Council, where real time traffic and pollution information will be integrated and the public advised on up-to the minute information regarding travel and pollution conditions within the city. The DSS system will also be used by those working within local authorities and administration departments, for example departments within the Leicester County Council, Leicester City Council and, when required the District Councils (Blaby, Charnwood, Harborough, Hinckley, Bosworth, Melton and Northwest Leicestershire). All these organisations have teams dealing with pollution, traffic and environmental management, thus the DSS will provide a direct source of relevant and up to date information to these departments. With regards to policy making, the above organisations are involved on both an advisory and decision making level. Another important group of DSS primary users includes those already familiar with Airviro, namely members of the national Airviro Users Group, who also work in areas directly involved in decision-making processes. This group incorporates those working outside Leicestershire, thus providing a wider scope for feedback.

Questionnaires were sent out to all these groups and responses have been received from individuals working in various Traffic and Environmental Departments in the Leicester and Leicestershire areas. These include those working to complete the UK Air Quality Review and Assessment process and the Local Transport Plan on a city- and countywide level. Traffic management, the environment, health, city planning, regeneration, air pollution, EMAS, Local Agenda 21 and crime and disorder are the main areas covered by those individuals and departments who have provided feedback from the questionnaires. Thus the results give an insight into the views and requirements of a variety of important primary users. These DSS users work at all geographical levels, from a basic district and city level, to a national and international level and feel they would make use of the system at least once a month. Those working directly with traffic management said they would make use of the DSS either every day or continuously, however some individuals felt unable to comment at this stage on how useful the system would be to them.

Secondary Users targeted with the questionnaire were individuals working in local NGO's, i.e. Transport 2000 and Friend of the Earth, and local citizens including car drivers, business workers and local residents. Transport 2000 has a major focus on all issues concerning the environment and quality of life, while citizens have a basic interest in the general quality of life within the city and surrounding residential areas. A relatively high number of the citizens completing the questionnaires stated they had a medical condition affected by air pollution (28.3%). Examples given were asthma, bronchitis and hayfever. A smaller percentage (5.7%) had a medical condition affected by noise levels. The majority of results came from individuals in the 20-39 and 60+ age range. Most work full-time, part-time or are retired and just under half were frequent car drivers. A large number of respondents indicated they had a good knowledge of individual traffic (40%), the environment (48%) and health issues (48%), while the rest had either some or little knowledge in these areas. With regard economics/business, the majority seemed to have some knowledge, with a few having a good understanding. Knowledge on freight traffic and urban planning was either 'some' or 'little' for the majority of individuals.

Individuals working in research, for example those working at Leicester and De Montfort Universities have also been classed as secondary users or users of the information platform. Those targeted with the

questionnaire were persons directly involved in traffic, health and environmental investigations. Responses were obtained from all these areas, including Leicester Children's Asthma Centre, the Institute for Environmental and Health and the Institute of Energy and Sustainable Development and Institute for Transport Studies, University of Leeds (ITS Leeds). The majority classed themselves as working at a national or international level, due to the nature of research. They also had a good working knowledge of the environment and related matters. Responses from Leicester University were from those involved in researching health issues in children and groups affected by respiratory diseases. Their opinion was that, apart from their work on the cohort study, they would probably use the information platform irregularly. At De Montfort University responses were received from those working directly on traffic emissions and emissions models and thus felt they would use the system on a more regular (e.g. monthly/weekly) basis.

Those who provided feedback felt the information platform would help to control and improve traffic congestion and provide information that will assist with both work and personal travel. However many secondary users felt the survey was too technical and they did not have enough knowledge of certain issues to provide answers (i.e. on questions such as 'how often should pollution levels be updated?'). There was a similar body of opinion from primary users who felt the questionnaire was too long. Some felt they did not have enough knowledge to provide comment or opinion on some questions. Most primary users failed to complete all aspects of the questionnaire, however through targeting a wide range of individuals within each department we did receive feedback for all sections covered by the survey.

Table 12 Secondary Users Identity

	Organisation	Function / Responsibilities	Address	Telephone / Fax	E-Mail
1	Leicester Children's Asthma Centre	Health of Asthmatics	Department of Child Health, University of Leicester, PO Box 65, Leicester, LE2 7LX	0116 252 5810/0115 252 3282	Jg33@le.ac.uk
2	MRC Institute for Environment and Health		University of Leicester, 94 Regent Road, Leicester, LE1 7DD	0116 223 1600/0116 223 1601	Ir24@le.ac.uk
3	Institute of Energy and Sustainable Development	Research of Traffic Schemes and modelling	De Montfort University, Neverleys Building, Scraftoft, Leicester, LE7 9SU	0116 2577978/0116 2557981	Kturpin@dmu.ac.uk
4	Transport 2000 (Leicestershire)	Local NGO	15 Heath Court, Hinckley Road, Earl Shilton, Leicester, LE9 7LJ	01455 850876	
5	ENVIRON	Employed to get citizens to complete Part C of questionnaire (50 completed)	Environ, Parkfield, Western Park, Leicester, LE3 6HX	0116 222 0222	Cacton@environ.org.uk

Table 13 Primary User Identity

	Organisation	Function / Responsibilities	Address	Telephone / Fax	E-Mail
1.	Environment Team Policy Unit (LCC)	LA21, EMAS, Sustainable development	New Walk Centre, Welford Place, Leicester, LE1 6ZG	0116 252 7258	
2.	Environmental Protection (Charnwood Borough Council)	Air Quality and Noise Management	Corporate and Environmental services, Macaulay House, 5 Cattle market, Loughborough	01509 634650	Env_health@charnwoodbc.gov.uk
3.	Leicestershire County Council	Local Transport Plan, traffic Policy, Highway Authority	Dept. of Planning and Transportation, Glenfield, Leicester	0116 2657183	jmarriott@leics.gov.uk
4.	Area Traffic Control (LCC)	Traffic Control	York House, 91 Granby Street, Leicester	0116 299 5678	Atc@lccatc.demon.co.uk
5.	Area Traffic Control (LCC)	Traffic & Travel Info	York House, 91 Granby Street, Leicester	0116 299 5678	Atc@lccatc.demon.co.uk
6.	Area Traffic Control (LCC)	Highway Network management	York House, 91 Granby Street, Leicester	0116 299 5678	Atc@lccatc.demon.co.uk
7.	North West Leicestershire District Council	Local Government, Environmental Management	Council Offices, Coalville, Leicestershire, LE67 3FJ	01530 454575/0153 0 454690	Mann.nigel@nwleicestershire.gov.uk
8.	Traffic Group (LCC)	Local Transport Provision	6 th Floor, Block A, New Walk Centre, Welford Place, Leicester, LE1 6ZG	0116 252 6563/0116 255 9782	Thomh002@leicester.gov.uk
9.	Birmingham City Council	Local Government (Environment and consumer services)	581 Tyburn Road, Erdington, Birmingham		Gec70@dial.pipex.com
10.	Blaby District Council	Environmental Health Services	Council Offices, Desford Road, Narborough, Leics, LE9 5EP	0116 2727546/0116 2727594	Environmental_health@blaby.gov.uk
11.	Babtie	Providing engineering and transport services for Kent County Council	Sandling Block, Springfield, Maidstone, Kent, ME14 2LQ	01622 696917/01622 677784	Richard.wolley@babtie.com
12.	Pollution/Environmental Health Group (LCC)	Pollution control and environmental health	New Walk Centre, Welford Place, Leics, LE1 6ZG	0116 2526439/0116 2526444	Coopn001@leicester.gov.uk
13.	Bristol City Council Environmental Quality Team	Air Quality Management, Water Quality, Quality of Life Indicators	Create Centre, Smeaton Road, Bristol, BS1 6XN	0117 9222745/0117 9224433	Env_qual@bristol-city.gov.uk
14.	Development Plans, LCC	Statutory and non-statutory strategic and local planning, Regional Planning guidance, structure and local plans, waste local plan	E&D, Leicester City Council, A Block, NWC, Welford Place, Leics, LE1 6ZG	0116 252 7251/0116 255 6385	Chapd001@leicester.gov.uk
15.	Rotherham Borough Council	Environmental Health	73 Alma Road, Rotherham	01709 823121/01709 823147	
16.	Leeds City Council, Housing and Environmental Health Services	Housing and Environmental Health	155 Kirkstall Road, Leeds, LS4 2AG	0113 247 5967/0113 247595	

2.3 Objectives

2.3.1 Objectives of public administration

Leicester City Council is enhancing the integration of a wide range of applications started in the EQUAL project. The DSS will make these available via the Council's intranet to appropriate officers; via virtual private network to authorised academics/researchers; and via the internet and other means to all these and the public at large. The information may be targeted to a variety of users, with a range of controlled or open access. Within the Council's administration the officers may be working on differing time resolutions ranging from strategic (land use planning, air quality review, traffic demand management strategy policies etc); medium term (forecasting, TDMS selection, traffic & travel information etc); 'near real-time' (demand responsive management of the traffic network and the environment etc). The DSS will focus on air quality, noise and weather; traffic network management and control; traffic and travel information.

The main objectives focused on by the other primary users included providing information on pollutants for both the administration and citizens, Modelling the environmental effects of long-term transport policies and getting information to support policy makers in the future. Individuals working within the Traffic Departments felt information about the noise impacts of traffic schemes would be useful, especially in residential areas. They also expressed the opinion that the dissemination of this type of information to the public would be improved. There was a requirement from individuals in both the Environmental and Traffic Departments to use the system for modelling the effects of temporary traffic measures, but on a more infrequent basis than for long-term policies. Some individuals in the Environmental Departments would also like to use the system for obtaining health information and to facilitate their departmental work.

The Environmental Departments require information to enable them to respond to specific accidents/incidents, obtain information to pass to the public regarding air pollution levels and information on the related health implications. The availability of data to enable comparison with their own data and to assist them with long-term management plans, was also an important requirement identified by these departments. In the long-term those involved directly with air pollution monitoring think that the DSS will assist with work being carried out on the Air Quality Review and Assessment and with any planning required for designation of Air Quality Management Areas. The availability of this type of data will also help to provide accurate information to the public and improve the system of dealing with pollution episodes and complaints. This will enhance the tools available for consultation and participation with the public.

Traffic Departments feel the system will contribute significantly to improving the city's transport systems by providing accurate information regarding the traffic and travel situation and thus assisting in the 'choice of travel mode' by both the administration and the public. In particular this would contribute to the success of the £20 million public transport schemes identified in the Local Transport Plan (LTP).

It is important that information provided by the DSS is accurate, meaningful and easy to understand.

2.3.2 Objectives of the Secondary Users

Local citizens and those working for NGO's and local business', feel they would use the information platform to assess traffic levels in the local area, avoid congestion and traffic jams and for the planning of personal and work related journeys. Transport 2000 feel the system should be used in conjunction with local bus companies to improve services, especially on high pollution days. The provision of predictive data will enable the bus companies to reduce fares on relevant days thus encouraging increased use of the service. Local traffic control services could also prioritise bus services within the city to a greater extent on these days, to also further encourage their use. An important objective of the Information platform is to provide information to enable the public to make environmentally friendly choices, especially with regards public transport and personal health. The majority of citizens providing feedback indicated that they would use the information platform on a regular basis, either weekly or daily.

Those involved in research on respiratory health issues will use the information platform for integrating modeled air pollution data with the development of respiratory diseases and estimating exposure levels of certain groups by correlating data from air pollution models with postal codes and specific locations. Individuals working at the Institute of Energy and Sustainable Development, at De-Montfort University would like to use the system to validate with other traffic emissions models.

2.4 Functionalities of the System

2.4.1 Functionalities of the information system

All the pollutants, CO, NO_x, CO₂, PM, O₃, SO_x, Benzene, 1,3 Butadiene and Pb should be measured by Law, as directed by the Air Pollution EU Daughter Directives. However, few users know any details or provided feedback in this matter. Those working directly with air pollution matters, (mainly those in the Environmental Departments) have some knowledge in this area and provided feedback regarding most air pollutants and the law.

The two pollutants that featured in most responses were NO_x and PM. All users of the system require this information. Those working within the Traffic Departments feel that all the air pollutants should be measured although currently they were less interested in SO_x and Benzene. Those in the Environmental Departments were currently only interested in CO, NO_x and PM, and possibly HC and Ozone measurements. Other pollutants mentioned included 1,3 Butadiene and Pb, but again these are not seen as important enough to be measured.

Researchers and NGO members feel that all the pollutants are important and should be measured, but with NO_x and PM being the most essential information required. Ozone was mentioned as a requirement, with some feeling it should be modeled within the system even if not measured directly, especially as O₃ increases the sensitivity of the respiratory system to other important pollutants. For those involved directly in health research, it is a requirement that information on 'fine particulate matter' is provided and additionally the chemical composition of pollutants to provide an indication of the probable source of pollution episodes. Citizens found it difficult to provide feedback in this area due to a low level of knowledge regarding individual pollutants. Most are familiar with Carbon Monoxide and Carbon Dioxide, but had not really heard much regarding other air pollutants. However, Carbon Monoxide and Particulates were most commonly cited as pollutants that should be monitored and reduced.

All users feel that air pollutants should be measured at both single street and area/district level. Single street measurements are especially important for research purposes, to enable specific problems to be pinpointed. Some citizens and NGO members feel that certain long roads that are particularly congested

should have several measurement points along them, providing a better indication of the situation (modelling is probably the economic answer here). Those Modelling pollution and working closely with the health authority feel that a facility able to model air pollutants at individual properties is needed. This is especially due to work involved in the cohort study. Those working in the Environmental Departments feel that area/district measurements are especially important, in particular villages and housing estates. This information would assist with the identification of problem areas, especially in relation to the designation of Air Quality Management Area's (AQMA's). City and regional level pollution information is an important requirement for primary users of the system as it will assist them when working with neighboring authorities. Transport 2000 feel it is important that pollution levels are modeled in very localised areas throughout the city and are carried out at exhaust height, where the pollutants originate and thus are more concentrated (canyon modelling is probably the answer here).

For the primary users it is important that the main pollutants of interest (PM and NO_x) and Carbon Monoxide, are measured at hourly, 6 hourly and 24 hourly time intervals. Other pollutants, such as, HC's, CO₂, Benzene and SO_x should be measured on a 12 and 24 hour basis, with requirements for 15 minute measurements of SO_x being important as well. Those working for the Environmental Departments stipulate that information on the time resolution of air pollution measurements must be provided in line with existing and future Air Quality Regulations and the National Air Quality Strategy. It is also felt that hourly measurements are important for assisting with the prediction of pollution episodes, whilst 12/24 hour measurements are needed for 24 hour pollution forecasts.

For citizens the provision of pollutant information on an hourly and 24-hourly basis is most important. This is possibly due to the fact that the hourly update would provide more relevant and accurate information, while the 24-hour update would be more relevant in terms of health and journey planning, and influence how often they would use the system. However some researchers need information on an hourly, 6-hourly and 12-hourly basis for purposes relating to their work.

For all primary users it is essential that the limits for pollutants and the limits when measures should and will be implemented automatically, are provided. This is seen as especially important by some users as it will assist departments when advising the public on pollution problems and methods for dealing with these episodes. Information regarding pollution limits when measures will be implemented, is also seen as important by the majority of secondary users, however some feel this information would be more important to members of high risk groups such as asthmatics and those with young children, than for themselves.

The researchers and NGO members see seasonal and annual impacts of all pollutants (especially air pollution) as very important and thus are a requirement from the system. Transport 2000 identified annual impacts as a possible source for monitoring global warming. However, citizens are most interested in monthly measurements, with daily impacts seen as moderately important. There was also an interest for information on annual impacts. The Traffic Department users feel that daily and monthly impacts are important, whilst the Environmental Departments feel all measurements have some importance and thus all should be provided by the system.

The Traffic Departments would like to obtain information on noise in all areas, (i.e. noise levels, number of people and dwellings affected). This is required for strategic planning and in relation to new traffic schemes that are proposed or have been recently implemented. The Environmental Departments also feel that noise pollution information, in all areas, is an important requirement from the system, especially measurements of L_{(A)eq}, L_{(A)10} and L_{(A)90}. Few users were aware of the law governing noise pollution.

The spatial requirements for noise pollution were again similar for all users. Single street information is very important, as is area/district measurements. This is related directly to traffic noise, which effects

certain streets and possibly areas, but does not cause an overall problem on a city or regional level and thus it is less important to get information at this level. However, many citizens did show interest for noise levels on a city scale. Again, Transport 2000 feel it is important that measurements of noise occur on a higher spatial resolution than single street, with sensors possibly being placed on 'high rise' buildings. Citizens and researchers feel it is very important to be provided with information on noise levels and the number of people affected by this pollutant, few saw that 'the number of apartments affected' as important. For citizens the level of noise pollution is important in the vicinity of their living and working areas.

For noise all users require information on a 24 hour basis, however very few primary users responded to this question, many feeling they are unqualified to provide an answer or opinion, although some feedback was obtained from the Environmental Departments. The views of the Environmental Health officers involved in Birmingham City noise monitoring/mapping project were sought. The users of the information platform (secondary users) feel that 24-hour measurements are the most important, with 6-hourly measurements seen as quite useful.

Although it is felt that noise generally has more to do with quality of life than actual health, it is still seen as an important requirement of the system. Information on limits for noise pollution are important, although limits for air pollutants are more important to citizens and all other users. Information on pollution limits is seen as essential by most secondary users, however researchers feel this information is not essential as they can obtain similar details from other sources. None of the DSS or information platform users are aware of any law governing spatial resolution for pollution measurements.

2.4.2 Information Channels

The most popular methods for dissemination of information to the public are via VMS, Internet terminals, radio broadcasts and RDS-TMC systems. Mobile phones, kiosks, newspapers and data collections are seen as additional methods for dissemination by the public administration. Citizens feel that kiosks and public display units would be very useful for receiving information. The most desirable methods for receiving information, identified by the secondary users, are radio and Television, with Teletext also being chosen as very useful by quite a high percentage. For the internet, both at home and in the office, the most frequently stated answers were 'very useful' (30 %) and 'not so useful' (35%). This could relate to whether or not people have access to the internet. An additional method for relaying information to the public could be through local and regional newspaper, which are accessible to all members of the City.

Additional requirements for the DSS system, stipulated by the primary users, include online help, access to data records, integration of Meteorological information, traffic situation and forecast. These last three are seen as very important requirements as they all effect pollution levels directly. An additional requirement is historical Meteorological and traffic information, which would be used for predictive purposes. When questioned regarding additional features for the system, the secondary users identified all possible choices, including health, traffic forecasts, emissions and noise and the current traffic situation, as being very useful and a requirement of the system.

For primary users the most important requirement for displaying information is through visualisation on maps. If it is not a direct function of the system it has been stipulated that this is available on request as it would prove very useful for monitoring traffic schemes that have been implemented. The most preferred method for communicating information on both noise and air pollution levels, identified by secondary users, is also via maps. Charts were identified as a second choice. If period reports were chosen for communication methods, the use of colorful maps, similar to those currently used for visualising pollen levels, would prove very useful and easy to understand.

2.4.3 Functionalities of the DSS

All primary users reported that the system will be used for two main functions. Policy makers will use it as a support tool in Modelling the environmental effects of long-term transport policies, while the public administration will use it to assist in their daily work and to improve information flows. Some individuals working within the Traffic Departments also feel the system will be used by policy makers as a support tool to model the environmental effects of any temporary traffic measures and as a tool to assist decision makers in optimising traffic flow.

The most desired function for the DSS is in a Modelling capacity. All primary users feel that the ability to evaluate environmental effects of long-term transport policies is essential. Current and historically monitored and modeled data is required by the Traffic Departments for Local Transport Plan (LTP) monitoring and by the Environmental Departments for the current and future Air Quality Review and Assessment process. The Modelling functions are an essential requirement by all primary users and would become an important part of evaluating strategies for the LTP and assisting with air quality management areas. Thus information required must be in line with general air quality and traffic modelling functions.

Those working within the Environmental Departments also require information on alarm levels and alarm functions, for dissemination of information to the public, assistance with the advice system for the public and for the tracking of pollution episodes. This would require information on levels above trigger levels.

The generation of optimal traffic demand management strategies for minimising the impact of traffic emission levels as the various thresholds are reached is a requirement by many of the primary users, as it would assist those working within the area of traffic management for the implementation of the transport policy. Also required are functions which provide up to date health information. This type of data would assist in providing information and advice to the public and with LTP monitoring. An additional objective that has been identified is the ability to assess the impact of area-wide traffic schemes, for example, traffic calming.

Overall those working within the area of traffic management believe the DSS system will contribute significantly to the provision of traffic and traveler information, which is essential for encouraging intermodal travel and improving the efficiency of the transport system. More specifically it will contribute to the success of the £20 million public transport scheme bid included within the current LTP document. Within the Environmental Departments the DSS will improve the quality of work by providing more data to work with when completing Air Quality Review and Assessments and planning for Air Quality Management Areas. It will also assist in the dissemination of information to the public by providing more accurate and up to date data on pollution episodes and traffic etc.

2.5 Transport Measures, which can be supported by the DSS System

2.5.1 The Traffic Situation in Leicester City

Air quality and noise are identified as environmental problems within Leicester City, although noise, many feel is less of a problem. Pollution Control are concerned about noise pollution in relation to planning applications, especially for residential areas. However, problems with noise pollution can be a very localised issue compared to those concerned with air pollution. The public also regard air pollution as a relatively important issue, whilst as with most users feel noise is only a moderate problem, if a problem at all. The main causes of both air and noise pollution are motor vehicle traffic and industry. Domestic noise has also been identified as a possible source of elevated noise levels. The main areas affected by traffic problems are the city centre and main road axes. More specifically the A6, A46, inner

ring roads and radial roads are the major problem areas. However, some individuals feel the problems are citywide and there are no hot spot areas.

The problems identified above stem from a number of causes. Mainly an insufficient public transport system, which is of poor quality and high cost and intense use of the private car, causing traffic congestion and accidents. Also contributing to the problem is an insufficient road infrastructure, the absence of strict pollution regulations, insufficient policing of illegal parking and poor maintenance of roads, footpaths and cycleways, making alternative travel unsafe and unpleasant. The delivery of goods and lack of control due to insufficient law are also thought to contribute to the problem but only on a minor level.

2.5.2 Description of Potential measures to improve the Situation within Leicester City

The current actions/systems already in place within Leicester and its surrounding areas to try and improve the problems of air quality and traffic congestion include traffic and travel information informing road-users and citizens', access, parking, speed, waiting and weight restrictions', 'Congestion management', and 'Re-routing'. These systems are performed and implemented by different departments within the Environment and Development Department of Leicester City Council. The Traffic Services (Area Traffic Control and Traffic) are involved with congestion management and informing road-users, speed restrictions and traffic management including re-routing.

It is planned to improve the overall situation within Leicester by developing these systems further in the future. Work Place Parking and Access control may also be implemented, although not during the lifetime of this project. Many individuals feel the following traffic management techniques would further reduce pollution problems within the city. Parking control, pedestrianisation, improved cycle routes, Urban Traffic Management and Control Systems, Intelligent Telematics Systems, Vehicle Emissions Standards and an improved road network, Park and Ride, lorry bans, traffic calming, Bus priority, Light Rapid Transit Systems, Road Pricing and the Limiting of Delivery Times.

Many citizens and other secondary users feel a number of traffic measures could help improve the city in regards to air and noise pollution. Many feel strongly that public transport should be improved and the number of facilities increased, for example, a significant reduction in fares when pollution episodes occur and the introduction of LRT or tramways. Facilities for pedestrians and cyclists should also be developed to make it safer to use this method of travel.

Possible temporary measures suggested include the use of VMS, car free days, low emission zones, tighter control on speed limits and traffic light priority to buses, cycles and pedestrians. The provision of information on air pollution and noise levels would influence the majority of secondary users to some degree. Most indicated that being able to obtain this information would influence their behavior either to a small amount or moderately. Methods by which their behavior may be influenced include choosing detours, different times for travelling and not making unnecessary journeys in their cars.

2.5.3 Benefits of the DSS System

The opinions regarding which policies/actions will be facilitated by the DSS System vary a great deal among the primary users. All feel that systems currently in place i.e. Traffic and Travel Information (via the TIS) informing Road-users and Congestion Management will definitely be facilitated by the system. Those working in the Traffic service feel the system would also assist with implementing and actioning road pricing and access control, whilst those working within the Environmental Departments and Area Traffic Control feel that re-routing and speed restrictions will be assisted by the DSS system.

Three quarters of citizens support the idea of traffic being restricted or diverted in some way on days when air pollution or noise reaches critical levels. However, road blocks/diversions were the least favored temporary traffic measure, with the most favored being Variable Message Signs and control of traffic signals. It is indicated by these results that the DSS would provide benefits by providing up to date information to the public who are prepared to make use of this information and comply with the measures being implemented.

2.6 Description of Local Data Exchange Requirements

Table 14 A: Needs and functions (Environmental Modelling)

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution ⁷	Sub-functions	Appropriate Model	Required Data
Modelling of air pollution	CO	Primary Users: 1, 6, 24 Hourly	Single Street, City area/district	<ul style="list-style-type: none"> Emissions Traffic Other emissions Background pollution Dispersion to produce concentration 	<ul style="list-style-type: none"> AIRVIRO AIRVIRO OPANA/NAME Gaussian (AIRVIRO) Grid (AIRVIRO) 	<ul style="list-style-type: none"> TRIPS + SCOOT – Congestion, Flows, Delays, Stops, Emissions Factors Emissions Data base AUN Monitored data and RPM Short-term weather forecasting
		Secondary Users: 1, 24 Hourly				
	NO _x	Primary Users: 1, 6, 24 Hourly				
		Secondary Users: 1, 24 Hourly				
	HC	Primary Users: 12, 24 Hourly				
		Secondary Users: 1, 24 Hourly				
PM	Primary Users: 1, 6, 24 Hourly					
	Secondary Users: 1, 24 Hourly					
SO ₂	Primary Users: 12, 24 Hourly (15 minute monitored)					
	Secondary Users: 1, 24 Hourly					
O ₃	Primary Users: Hourly					

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution ⁷	Sub-functions	Appropriate Model	Required Data
		Secondary Users: 1, 24 Hourly				
	Chemical Composition	In line with researchers requests	City area/district Region	Not in Heaven	Not in Heaven	Not in Heaven
Modelling of Noise pollution	Noise Pollution Concentration $L_{(A)eq}$ $L_{(A)10}$ $L_{(A)90}$ $L_{(A)50}$	<Hourly Hourly, 24 Hourly	Individual property Single Street City area/district City Wide	<ul style="list-style-type: none"> • Vehicle Noise Emission Prediction (Leq, L10, L50, L90) • Basic Noise level prediction (Leq, L10, L50, L90) • Prediction for point Contour Generation • Advanced Noise Level Prediction (Leq, L10, L50, L90) • Prediction for a point contour generation 	<ul style="list-style-type: none"> • AVTUNE 	<ul style="list-style-type: none"> • Geometric Information (Coordinates, Width) • Road Classification => Mean Speed, Flow, Composition • Gradient, Surface Type • Static Flow Volumes (non-SCOOT, TRIPS/AIRVIRO) • SCOOT/AIRVIRO Flow, Estimate from SCOOT/AIRVIRO data • Ground cover, Street Type (Open, single Façade, Canyon, Broken etc), Source height • Building locations and Dimensions
	People impacted	<Hourly Hourly, 24 Hourly	Individual Property Single Street City area/district City Wide			

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution ⁷	Sub-functions	Appropriate Model	Required Data
	Apartments affected	<Hourly Hourly, 24 Hourly	Individual property Single Street City area/district City Wide			<ul style="list-style-type: none"> • Ground Topography (Slopes, Cuttings, Elevated Sections) • Building Acoustic properties • Frequency Spectra • Wind Speed and Direction, Temperature, relative humidity, Atmospheric pressure • Population Distributions • Sensitive Building Locations
Limits for pollutants	Levels of pollution that are classed as the highest agreeable level without posing a risk (according to law)			<ul style="list-style-type: none"> • Database of legislative pollution limits 	<ul style="list-style-type: none"> • AIRVIRO 	<ul style="list-style-type: none"> • Pollution limits set by EU, National and regional legislation
Limits when measures will be implemented	Levels of pollution which will cause the initiation of pollution controlling measures			<ul style="list-style-type: none"> • Limits when measures implemented • Measures to be implemented 	<ul style="list-style-type: none"> • UTC • Airviro 	<ul style="list-style-type: none"> • Pollution limits • Traffic signal measures • Traffic demand strategies

The above table shows the Air pollutants identified through the user needs questionnaires. It can be seen that the needs of primary users vary slightly from those of the secondary users. The identification of the need for chemical composition of pollutants occurred through the requirements of researchers, specifically those working in the field of health effects of pollution. However, this User Need will not be realised during the duration of

HEAVEN and thus has not been explained in the table. All air pollution modelling will occur using mainly Airviro, with the data produced from other models (NAME/OPANA) also being fed into AIRVIRO as background or imported pollution data.

The requirements for monitoring and modelling of noise pollution are indicated above. In this instance both primary and secondary users identified very similar needs. All requirements for noise will be realised through the noise model AVTUNE, thus the WP5 functions for all noise user needs are the same as indicated in the table. The data requirements for each noise measurement (i.e. number of people affected or number of apartments affected) will be the same as all this data will be inputted into the AVTUNE model and the forecast, according to spatial and time resolution, will be calculated.

According to EU and UK legislation, many pollutants have recommended limits above which there is a risk of health problems, thus it is important that the users of the Heaven system have access to this information. Through AIRVIRO a database will be available that will provide this information and subsequently enable policy and decision makers to decide when TDMS will be implemented. Thus both the two users needs, Pollutant limits and limits when measures will be implemented, will be realised through further development of the AIRVIRO database

Table 15 B: Needs and functions (Environmental Modelling)

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution	Sub-functions	Appropriate Model	Required Data
Decision support Scenarios / forecasts	Health Statistics	On demand Max. 1 hour old	Individual buildings	<ul style="list-style-type: none"> Health Study Pollution Data 	<ul style="list-style-type: none"> AIRVIRO 	<ul style="list-style-type: none"> Emissions data Life Style Data
	Environmental Modelling	On demand Max. 1 hour old	Street/district	<ul style="list-style-type: none"> Weather Forecasting Regional Modelling Local Modelling (250x250m, 500x500m and 1x1m) 	<ul style="list-style-type: none"> NWP OPANA/NAME AIRVIRO 	<ul style="list-style-type: none"> Meteorological data, Network Parameter Met office forecast data, Name model outputs, lane use and emissions database Traffic Flow, Network parameters, Meteorological data, ambient air quality data
				<ul style="list-style-type: none"> Noise modelling 	<ul style="list-style-type: none"> AVTUNE 	<ul style="list-style-type: none"> Static road section database, Static receiver grid database, Traffic flow, speed and composition data Static topographical data, Meteorological data
	Traffic Modelling	On demand Max. 1 hour old	Street/district	On-line: <ul style="list-style-type: none"> Congestion Incident Actual data Historic data 	<ul style="list-style-type: none"> COMIS ASTRID INGRID SCOOT ASTRID 	<ul style="list-style-type: none"> SCOOT data – delays, flows, congestion, stops, saturation SCOOT data – delays, flows, saturation, historical flow parameters, detector flow, detector occupancy, stage length and journey time SCOOT data from ASTRID ¼ second occupancy of vehicles on traffic detectors As described above
				Off-line: <ul style="list-style-type: none"> TDMS Library General information for modelling 	<ul style="list-style-type: none"> SATURN TRANSYT TRIPS 	<ul style="list-style-type: none"> Signal timings, 0+D matrices, numbers of links and junctions, network etc Average traffic flows Network, junction, turn penalty, light vehicle matrix, heavy vehicle matrix, specification of geometric layout parameters, geographic jurisdiction and off-road features

Both Traffic and Environmental modelling will be carried out by a number of different models (Table 2b), with the outputs being fed into the DSS and subsequently used by policy and decision makers. Selective information will be passed on by the Primary Users and made available to Secondary Users through the information platform. As part of the cohort study, relevant modelled [and monitored] data will be analysed through AIRVIRO, which will be updated as part of HEAVEN.

Table 16 Needs and functions (User Interface)

User Needs (WP4)		Functions (WP5)
What?	Module	Sub-functions
Variable Message Sign	EQUAL	<ul style="list-style-type: none"> • Integrate air & traffic databases
Internet/Intranet	Internet/Intranet-client	<ul style="list-style-type: none"> • Internet/intranet-client for information representation
Radio		<ul style="list-style-type: none"> • Radio Stations must use DSS
RDS-TMC		<ul style="list-style-type: none"> • Radio Stations must use DSS
Public Display		<ul style="list-style-type: none"> • Use internet-client
Cable		<ul style="list-style-type: none"> • Cable Net Work must use DSS
Newspapers		<ul style="list-style-type: none"> • Newspaper Officers/editors must use DSS

Most methods for dissemination of information will have direct links to the DSS. Information will be passed electronically from the DSS, for example to Variable Message Signs via the EQUAL system, or manually through extraction of information from the DSS, i.e. for information being disseminated using the radio or local Newspapers.

Table 17 System Needs and functions (System Modules)

The DSS also requires certain system functions that will not be directly accessed by the user. These, for example, include the transferring of data from a traffic management centre and the acquisition of meteorological data.

System Needs (WP5)				Functions (WP5)	
What?	Module	Time resolution	Spatial resolution	Sub-functions	Required Data
Traffic Incident Detection	Incident Detection Module	15 minutes	Demand responsive signal control areas – INGRID, ASTRID, COMIS, MATTISSE, TISDB	<ul style="list-style-type: none"> • ASTRID 	<ul style="list-style-type: none"> • SCOOT data – delays, flows, saturation, historical flow parameters, detector flow, detector occupancy, stage length and journey time
				<ul style="list-style-type: none"> • INGRID 	<ul style="list-style-type: none"> • SCOOT data from ASTRID
				<ul style="list-style-type: none"> • MATTISSE 	<ul style="list-style-type: none"> • Incident data (inputted manually), i.e. road works, accidents, floods etc
				<ul style="list-style-type: none"> • TISDB 	<ul style="list-style-type: none"> • Historical, Current and Future incident data
Traffic Congestion	Congestion module	5 minutes		<ul style="list-style-type: none"> • COMIS 	<ul style="list-style-type: none"> • SCOOT data – delays, flows, congestion, stops, saturation
Calibration of models	Calibration Module	As for individual models		<ul style="list-style-type: none"> • As for individual models 	<ul style="list-style-type: none"> • As for individual models

Table 18 Required data (Environmental modelling)

Function (WP5)	Required data (WP5)	
Modelling air pollution	Statistical data (temporal resolution >= 1 year)	<ul style="list-style-type: none"> • Vehicle Emission Factors • Traffic Model data • Emission database (point /area/ source/line)
		<ul style="list-style-type: none"> • Historical weather database • Historical Air Quality Monitoring • Topography
	<ul style="list-style-type: none"> • Dynamic Data (temporal resolution = 1 year) 	<ul style="list-style-type: none"> • SCOOT/Vehicle traffic data • Monitored Air Quality • Monitored Weather
		<ul style="list-style-type: none"> • Forecast Air Quality • Forecast Weather
Modelling noise pollution		
<ul style="list-style-type: none"> • Vehicle Noise Emission Prediction (Leq, L10, L50, L90) 	<ul style="list-style-type: none"> • Statistical Data (Temporal resolution >=1 year) 	<ul style="list-style-type: none"> •
	<ul style="list-style-type: none"> • Segment Line Source 	<ul style="list-style-type: none"> • Geometric Information (Co-ordinates, Width) • Road Classification => Mean Speed, Flow Composition • Gradient • Surface Type • Static Flow Volumes (non-SCOOT, TRIPS/AIRVIRO)
	<ul style="list-style-type: none"> • Dynamic Data (temporal resolution = 1 hour) 	<ul style="list-style-type: none"> •
	<ul style="list-style-type: none"> • Vehicle Flow Volumes 	<ul style="list-style-type: none"> • SCOOT/AIRVIRO Flow
	<ul style="list-style-type: none"> • Vehicle Speeds 	<ul style="list-style-type: none"> • Estimate from SCOOT/AIRVIRO data
	<ul style="list-style-type: none"> • Vehicle Queues 	<ul style="list-style-type: none"> • Estimate from SCOOT/AIRVIRO data
<ul style="list-style-type: none"> • Basic Noise level prediction (Leq, L10, L50, L90) 	<ul style="list-style-type: none"> • Statistical data (temporal resolution >=1 year) 	

Function (WP5)	Required data (WP5)	
<ul style="list-style-type: none"> Prediction for point Contour Generation 	<ul style="list-style-type: none"> Propagation Information 	<ul style="list-style-type: none"> Receiver Co-ordinates Ground Cover Street Type (Open, single Façade, Canyon, Broken etc) Source Height
<ul style="list-style-type: none"> Advanced Noise Level Prediction (Leq, L10, L50, L90) 	<ul style="list-style-type: none"> Statistical Data (temporal resolution ≥ 1 year) 	
<ul style="list-style-type: none"> Prediction for a point contour generation 	<ul style="list-style-type: none"> As for both Emissions and Basic Noise level Predictions + 	
<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Topographical Information 	<ul style="list-style-type: none"> Building Locations and Dimensions Ground Topography (Slopes, Cuttings, Elevated Sections)
<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Propagation information 	<ul style="list-style-type: none"> Building Acoustic Properties Frequency Spectra
	<ul style="list-style-type: none"> Dynamic Data (temporal resolution = 1 hour) 	
	<ul style="list-style-type: none"> As for both Emissions and basic Noise level Predictions + 	
<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Meteorological Data 	<ul style="list-style-type: none"> Wind Speed and Direction Temperature Relative Humidity Atmospheric pressure
<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Demographic Data 	<ul style="list-style-type: none"> Population Distributions Sensitive Building Locations

3 PARIS

The regional user needs analysis has identified requirements of different user groups of the air quality decision support and information system that HEAVEN intends to implement in Paris. The UNA results described in the present document should enable the project to implement a system which meets the users' needs and which adds value over existing systems.

The UNA for the Paris region has been conducted following the common approach defined by the HEAVEN partner cities. The common approach to UNA is motivated by the objective of classifying user needs across the six participating cities and of making a comparative analysis, in order to establish a basis for the definition of a common system architecture, of common rules for system implementation, and of common validation criteria. Also, such results will be useful for ensuring the transferability of the achievements of the HEAVEN project.

The situation in the Paris region is characterised by a fairly advanced existing system for air quality information and decision support. This system is operated by AIRPARIF, who leads the regional HEAVEN consortium. AIRPARIF has presented, from the beginning of the HEAVEN project, a clear orientation for the system developments to be achieved by the project: link traffic and air quality data. In consequence, the regional stake of the project is narrower than the thematic coverage of the common UNA approach.

For these reasons, there have been some discrepancies between common approach and specific regional situation. We have complemented the information obtained by means of the common questionnaires through interviews and discussions, in particular with representatives of AIRPARIF, who have a large technical and political experience in the matter, as all important decision makers are represented in AIRPARIF's administrative board. Also, we have tried to indicate consistently which user requirements are met by the existing system, and which requirements correspond to desired new features.

3.1 User groups

3.1.1 Roles of Authorities, Decision Makers, and AIRPARIF

The following table represents in simplified manner the distribution of responsibilities for improving air quality in the Ile de France region:

What ?	Who ?
Monitor air quality	AIRPARIF
Propose and promote measures	Authorities
Decide on application of measures	Decision makers
Implement measures	Authorities
Evaluate impact of measures	AIRPARIF

AIRPARIF, authorities (departments of public administration), and decision makers are among the potential users of the HEAVEN DSS.

The organisation AIRPARIF has been created in 1979. It has a well-structured and broad institutional support. 4 groups of stakeholders in air quality issues are represented with equal weight, and each group's representation does quite completely reflect its internal spectrum. The 4 groups are:

- Representatives of national administrations for Environment, Transport, Industry, Health
- Representatives of regional political authorities
- Representatives of industry and transport
- Experts and representatives of NGOs.

AIRPARIF is in charge of:

- Monitoring air quality
- Informing authorities and citizens on air quality
- Forecasting air pollution episodes
- Evaluating the impact of measures for reduction of pollutant emissions.

Hence AIRPARIF is relatively independent. In particular, it is not part of a determined sector of public administration. However, AIRPARIF's responsibilities are limited, as the role of monitoring air quality and of evaluating measures is dissociated from the role of preparing and implementing measures for air quality improvement.

AIRPARIF is the leader of HEAVEN in Paris-Ile-de-France. AIRPARIF operates the existing air quality monitoring and information system, and will be the operator of the HEAVEN DSS and information platform.

3.1.2 Authorities

Behind AIRPARIF who operates the system, the administrative bodies form the largest group of users for which the HEAVEN DSS of Paris-Ile-de-France is developed. They are also among the users of the existing air quality monitoring and information system.

The decision support which will result from the combination of air quality and traffic data will be used in particular by:

- **Traffic departments:** Traffic and transport departments exist on the administrative level of the *région*, on the level of the *départements* (the *région* Ile-de-France consists of 7 *départements* plus the city of Paris) and in the city of Paris. Each level has responsibilities for planning, building, and operating roads. The regional level is under national political control, while the smaller entities are under local political control.
- **Environment departments:** The main activities in air quality issues are deployed, first, by the regional environment department (*Direction Régionale de l'Industrie, de la Recherche et de l'Environnement*) which is responsible for regional air quality, and concerned also with industrial emissions. It acts under national political control. Second, the environment department of the city of Paris deploys important activities, because the air quality problem has been and still is most strongly perceived in the dense core of the urban area. It acts under local political control.

Other potential administrative users of the system are:

- Health departments
- Urban development departments.

3.1.3 Decision Makers

The following decision makers have a certain autonomy, with respect to legal constraints, in deciding on the application of measures for air quality improvement. They will be among the users of the HEAVEN DSS, and are among the users of the existing air quality monitoring and information system.

- **Prefects:** the regional *préfet*, the 7 departmental *préfets*, and the chief commissioner of the police of Paris, have jointly defined procedure for temporary reduction measures for pollutant emission in case of acute air pollution episodes. They decide on which measures, out of the established catalog of possible measures, are to be applied in a particular case. They depend on national political authorities.
- **Mayors:** the mayors may decide on complementary measures for reduction of pollutant emission, which may be overruled, however, by prefectural decisions.

3.1.4 Other Users

Among the users of the existing air quality and information system, and the potential users of the new features of the HEAVEN DSS and information platform, there are:

- Citizens
- Residents of "hot spot" areas
- "Patient groups", and medical services specialized in respiratory diseases
- NGOs
- Research institutions
- Chamber of commerce.

3.1.5 Questionnaires and Interviews

The HEAVEN project in Paris-Ile-de-France being oriented on the link between traffic and air quality data, we have contacted primarily transport and environment stakeholders for User Needs Analysis. The DSS user questionnaire (Part B) has been sent to 3 traffic departments, 3 environment departments, 2 health departments, 1 medical service and 1 environment NGO.

Only two user organisations, one concerned with environment and industry and one concerned with transport planning, have finally provided a completed copy of the questionnaire. No health department has filled in the questionnaire. We have contacted most users by telephone for a second instance, getting the following elements which may help to explain the absence of a positive contribution to the questionnaires.

- 1) The contacted users have been somewhat surprised by a UNA procedure very different from how they usually communicate their needs to AIRPARIF. The contacted administrative bodies have approved the orientation of the regional HEAVEN project through their representation in AIRPARIF's administrative board, when AIRPARIF's participation to HEAVEN has been decided. In contrast, they have now expressed reluctance to intervene in a phase during which, in their opinion, AIRPARIF should be autonomous.
- 2) Reading the questionnaire, the contacted users have judged some more general questions as being too broad with respect to what is planned to be realised by HEAVEN, and some questions as imprecise or not pertinent on the background of the already existing system. The more technical questions have awoken more direct concern; also, two of the contacted higher administrative officials have transmitted the questionnaire to their respective technical specialists with whom we have already started to work for WP5.
- 3) AIRPARIF's representatives had experienced different levels of sensitivity to air quality issues at different administrative bodies on previous occasions; these differences depend on personal, organisational, political contingencies. The pattern of responses to the questionnaires does in some part reflect such differences.
For these reasons, we have completed the information retrieved through the questionnaires through discussions and interviews with AIRPARIF's representatives and other selected persons.

For these reasons, we have completed the information retrieved through the questionnaires through discussions and interviews with AIRPARIF's representatives.

Also, we have interviewed the Head of the Road and Transport Department of the City of Paris.

Concerning citizens, we have not based our results on the few completed copies of the questionnaire (Part C). Instead, we have had access to the results of a qualitative study on the citizens' perception of air quality issues, which has been realised for the Regional Environment Department during november 1999. The study has interviewed a representative sample of 40 citizens.

Also, AIRPARIF's representatives for communication get very frequent feedback from citizens. As 8 out of 10 citizens know the name of AIRPARIF (it is perceived as the single actor in air quality issues), but only few know about the scope of its powers and responsibilities, AIRPARIF receives a lot and a very large spectrum of citizens' feedback.

3.2 Objectives

3.2.1 Objectives of Public Administration

In the HEAVEN project, AIRPARIF and the public authorities aim at enhancing the description of air quality through both background and street level concentrations, at improving significantly the analysis and the description air quality in relation to traffic management measures, at informing decision makers and citizens about this relationship, and at enhancing the forecast of air quality.

The relationship between traffic and air quality is of interest in a short-term and a long-term perspective.

The short term deals with episodes of acute pollution peaks which exceed the limit values of ozone in summer and NO₂ in winter. Thanks to frequent wind, these episodes do not last more than one, two, or three days. The different traffic management measures which are taken in these situations are described further below. The benefit of the temporary measures is controversial. Hence there is an acute need for assessing their real impact on air quality. It is shared by:

- The prefects who decide on the application of temporary measures for the reduction of pollutant emissions,
- The environment and traffic departments who advise the decision makers on the nature of appropriate measures,
- The road operators and authorities who have to implement the measures (some are unpopular),
- Local traffic departments who decide autonomously on accompanying measures,
- Public transport operators who may be forced to open their networks for free,
- Health departments who have to give adequate recommendations to the population and to patient groups,
- The chamber of commerce and others, who contest the overall benefit of the measures.

The long term is concerned with improving the medium level of air quality, in order to comply with the respective EU policy. It is generally accepted that important actions will be required to reach this goal; also, there is agreement on the fact that traffic is presently the main responsible for air pollutant emission in the Paris region. Clearly, all administrations which may be asked to prepare and implement appropriate actions need best possible knowledge about the relationship of traffic and air quality. They are traffic departments, environment departments, and urban planning departments.

While not every questioned administrative body gives the same weight to this need, it is interesting to note that those who give most weight to it, do at the same time consider it as a collective need, not as one special to their role. They say that it is rarely possible to implement efficient measures for better air quality and traffic management within the limited scope of power of one administrative body; and if a significant impact might be reached through an isolated measure, as for example inside the area of the city of Paris, such measures are not generally considered as politically opportune. But, in order to take co-ordinated actions, every participating administration has to be convinced of its benefit (of the benefit for its own geographical domain of competence), and therefore has to have access to the respective concrete information about the relationship between traffic and air quality.

Those who are deciding on temporary traffic management measures which intend to improve air quality, do actually decide measures without being convinced of their direct benefit for air quality. Reliable evaluations of the impact of such measures are not available at present time. Some decision makers do even believe that the impact on pollutant concentrations is contrary (i.e. concentrations augment), as for

example a speed limitation might augment the time during which a car emits pollutants for a given trip in a higher proportion than the speed lowering lowers emission. Most decision makers decide temporary measures for the sake of public awareness raising. To go beyond, and to reach a measurable improvement of air quality, they need reliable impact evaluations.

3.2.2 Objectives of Citizens

Citizens are concerned about "hot spots": points, streets or areas where air pollution is particularly bad. They demand to be informed on such spots, because they wish to avoid them.

In contrast, they believe to know that background pollution is higher in the dense urban area than in the outskirts, and consider generally that their choice of residence (dense urban area, suburban area, outskirts) reflects the extent of their concern about pollution with respect to other factors of their way of life.

In general, citizens do not relate their concern about air pollution to particular pollutants. This relates to the fact that they know little about the effects of air pollution on health.

Most citizens are ready to comply with temporary measures in order to avoid pollution peaks. In contrast, they generally estimate that permanent changes of behaviour must happen on a voluntary basis. They wish to be informed and "educated" in this respect.

3.3 Functionalities of the System

3.3.1 Functionalities of the Information System

The existing information system makes available to citizens:

- A composite air quality index (named "Atmo") ranging from 1 (very good) to 10 (very bad), associated with the name of the responsible pollutant (the index is composed of SO₂, NO₂, O₃ and particulates),
- The index for day D-1, the expected index for day D, the tendency for day D+1,
- 12 sectorial indexes (the region is divided in a central disk and two concentric rings, each divided in 4 sectors),
- An expectational ozone level for the afternoon (in summer),
- Information on exceeded limit values,
- On request, measured pollution levels per station.

This information is updated twice a day.

As a new feature, citizens desire information about "hot spots", i.e. streets or areas where pollutant concentrations are particularly high. The desired information is street level pollution, with a resolution equivalent to the urban and suburban street and road network.

Citizens desire this information in real-time, hence best possible time resolution. Also they desire forecasts.

Regional public administration desires information on background pollution levels at a spatial resolution of districts (*arrondissements*) in the city of Paris and municipalities in the surrounding area. (For a grid to provide this resolution, the distance between the grid lines should be about 2 km.) Such a resolution for the description of background pollution is a new feature.

The city of Paris' administration desires information on street level pollution, the spatial resolution being the one of the urban street network. This requirement corresponds to the new feature demanded by the citizens.

Administration desires a good time resolution, but depending on the pollutant. For NO_x, SO_x, O₃, public administration desires information on hourly basis. For CO, 2 or 3 updates per day are desired. For particulates and hydrocarbons, less frequency is demanded. AIRPARIF's measurements have sufficiently good time resolution to meet this demand. However, for information on background and street level pollution which is based on model outputs, such time resolution goes beyond existing system features.

Public administration demands automatic alarm functions for those pollution limits that are critical for entering into force of temporary measures. The requirements do not go beyond the features of the existing information system.

For the long-term perspective, public administrations desires aggregate values for all pollutants. Principally daily impacts; seasonal impacts are desired for NO_x (winter) and Ozone (summer), annual impacts for benzene and particulates. The desired aggregates (means, medians, percentiles) correspond to the legal provisions and are desired mainly by environment departments. The existing system does not automatically provide these aggregates.

For CO₂, the regional environment department has expressed the desire to know the annual emission totals. Such a feature is not feasible.

3.3.2 Information Channels

The existing information system delivers information by Internet (WWW), Minitel, Teletext, variable message signs of the City of Paris, radio, and daily press.

Citizens demand graphical presentation on maps. Such information is most easily displayed on a WWW interface. A corresponding extension of the WWW interface is a new feature.

There seems to be weak demand for access from mobile terminals.

Public administration has demanded rendering on maps, and data on request. Requests are a feature of the existing WWW interface, while maps will be a new feature.

3.3.3 Functionalities of the DSS

The questioned administrative bodies plan to use the system as a help for evaluating and modelling the environmental effects of transport and traffic management measures for air quality improvement, both on short term (temporary measures for emission reduction) and on long term (transport and environment policy).

The following functionalities have been demanded:

- Modelling of the environmental effects of long term transport policies.
This functionality is demanded by traffic and environment departments which are in charge of preparing measures for the improvement of air quality. The public authorities wish to evaluate the impact on air quality of mid- and long term transport policy action, which may be driven by European or national legislation, by regional plans, or by local or regional political authorities. The functionality requires careful (off-line) emission and dispersion modelling with different hypotheses of traffic volume, speed, composition etc. Such modelling is presently done by AIRPARIF. The desired functionality, in particular the inclusion of a good traffic description, and the extension of model output to street level concentrations, corresponds to a significant enhancement and extension of the existing functionality.

- Modelling of the effects of temporary measures.
This functionality is demanded by traffic and environment departments, and by those who decide on the application of temporary measures. They wish to optimize the environmental impact of such measures.
As the previous one, the functionality requires careful modelling of pollutant emission and dispersion. Model input are weather and traffic conditions actually observed during pollution episodes. As previously, the desired functionality corresponds to a significant enhancement and extension (good traffic description and street level concentrations) of the modelling presently performed by AIRPARIF.
- Help to decide on most suited temporary measures.
This functionality is desired by traffic and environment departments, and decision makers on temporary measures.
The full functionality would result from a combination of an air pollution forecast and a traffic forecast. The air pollution forecast is to be realised by HEAVEN as a new feature. A traffic forecast would constitute a new feature as well. A tool for traffic forecast is currently developed by the 5th FP project CAPITALS PLUS.
- Information on historical data.
Environment and traffic departments demand a functionality which allows actual air quality to be compared with historical data. They desire the information required for understanding major trends, and for supporting arguments with quantitative historical information.
Requests for historical values can be made through the WWW interface of the existing system. Presentation of historical values on charts or graphics would be a new feature.
- Alarm levels and alarm functions.
Decision makers and traffic and environment departments involved in the procedure for temporary measures demand this functionality. However no modification of the existing functionality has been demanded.
- Automatic generation of optimal measures.
Such a functionality has been indicated as a desirable extension of the modelling of temporary measures, and the forecast feature. However this task clearly appears to be outside of what can be performed automatically at present time.

3.4 Transport Measures which can be Supported by the DSS System

3.4.1 Traffic Situation in the City

There is no disagreement on the fact that the Paris-Ile de France region has an air quality problem, and that today motorised traffic is the main responsible for pollutant emission. Hence transport policy is the central issue for air quality improvement.

3.4.2 Description of Potential Measures to Improve the Situation in the City

Current political discussions in the field of transport and environment are clustered around three strong action lines.

First, a prefectural order established in 1999 defines a catalog of temporary measures which can be applied selectively when pollutant limit values are exceeded. There is an ongoing discussion on the balance of positive and negative impacts of these measures.

The catalog comprises the following measures.

"Information level":

- Information of citizens
- Health recommendations for children, aged, persons with asthma or respiratory diseases
- Recommendations to stationary emission sources
- Recommendations to car and truck drivers
- Lowering of speed limitations by 20 km/h on main roads
- Enhanced enforcement
- Suppression of fees for residential parking

"Persistence of information level": previous catalog, plus

- Mandatory limitations for stationary emission sources
- Lowering of speed limitations by 30 km/h on main roads

"Alarm level": previous catalog, plus

- Stopping of determined stationary sources
- Immobilisation of 10% of publicly owned vehicles
- Prohibition of truck traffic outside established transit routes
- Prohibition of half of car traffic in urban and suburban area (depending on number plate) and free public transport

"Ozone peaks in city outskirts"

- Recommendations
- Suppression of fees for residential parking
- Lowering of speed limits

Second, the regional administration currently finalizes the a five-year masterplan for urban and suburban transport policy, named *Plan de Déplacements Urbains* (PDU).

The PDU aims at reducing car traffic (indicative figure -5% by 2005) and developing public transport, bicycle and pedestrian traffic; at a good operation of the main road network, namely through traffic information; and at organising parking, goods delivery and professional traffic in a way which is consistent with the previous objectives.

The PDU stipulates a long list of actions which have to be implemented on regional level, on town level or in smaller areas, by administration as well as by private partners. The proposed actions include work on infrastructures, adaptations of fees and prices, information actions, regulatory issues. They are to produce effects on a time scale of 5 to 10 years.

Third, a regional plan for air quality (*Plan Régional pour la Qualité de l'Air PRQA*), is currently defined in an effort which associates all major stakeholders in air quality issues. The plan is required by the national on air and energy consumption of 1996.

The PRQA aims at identifying all major phenomena which affect air quality in the Ile de France region, and at defining strategic policy orientation in order to reach the air quality objectives defined by law.

- The plan identifies a need for further knowledge about the consequences of air pollution on health and environment and about pollutant emissions.
- The plan recommends an accelerated renewal of the regional car and truck fleet in favour of low-emission engines and low-pollutant fuels.
- It recommends to lower volume and speed of car traffic in the dense part of the agglomeration.

- It recommends to lower energy consumption of residential and professional activities, of industry and airports.
- It identifies a large need for information of all concerned actors.
- It identifies taxing mechanisms which hinder the preceding orientations, and needs for funding for the preceding orientations.

The present situation can be summarized as follows: Temporary measures for awareness raising are a reality, but their environmental effect is small. Many limited policy measures for reducing pollutant emissions from traffic appear feasible, but are yet to be realised (PDU). For important strategic reorientations political consensus is not established yet (PRQA).

3.4.3 Benefits from the System

The HEAVEN decision support and information system will contribute small but significant elements to satisfy the big strategic need of knowledge about pollutant emission and about the consequences of air pollution, which has been identified by the PRQA. The system will inform citizens and public administration about the relationship of air quality and road traffic.

In its decision support component, it is expected that the system's modelling functionalities will concretely support regional and local public administrations in implementing some of the measures stipulated by the regional traffic masterplan PDU, by showing their effect on air quality.

With respect to temporary measures, it can be expected that the modelling and forecast functionalities will lead to an optimized application of the temporary measures with a positive impact on air quality.

3.5 Description of Local Data Exchange Requirements

The input data required by the HEAVEN DSS for environmental modelling functions and for system modules pre-processing the data are described in the following table.

Table 19 Data Exchange Requirements Paris

	Description	Sources
<u>Dynamic data</u>		
Air quality data	<ul style="list-style-type: none"> Concentrations of primary and secondary pollutants measured on AIRPARIF monitoring sites. Pollutant concentrations measured on monitoring sites of surrounding regions. Frequency of renewal 1h.	<ul style="list-style-type: none"> Air quality monitoring network server Servers of surrounding air quality monitoring networks.
Meteorological data	<ul style="list-style-type: none"> Data measured by meteorological offices, AIRPARIF, or other laboratories, on ground stations, masts, by radiosondes, SODAR platforms in the Ile-de-France region: Wind Speed, Wind Direction, Temperature, Radiation, Humidity. Data from meteorological offices: Pressure, Temperature, Water Vapour, Wind Speed, Wind Direction, Geopotential. Frequency of renewal: probably 6 or 12h.	<ul style="list-style-type: none"> Air quality monitoring network servers for measure stations owned by AIRPARIF Servers of meteorological offices Server of other laboratories
Dynamic traffic data	<ul style="list-style-type: none"> Number of Vehicles and Average Speed on 100 automatic traffic sensors. Frequency of renewal 1h.	<ul style="list-style-type: none"> City of Paris Traffic Control Center SIER Traffic Control Center
<u>Static data</u>		
Topography	<ul style="list-style-type: none"> Numerical model giving the heights of points located on a regular grid (resolution for ex. 200m). 	<ul style="list-style-type: none"> IGN (National Geographic Institute)
Land-use	<ul style="list-style-type: none"> Set of data giving in each grid cell of the domain the surface occupied by each of the 44 CORINE land-use categories. 	<ul style="list-style-type: none"> IGN IFEN (French Institute for Environment)
Population and activity	<ul style="list-style-type: none"> Set of data giving in each grid cell of the domain the number of residents per age class, number of workers per age class, etc. 	<ul style="list-style-type: none"> INSEE (National Institute for Statistics)
Static traffic data	Network morphology: <ul style="list-style-type: none"> Vector representation of links and nodes Characteristics of roads, determining parameters for modelling of traffic composition, traffic emissions (urban road, rural road, motorway, tunnel etc) Morphology of zones which support description of diffuse traffic Localisation of 100 sensors which deliver dynamic pinpoint measurements Static traffic description:	<ul style="list-style-type: none"> DREIF (Regional Traffic and Transport Department)

	Description	Sources
	<ul style="list-style-type: none"> Model traffic assignment: for each link, Number of Vehicles, Average Speed, Percentage of Heavy Vehicles Description of diffuse traffic: Number of Vehicles per Zone, and Average Speed Description of stationary vehicles: Number of Vehicles per Zone 	
Street characteristics	<ul style="list-style-type: none"> Classification of streets and roads in 34 morphological categories 	<ul style="list-style-type: none"> IAURIF (Regional Institute for Urban Development)
Vehicle emission factors	<p>The vehicle emission factors will be established following the COPERT III methodology. It addresses:</p> <ul style="list-style-type: none"> The mode of distribution of vehicle emission factors including vehicle categories, average speed, hot/cold motor cycle. The value of emission factors for different groups of primary pollutants. 	<ul style="list-style-type: none"> European project COPERT III
Airport traffic related emissions	<ul style="list-style-type: none"> Total annual emissions Spatial resolution of emission sources Hourly, daily and monthly profiles. <p>These data are required for the main airports in the domain.</p>	<ul style="list-style-type: none"> AdP (Airports of Paris)
Diffuse sources	<p>Description of emissions of district heating, vegetation cover, diffuse industrial emissions.</p> <ul style="list-style-type: none"> Total annual emissions Enhancement of spatial resolution Hourly, daily and monthly profiles. 	<ul style="list-style-type: none"> CITEPA (Interprofessional Technical Centre for Atmospheric Pollution)
Industrial sources	<p>For major industrial sources (power stations, incinerators, furnaces, refineries, paper mills, quarries etc):</p> <ul style="list-style-type: none"> Location Height and diameter of stack Total quantity of emitted effluents Temperature of emissions Average speed of gas emissions Type of emission-generating activity (SNAP classification) Monthly, daily and hourly profiles of stack activity. 	<ul style="list-style-type: none"> Industry DRIRE (Regional Direction for Industry, Research and Environment)
VOC speciation profiles	<ul style="list-style-type: none"> Split of VOC emission into different species, per SNAP category. 	<ul style="list-style-type: none"> University of Stuttgart

4 PRAGUE

4.1 User groups

The main users of the DSS are both decision makers administrations as well as data providers. Data providers represent the core of DSS system users in Prague.

In terms of type of organisation, the first group of users are public authorities or institutions, mostly at municipal level.

It is positive as for relatively good liaisons and non-existence of legal or trade barriers for data providing or data exchange, however, it often also limits effectiveness and flexibility of accepting new technologies or approaches due to rigid budget rules and necessary bureaucracy management.

In addition to the users at municipal level, one national level user takes part in the project as well (CHMU - as meteo and environmental data provider and responsible for environmental modelling). Progress of the program requires to also connect other research institutions particularly dealing with short time traffic predictions. Their role is seen rather in the level of know-how support.

Speaking about decision support system we can not skip the users who shoulder the primary responsibility for the implementation of traffic, environmental and health management strategies. Activity and demands of these users, represented by the respective departments of City Council and the Institute of Hygiene at Prague, reflect experience with solving day to day tasks. It was helpful for achievement of fast progress in specification of user needs. On the other hand, the involvement and consensus building among these users requires an increased effort to provide clear and convicting explanation.

All user groups described above answered the part A and B of the questionnaire, as well as part C of the questionnaire was filled out by some of them acting as a private person.

Part C was handed out mainly to persons or organisations dealing with urban planning, traffic or environment, NGOs, Chamber of Commerce etc. It was experienced that vocational level of questionnaire is maybe too high for non-informed people.

List of main users with brief characteristic is attached below.

Primary users - authorities

MHMP – Odbor dopravy, Řásnovka 770/8, Praha 1

Prague City Council – Department of Transportation

Tel.:2314105, fax.:2323029, e-mail.:dop1593@mepnet.cz

Development and implementation of traffic management policies

Proposed use of the system: discussion of proposed traffic management policies and measures at the political level and municipal administration and implementation of accepted measures which fall under it's competence

MHMP – Odbor ŽP, Řásnovka 770/8, Praha 1

Prague City Council – Department of Environment

Tel.:24484363, fax.:2326185, e-mail.:ozp1906@mepnet.cz

Protection of air quality

Proposed use of the system: improvement of quality of information for making decisions for protection of environment, cooperation at development of flexible traffic management scenarios for periods of critical air quality and implementation of accepted measures which fall under it's competence

Primary users - Decision makers

ÚRM.– Hradčanské nám. 1, Praha 1 City Development Authority

Tel.: 20514652, fax.: 20514652, e-mail.: podatelna@urm.mepnet.cz

City planning

Proposed use of the system: providing the high quality impact assessment of new planned road connections and implementing environmentally oriented feedback into the planning process; dissemination of model outputs among other users, administration and public; implies installation of the Airviro system.

Policie ČR – HDŘÚ, Na Bojišti 5, Praha 2 Police of the Czech Republic

Tel.: 61426356, fax.: 61426365, e-mail.: petrsa@seznam.cz

Traffic control centre - approval for TDMS

Proposed use of the system: considerable improvement of current automatic traffic management system mainly in terms of implementing environmental inputs and traffic demand real-time modelling; processing and storage of traffic demand data; cooperation in preparation new traffic management strategies and measures as a part of DSS

Hygienická stanice hl. m. Prahy Institute of Hygiene

Assessment and surveillance of hygienical and noise limits compliance

Proposed use of the system: improvement of quality of information for making decisions for protection of health, cooperation at development of traffic measures in DSS for reduction of noise level in affected areas

Ústav dopravního inženýrství hl. m. Prahy Institute of Transportation Engineering of the City of Prague

Traffic surveys, preparation of controlling schemes for intersections, traffic demands modelling

Proposed use of the system: main provider of traffic surveys data, preparation of traffic control strategies in DSS

Český hydrometeorologický ústav, Na Šabatce 17, 143 06 Praha 4 Czech Hydrometeorological Institute

Tel.: 4403 2410, fax.: 4403 2468, e-mail.: macoun@chmi.cz

Providing and treatment of the meteorological and hydrological data and air pollution data

Proposed use of the system: air quality modelling and forecasting in system Airviro (to be installed within HEAVEN), improvement of current data inputs and model methodology, pending Prague air quality modelling centre for real-time phase of HEAVEN

TSK – Štefánikova 23, Praha 5

Tel.: 24231984, fax.: 24230644, e-mail.: semberal@tsk.mepnet.cz

Maintenance of traffic controlling utilities inc. traffic light, loops, controllers, etc., maintenance of road and marking

Transfer of responsibilities for TDMS applications from the Police is expected as from 2001 according to the newly approved legislation

Proposed use of the system: cooperation in preparation of traffic demand data as an input to the system and implementation of the approved traffic measures

Public + Interest group**Institut mestske informatiky hl. m. Prahy (IMIP)****Institute of Municipal Informatics of the City of Prague**

Municipal data centre maintaining particularly digital cadastral map of Prague, digital model of terrain and environmental digital data. Main Prague's dissemination centre for environmental data. In July 2000, IMIP will go through considerable reorganisation which likely would affect its role in HEAVEN

Proposed use of the system: providing and maintenance of basic input geo-data and environmental data and internet dissemination centre for Prague's HEAVEN

DP a.s. – Bubenská 1, Praha 7**Prague Public Transit Co. Inc.**

Tel.: 96192213, fax.: 96192209

Municipal transportation company, ensures regular bus, tram and metro transportation throughout the city of Prague

Proposed use of the system: cooperation in preparation of traffic management strategies focused mainly on public transport preference

Section for Traffic at the Chamber of Commerce

NGOs - SOS, Zelený kruh, STUŽ - Společnost pro trvale udržitelný život, Pražské matky

4.2 Objectives

4.2.1 Objectives of the Public Administration

While developing of the DSS system for evaluation of impact of traffic related emissions to air quality and noise level, as well as for the traffic demand prediction and forecast remains the main goal of all users, the detail expectations of system functionality varies from user to user according particularly to the focus of each organisation.

The answers of respondents have, thus, a relatively small overlaps. However, the small number of concerning organisations may seem insufficient, as the questionnaires had been filled by all pending future users, it gives us a good chance to adjust all parts of system to individual requirements of its future users without considerable conflicts.

The city administration users see the main objectives particularly in the improvement of the existing information system on pollutants and on noise levels as well as in preparation of the system for modelling

of the environmental effects of transport policies, irrespectively on the length of time range of assessed policies or measures.

Health information system is of less priority. Future users see as very important also facilitation of support for policy makers on future transport policies and DSS for administrations in order to facilitate their daily work (of course, who wouldn't).

In case of an alarm situation, it is crucial to provide real time warning to citizens. The prognosis of the levels of alarm situations for the next day is also requested.

Last but not least, the realisation of Airviro-centered traffic management and modelling brings us also unified and accessible database of environmental and traffic data which is considered as a significant improvement.

4.2.2 Objectives of the Citizens

Addressed citizens consider that the main priorities are: mainly early warning for smog alarm situation, operational traffic management and its improvement and development of new decision support tool.

Citizens do not differ from the primary users as for the necessary pollutant and noise indicators. In addition to numerical information on the current air quality and noise levels they request also qualitative description (in wording mainly), which is usually easier to understand for an "average citizen". Such approach applies also for the description of a current traffic situation. The traffic levels (1-5) are traditionally used in broadcast reports and could be implemented into visualisation of the forecasts as well.

There is no need for real-time public presentation of current air quality situation. Citizens require 6-hour update, however, a daily update is still sufficient. On the other hand, the information on noise situation is not recognised as very important. The majority of respondents answered appropriate question with mark 3 or higher. It is probably caused by a low awareness on significance of the noise pollution as well as by the fact that citizens are rather sceptical about effectiveness of available measures for traffic noise reduction.

The most requested media for providing current information are radio and television. However, other kind of media had been also often marked. Information update must be provided on a regular basis. In terms of visual presentation, maps followed with charts and graphic presentations are probably the best option.

The good news for implementation in Prague is the willingness of citizens to follow the transport measures even if they are expected to be mostly restrictive (restriction of passing through the city centre, parking regulations, diversions). Part of the respondents are ready to use the public transport more then they do at the time being.

4.3 Functionalities of the system

4.3.1 Functionalities of the information system

In terms of pollutants to be measured, all pollutants were recognised as important, except for CO₂ (which is not relevant for inner town conditions). In addition, there were specified two new items – PM₁₀ and PM_{2,5} instead of originally one generic item particular matters group.

In terms of noise, measurement and modelling of noise levels is a priority task, however description of affected groups of people would be appreciated as in a „nice to have“ category.

System should provide information on critical pollution levels.

In Prague the system will provide complete information on pollution and noise levels in a selected demonstration area only. However, some figures (esp. air quality data) will be provided for the wider area of the Prague's centre. In spite of it, main users should appreciate detailed spatial resolution in level of selected city areas (city centre and important streets).

The implementation of the HEAVEN project in Prague will go in two phases. The first one is focused on preparation and evaluation of the input data sources, data flow, digital map of topography, street network and modelling mainly for city and district planning purposes. It is implied to prepare some parts of DSS components to the real-time based run of the system in the latter phase.

The second phase will be the implementation of real time meteorological and environmental data together with real time data on traffic demand into the DSS. The evaluation of possible environmental impacts for different TDM strategies and scenarios will help the users to tune real-time and next-to real time TDMS

All input information on pollutant and noise levels should be updated hourly or within 6 hours respectively according to model limits.

4.3.2 Information Channels

Answers on user interface agree on providing data on request as well as visualisation of modelling or monitoring results. The slightly more preferred is the latter option. Statistic evaluation should be provided annually. Prague has a long tradition in edition of the annual reports on the state of environment. The results of HEAVEN are expected to be implemented.

All media devices was mentioned as possible to use, the preferred are radio broadcast, internet, RDS-TMC, public transit computer data and VMS.

Users require the system to enable also additional functions: on-line information on traffic situation, a possibility to integrate meteorological information and traffic forecast. There were two further requests of a less importance – online help and access to data records.

To sum up, all requested media for providing information have been already used in Prague currently. The task of HEAVEN is to define the information to provide by each kind of media, define and ensure data-flow between monitoring, model processing and presentation centres and promote inter-user liaison to gain the maximal effect from use of the existing information systems.

4.3.3 Functionalities of the DSS

In terms of DSS, the accent should be put to the automatic generation of optimal traffic measures when critical emission levels are reached (i.e. in alarm situation) and modelling functions in order to evaluate the environment effects of long term and short and near to real term transport policies. These requests are reflected in the time schedule of Prague HEAVEN project and represent also Prague's main aims. Historical data are expected to be used for evaluation and calibration as well as for urban planning impact assessment.

Additional requirements focus particularly on functions for promotion of the presentation, traffic and environmental modelling and assessment of proposed measures.

System should enable to evaluate trends of selected indicators in connection with the concept of air quality protection and traffic development. The crucial requirement of DSS is the support of flexible feedback information channels. All kind of users must have an adequate option to give comments back to the data provider.

In terms of alarm functions, both modelling inputs and outputs should be presented, particularly selected monitoring results, prognosis of levels of alarm situations for the next day and real time warning are of big importance.

While the air pollution monitoring and modelling were recognised as the main tasks to solve, simplified risk analysis on health should be possible to provide by the system. These analysis could be focused mainly on the definition of the number of people within the area affected by the poor air quality.

4.4 Transport measures which can be supported by the DSS system

4.4.1 Traffic Situation in the City

The complicated topography of Prague, composed by river, its banks and surrounding hills determines the limited possibilities for traffic demand management and possible strategies at Prague.

The street network at Prague is overloaded with a continuously rising traffic demand. Since 1990 the number of vehicle-kilometres was raised by 219%, the number of cars in last 7 years in Prague almost doubled, and the car ownership ratio at Prague for 1999 is 1.9. The ratio between mass public transportation user vs. Individual transport has dropped to 58:42. The street network is 3398 km long and practically has not been changed, except for the Strahov tunnel and Sterboholy radial. The construction of new routes is proposed (inner and outer rings, radials) The parts of the outer and inner rings are still only under planning, assessment and partially under construction. Due to insufficient variability the transit transport (also truck transport) passes through the parts of the inner ring with all the environmental and social impacts on the citizen of Prague.

The system of the public mass transportation is built by metro lines, trams and buses The Prague's Integrated Transportation system includes also trains and regional buses.

The traffic demand management system is built by intersections with signal traffic lights monitored from the Traffic Control Centre. Recently, the communication network is fully saturated.

The high traffic volumes result from the fact, that Prague is a vital administrative centre situated in the middle of the Czech part of the country, offering many job opportunities, industries and services, sources and targets for traffic. Traffic related air pollution and noise represents a high health risk for a majority of 1.2 Million inhabitants of Prague.

4.4.2 Description of potential measures to improve the situation in the city

The most appropriate traffic measures in case of alarm situations seem to be diversion and dislocation of traffic flows, public mass transport prioritisation in order to reduce the emission levels in affected areas.

4.4.3 Benefits from the system

The main achievement of the system at the first stage is an availability of sophisticated model for air quality assessment at different traffic demand management options of different development strategies.

The improvement and availability of a decision support system for real-time traffic management with assessment and prediction of its impacts on air quality and noise levels will be the another benefit for both city administration and wide public.

Development of DSS will be followed by definition and optimization of tools for air quality data and traffic demand data presentation and dissemination to public.

4.5 Description of Local Data Exchange Requirements

Table 20 Needs and functions (Environmental Modelling)

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution ⁷	Sub-functions	Appropriate Model	Required Data
Modelling of air pollution	CO	Primary Users: 1, 6, 24 Hourly	Single Street, City area/district	<ul style="list-style-type: none"> • Emissions Traffic • Other emissions • Background pollution • Dispersion to produce concentration 	<ul style="list-style-type: none"> • AIRVIRO • AIRVIRO • OPANA/NAME • Gaussian (AIRVIRO) • Grid (AIRVIRO) 	<ul style="list-style-type: none"> • TRIPS + SCOOT – Congestion, Flows, Delays, Stops, Emissions Factors • Emissions Data base • AUN Monitored data and RPM • Short-term weather forecasting
		Secondary Users: 1, 24 Hourly				
	NO _x	Primary Users: 1, 6, 24 Hourly				
		Secondary Users: 1, 24 Hourly				
	NO ₂	Primary Users: 12, 24 Hourly				
		Secondary Users: 1, 24 Hourly				
PM	Primary Users: 1, 6, 24 Hourly					
	Secondary Users: 1, 24 Hourly					
SO ₂	Primary Users: 12, 24 Hourly (15 minute monitored)					
	Secondary Users: 1, 24 Hourly					
O ₃	Primary Users: Hourly					

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution ⁷	Sub-functions	Appropriate Model	Required Data
		Secondary Users: 1, 24 Hourly				
Modelling of Noise pollution	Noise Pollution Concentration $L_{(A)eq}$	<Hourly Hourly, 24 Hourly	Individual property Single Street City area/district City Wide	<ul style="list-style-type: none"> • Vehicle Noise Emission Prediction 		<ul style="list-style-type: none"> • Geometric Information (Coordinates, Width) • Road Classification => Mean Speed, Flow, Composition • Gradient, Surface Type • Static Flow Volumes (non-SCOOT, TRIPS/AIRVIRO) • SCOOT/AIRVIRO Flow, Estimate from SCOOT/AIRVIRO data • Ground cover, Street Type (Open, single Façade, Canyon, Broken etc), Source height • Building locations and Dimensions
	People impacted	<Hourly Hourly, 24 Hourly	Individual Property Single Street City area/district City Wide			
						<ul style="list-style-type: none"> • Ground Topography (Slopes, Cuttings, Elevated Sections) • Building Acoustic properties • Frequency Spectra • Wind Speed and Direction, Temperature, relative humidity, Atmospheric pressure • Population Distributions • Sensitive Building Locations

The requirements for monitoring and modelling noise pollution are indicated above. All requirements of noise will be realised through the noise model and the WP5 functions for all noise user needs are the same as indicated in the table. The data requirements for each noise measurement will be the same and the forecast according to spatial and time resolution will be calculated.

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution	Sub-functions	Appropriate Model	Required Data
Decision support Scenarios / forecasts	Health Statistics	On demand Max. 1 hour old	Individual buildings	<ul style="list-style-type: none"> Health Study Pollution Data 	<ul style="list-style-type: none"> AIRVIRO 	<ul style="list-style-type: none"> Emissions data Life Style Data
	Environmental Modelling	On demand Max. 1 hour old	Street/district	<ul style="list-style-type: none"> Weather Forecasting Local Modelling (50x50m, 250x250m and 1x1m) 	<ul style="list-style-type: none"> ALADIN AIRVIRO 	<ul style="list-style-type: none"> Meteorological data, Network Parameter Met office forecast data, Name model outputs, lane use and emissions database Traffic Flow, Network parameters, Meteorological data, ambient air quality data
				<ul style="list-style-type: none"> Noise modelling 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Static road section database, Static receiver grid database, Traffic flow, speed and composition data Static topographical data, Meteorological data
	Traffic Modelling	On demand Max. 1 hour old	Street/district	On-line: <ul style="list-style-type: none"> Congestion 	<ul style="list-style-type: none"> VISUM 	<ul style="list-style-type: none"> SCOOT data – delays, flows, congestion, stops, saturation

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution	Sub-functions	Appropriate Model	Required Data
				<ul style="list-style-type: none"> Incident Actual data Historic data 	<ul style="list-style-type: none"> VISUM 	<ul style="list-style-type: none"> SCOOT data – delays, flows, saturation, historical flow parameters, detector flow, detector occupancy, stage length and journey time SCOOT data from ASTRID ¼ second occupancy of vehicles on traffic detectors As described above
				Off-line: <ul style="list-style-type: none"> TDMS Library General information for model 	<ul style="list-style-type: none"> TRIPS 	<ul style="list-style-type: none"> Signal timings, 0+D matrices, numbers of links and junctions, network etc Average traffic flows Network, junction, turn vehicle matrix, heavy vehicle specification of geometric parameters, geographic off-road features

Both Traffic and Environmental modelling will be carried out by a number of different models (Table 2), with the outputs being fed into the DSS. Through AIRVIRO, which will be updated as part of HEAVEN, the relevant modelled [and monitored] data will be analysed as part of the cohort study.

Table 21 Needs and functions (User Interface)

User Needs (WP4)		Functions (WP5)
What?	Module	Sub-functions
Variable Message Sign		<ul style="list-style-type: none"> • Integrate air & traffic databases
Internet/Intranet	Internet/Intranet-client	<ul style="list-style-type: none"> • Internet/intranet-client for information representation
Radio		<ul style="list-style-type: none"> • Radio Stations must use DSS
Public Display		<ul style="list-style-type: none"> • Use internet-client

Table 22 System Needs and functions (System Modules)

System Needs (WP5)				Functions (WP5)	
What?	Module	Time resolution	Spatial resolution	Sub-functions	Required Data
Traffic Incident Detection	Incident Detection Module	15 minutes	Demand responsive signal control areas	•	<ul style="list-style-type: none"> • data – delays, flows, saturation, historical flow parameters, detector flow, detector occupancy, stage length and journey time
				•	<ul style="list-style-type: none"> • Incident data (inputted manually), i.e. road works, accidents, floods etc
				•	<ul style="list-style-type: none"> • Historical, Current and Future incident data
Traffic Congestion	Congestion module	5 minutes		•	<ul style="list-style-type: none"> • data – delays, flows, congestion, stops, saturation
Calibration of models	Calibration Module	As for individual models		•	<ul style="list-style-type: none"> • As for individual models

Table 23 Required data (Environmental modelling)

Function (WP5)	Required data (WP5)	
Modelling air pollution	Statistical data (temporal resolution >= 1 year)	<ul style="list-style-type: none"> • Vehicle Emission Factors • Traffic Model data • Emission database (point /area/ source/line)
		<ul style="list-style-type: none"> • Historical weather database • Historical Air Quality Monitoring • Topography
	<ul style="list-style-type: none"> • Dynamic Data (temporal resolution = 1 year) 	<ul style="list-style-type: none"> • Vehicle traffic data • Monitored Air Quality • Monitored Weather
		<ul style="list-style-type: none"> • Forecast Air Quality • Forecast Weather
Modelling noise pollution		
<ul style="list-style-type: none"> • Vehicle Noise Emission Prediction (Leq, L10, L50, L90) 	<ul style="list-style-type: none"> • Statistical Data (Temporal resolution >=1 year) 	<ul style="list-style-type: none"> •
	<ul style="list-style-type: none"> • Segment Line Source 	<ul style="list-style-type: none"> • Geometric Information (Co-ordinates, Width) • Road Classification => Mean Speed, Flow Composition • Gradient • Surface Type • Static Flow Volumes
	<ul style="list-style-type: none"> • Dynamic Data (temporal resolution = 1 hour) 	<ul style="list-style-type: none"> •
	<ul style="list-style-type: none"> • Vehicle Flow Volumes 	<ul style="list-style-type: none"> • VISUM/AIRVIRO Flow
	<ul style="list-style-type: none"> • Vehicle Speeds 	<ul style="list-style-type: none"> • Estimate from VISUM/AIRVIRO data
	<ul style="list-style-type: none"> • Vehicle Queues 	<ul style="list-style-type: none"> • Estimate from VISUM/AIRVIRO data
<ul style="list-style-type: none"> • Basic Noise level prediction (Leq) 	<ul style="list-style-type: none"> • Statistical data (temporal resolution >=1 year) 	
<ul style="list-style-type: none"> • Prediction for point Contour Generation 	<ul style="list-style-type: none"> • Propagation Information 	<ul style="list-style-type: none"> • Receiver Co-ordinates • Ground Cover • Street Type (Open, single Façade, Canyon, Broken etc) • Source Height

Function (WP5)	Required data (WP5)	
<ul style="list-style-type: none"> Advanced Noise Level Prediction (Leq, 	<ul style="list-style-type: none"> Statistical Data (temporal resolution ≥ 1 year) 	
<ul style="list-style-type: none"> Prediction for a point contour generation 	<ul style="list-style-type: none"> As for both Emissions and Basic Noise level Predictions + 	
	<ul style="list-style-type: none"> Topographical Information 	<ul style="list-style-type: none"> Building Locations and Dimensions Ground Topography (Slopes, Cuttings, Elevated Sections)
	<ul style="list-style-type: none"> Propagation information 	<ul style="list-style-type: none"> Building Acoustic Properties Frequency Spectra
	<ul style="list-style-type: none"> Dynamic Data (temporal resolution = 1 hour) 	
	<ul style="list-style-type: none"> As for both Emissions and basic Noise level Predictions + 	
	<ul style="list-style-type: none"> Meteorological Data 	<ul style="list-style-type: none"> Wind Speed and Direction Temperature Relative Humidity Atmospheric pressure
	<ul style="list-style-type: none"> Demographic Data 	<ul style="list-style-type: none"> Population Distributions Sensitive Building Locations

5 ROME

5.1 User groups

The User Groups of the System are mainly the Administrations and the Agencies concerning environment, health and mobility.

These Organisations work at different geographical level: National, Regional and Local level.

The Organisations are:

Political and Administrative Organisation

- Ministero dell’Ambiente – Direzione Generale Inquinamento Atmosferico e Acustico (Italian Ministry of Environment Atmospheric and Acoustic Pollution Dept.)
- Comune di Roma Dipartimento VII Politiche della Mobilità (Municipality of Rome Dept. VII Mobility Policy)
- Comune di Roma Dipartimento X Politiche Ambientali e Agricole Ufficio Operativo Prevenzione Inquinamento Atmosferico, Acustico e dell’Acqua (Municipality of Rome Dept. X Environmental and Agricultural Policy - Atmospheric, Acoustic, Water Pollution Prevention Office).

Technical Agencies

- Agenzia Nazionale per la Protezione dell’Ambiente (Italian Environmental Protection Agency)
- Agenzia Regionale per la Protezione dell’Ambiente del Lazio (Regional Environmental Protection Agency – Lazio)
- Istituto Superiore di Sanità (Advanced Health Institute)
- S.T.A. S.p.A. / Centrale del Traffico (Mobility Agency for the Municipality of Rome / Traffic Control Center)

These Organisations cover the conceptual matrix:

	National	Regional	Local
Environment	Ministero dell’Ambiente Agenzia Nazionale per la Protezione dell’Ambiente	Agenzia Regionale per la Protezione dell’Ambiente del Lazio	Comune di Roma Dipartimento X Politiche Ambientali e Agricole
Mobility	Comune di Roma Dipartimento VII Politiche della Mobilità		
Health	Istituto Superiore di Sanità		

In fact:

- Mobility: Comune di Roma Dipartimento VII Politiche della Mobilità ideates mobility policy over urban area, accomplishes mobility policy and takes mobility routine decision.
- Health: Istituto Superiore di Sanità is the technical organ of Italian Health Ministry for hygienic sanitary questions

All these Organisations are dealing with questions of traffic related pollution every day.

Depending different characteristics of Organisations, the role on traffic / environment policies are:

- Informing and Advising the decision makers (the Agencies System)
- Making the final decision (Administrative Organisations)

Depending different territorial characteristics of Organisations, the role on short term decisions are

- Informing and Advising the decision makers (the Local and Regional Agencies System, Istituto Superiore di Sanità)
- Making the final decision (Municipal Administrative Organisations)
- No Role (Italian Ministry of Environment and National Environmental Agency)

Some Organisations think to use HEAVEN DSS:

- continuously or every day (the Local and Regional Agencies System, Comune di Roma Dipartimento X Politiche Ambientali e Agricole)
- several days a month or a year (Agenzia Nazionale per la Protezione dell' Ambiente, Comune di Roma Dipartimento VII Politiche della Mobilità, Istituto Superiore di Sanità)
- never (Ministero dell' Ambiente).

5.2 Objectives

5.2.1 Objectives of public administration

The main objectives for Public Administration and Agencies are:

(very important)

- Information system on pollutants for the administration
- Help for modelling the environmental effects of long term transport policies
- Support for policy makers on future transport policies

(important)

- Information system on noise for the administration
- Help for modelling the environmental effects of temporary transport policies/measures
- Health information system
- Decision support system for administrations in order to facilitate their daily work

(least important)

- Information system on pollutants for the citizens
- Information system on noise for the citizens

The requirements for the information, monitoring and DSS are:

(very important)

- Quality of data
- System reliability
- Easy to use
- Information on organic and inorganic micro pollutant (for Istituto Superiore di Sanità)

(least important)

- Capability to Data Export

5.2.2 Objectives of citizens

The HEAVEN initiative in Rome is focused on intermediate end users: institutions involved or impacted by transport and the environment. So objectives of citizens didn't directly investigate.

5.3 Functionalities of the system

5.3.1 Functionalities of the information system

Pollutant

Some pollutants have to be measured by law. For the complete table of pollutant measured by law and time resolution, see Official Table by Agenzia Nazionale per la Protezione dell'Ambiente in Annex 1.

The pollutants **most important** are:

- CO
- Nox
- HC
- PM
- Benzene
- O3
- IPA

The pollutants **important** are:

- Sox

CO2 is **not important**, excepted for Global Atmosphere Watch

In addition to pollutant measured by law, other pollutant (**very important**) desired are:

- PM2.5
- Aldehyde (for health)

An update of information is desired on:

- hourly basis (except PM and SOx)
- 24 hour basis
- annual (for the Health)

The PM25 should be measured with the same time resolution of PM10.

The Aldehyde should be measured on hourly basis and with annual mean.

The spatial resolution by law is:

- region
- province
- city
- urban zonation
- point of measurement

But the **important** spatial resolutions are:

- City
- City area / district

It is **important** that the system automatically provide information on critical pollution levels, both limits for pollutants and limits when measures will be implemented automatically.

Noise

For the noise, the indicator calculated by law is the noise levels.

Noise levels are **very important**.

Other **very important** indicators are:

- Number of people affected by noise
- Map of population to a risk

An update of information is desired on:

- hourly basis
- daily (06/22 h) / Nightly (22/06)
- annual basis

The spatial levels are urban zonization, city and region.

The **very important** spatial levels are:

- Region
- City
- Measurements over critical areas

General

Global statistics required are (**very important**):

- Daily impacts, mainly for primary pollutants (see EU 97/101 “Exchange of information”)
- Seasonal impacts, especially for O₃ (secondary pollutants)
- Annual impacts, especially for benzene and PM₁₀

The **most useful** way to display the information are:

- Data on request
- Visualisation of levels on maps

Additional requirements needed are:

(**very important**)

- Traffic situation
- Traffic forecast

(**important**)

- Online help
- Access to data record
- Possibility to integrate meteorological information

5.3.2 Information channels

Preferred telematic devices to inform the public about traffic conditions are:

(very important)

- Radio data system - traffic message channel (RDS - TMC)
- Variable message sign (VMS)

(important)

- Internet
- Data collected from computer controlled operation system
- Radio broadcast

5.3.3 Functionalities of the DSS

DSS can be used for

- Policy makers as a support tool to model the environmental effects of long term transport policies
- Policy makers as a support tool to model the environmental effects of temporary measures to reduce traffic
- Public administration to help them in their daily work, better information flows, etc
- Decision maker to optimise transport flows (only Traffic and Environmental Municipal Authorities)

In these areas, the most useful functions are:

1. Information on historical data in order to compare existing levels with historic levels (very important)

Objective

- To verify air pollution trend
- To compare statistical data of pollutant concentration with present data
- To evaluate the effects of measures

Description of function (what kind of information shall be provided)

- To show present situation respect an historical mean value (better or worst)
- Representation of statistical analysis
- To see actual trend (curative or pejorative)

Expected Impact / Benefits

- To improve the citizen's understanding of administrative decisions
- To evaluate the effectiveness of measures and indication on actions to undertake.
- To know historical data on exposition of population

2. Alarm levels and alarm functions (important)

Objective

- Alarm functions: the decision makers must intervene in time by law
- Forecast of evolution of air quality
- Forecast to eventually reach pollution critical level

Description of function (what kind of alarm functions shall be provided)

- Probability of exceeded warning or alarm levels with the indication the interested area
- Dynamical evolution on map
- To signal to operators data qualitatively, quantitatively and territorially

Expected Impact / Benefits

- Citizens can arrange correct sanitary measures and can organise private mobility
- Better geo statistical knowledge of air quality evolution on urban area
- To improve efficiency of information

3. Modelling functions in order to evaluate the environmental effects of long term transport policies (important)

Objective

- To use modelling functions to forecast pollution situations
- To evaluate the environmental effects
- To forecast the connection between the changing of transport private / public network and air quality status
- To evaluate environmental effects of long term transport policy

Description of function (what pollutants should be modelled etc.)

- To show the trend and the forecast improvement for adopted or studied measures (benzene)

Expected Impact / Benefits (Can such models assist in developing long term transport policies)

- To control pollution
- To support the develop of long time urban transport plans

4. Health information system

5.4 Transport measure which can be supported by the DSS system

5.4.1 Air and Noise Quality Monitoring and Traffic situation in the city

The public consider air quality to be an important issue. He considers noise to be less important. There is a major environmental problem related to air quality and noise in Rome: this is the traffic.

The **main problems** are:

- Street network (in the city center for the historical town planning structure)
- Great number of vehicles (motorbike included)
- Congestion level (especially in the city centre)
- Insufficient underground network
- Low efficiency in public transport network
- Difficulty in park
- Scarcity of park and ride
- High concentration of activities

These problems are identified with:

- city centre
- main road axes

but all is the same over the urban area for an half of interviewed.

The main reasons for these traffic problems are:

(very important)

- Intense use of the private car
- Insufficient public transport system
- Insufficient law regulations for urban planning

(important)

- Insufficient parking space
- Insufficient policy of illegal parking
- Delivery of goods

5.4.2 Description of potential measures to improve the situation in the city (regarding air and noise quality)

The potential measures to improve the situation are:

(very important)

- Traffic calming
- Pedestrianisation
- Bus priorities
- Light rail transit system
- Access control
- Park and ride

(Important)

- Parking control
- Limiting times of deliveries
- Cycle routes
- Lorry ban
- Urban traffic control (UTC) system

(not so important)

- Intelligent telematics

Policies / Actions based on information on air quality are at the moment:

(very important)

- Inform citizens

(important)

- Inform road-users
- Congestion management

The policies, strategies or actions to be implemented or tested within the project lifetime are:

(very important)

- Inform road-users
- Inform citizens

(Important)

- Access Control
- Congestion management etc.

An important political action a national level will be to promulgate First Technical Directive on Air Quality from 96/62/CE

5.4.3 Benefits from the system

DSS will facilitate and improve the quality of the work:

- For the availability of data bank on historical situations for pollutant concentrations
- Realising an organised base of knowledge to understand the connection of cause and effect between rules of circulation construction or fleet composition and environmental effects
- Supplying more information especially in alarm situation for a better effectiveness of decision

The benefit expected from the system is to facilitate the implementation of policies, strategies and actions. They are

(very important)

- Congestion management etc.
- Access control
- Inform road-users

(Important)

- Re-routing
- Speed restrictions

5.5 Local Data Exchange Requirements

Table 24 User needs and functions for air and noise pollution modelling

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution	Sub-functions	Appropriate Model	Required Data
Modelling of air pollution	CO	<ul style="list-style-type: none"> ▪ hourly basis ▪ 24 hour basis ▪ annual 	<ul style="list-style-type: none"> ▪ city ▪ city area / district 	<ul style="list-style-type: none"> ▪ traffic emissions ▪ other emissions ▪ background pollution ▪ concentration ▪ model calibration 	<ul style="list-style-type: none"> ▪ modal & average models ▪ to be selected/developed 	<ul style="list-style-type: none"> ▪ meteo information ▪ traffic data ▪ network physical characteristics ▪ fleet data
	NOx	<ul style="list-style-type: none"> ▪ hourly basis ▪ 24 hour basis ▪ annual 	<ul style="list-style-type: none"> ▪ city ▪ city area / district 	<ul style="list-style-type: none"> ▪ traffic emissions ▪ other emissions ▪ background pollution ▪ concentration ▪ model calibration 	<ul style="list-style-type: none"> ▪ modal & average models ▪ to be selected/developed 	<ul style="list-style-type: none"> ▪ meteo information ▪ traffic data ▪ network physical characteristics ▪ fleet data
	O3	<ul style="list-style-type: none"> ▪ hourly basis ▪ 24 hour basis ▪ annual 	<ul style="list-style-type: none"> ▪ city ▪ city area / district 	<ul style="list-style-type: none"> ▪ traffic emissions ▪ other emissions ▪ background pollution ▪ concentration ▪ model calibration 	<ul style="list-style-type: none"> ▪ modal & average models ▪ to be selected/developed 	<ul style="list-style-type: none"> ▪ meteo information ▪ traffic data ▪ network physical characteristics ▪ fleet data
	Benzene C ₆ H ₆	<ul style="list-style-type: none"> ▪ hourly basis ▪ 24 hour basis ▪ annual 	<ul style="list-style-type: none"> ▪ city ▪ city area / district 	<ul style="list-style-type: none"> ▪ traffic emissions ▪ other emissions ▪ background pollution ▪ concentration ▪ model calibration 	<ul style="list-style-type: none"> ▪ modal & average models ▪ to be selected/developed 	<ul style="list-style-type: none"> ▪ meteo information ▪ traffic data ▪ network physical characteristics ▪ fleet data
Modelling of Noise pollution	Noise levels	<ul style="list-style-type: none"> ▪ hourly basis ▪ daily (06/22 h) / Nightly (22/06) ▪ annual basis 	<ul style="list-style-type: none"> ▪ (Region) ▪ City ▪ Measurements over critical areas 	<ul style="list-style-type: none"> ▪ Noise modelling 	<ul style="list-style-type: none"> ▪ to be selected/developed 	<ul style="list-style-type: none"> ▪ traffic data ▪ building profiles ▪ network representation & characteristics ▪ fleet data

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution	Sub-functions	Appropriate Model	Required Data
	Number of people affected by noise	<ul style="list-style-type: none"> ▪ hourly basis ▪ daily (06/22 h) / Nightly (22/06) ▪ annual basis 	<ul style="list-style-type: none"> ▪ (Region) ▪ City ▪ Measurements over critical areas 	<ul style="list-style-type: none"> ▪ impacted people in decibel classes 	<ul style="list-style-type: none"> ▪ to be selected/developed 	<ul style="list-style-type: none"> ▪ area population model ▪ traffic data ▪ network representation & characteristics ▪ fleet data
	Map of population to a risk	<ul style="list-style-type: none"> ▪ hourly basis ▪ daily (06/22 h) / Nightly (22/06) ▪ annual basis 	<ul style="list-style-type: none"> ▪ (Region) ▪ City ▪ Measurements over critical areas 	<ul style="list-style-type: none"> ▪ impacted population on the territory 	<ul style="list-style-type: none"> ▪ to be selected/developed 	<ul style="list-style-type: none"> ▪ area population model ▪ traffic data ▪ network representation & characteristics ▪ fleet data
pollution value exceeded	Warning on measured and predicted limit exceeding.	<ul style="list-style-type: none"> ▪ On event 	<ul style="list-style-type: none"> ▪ City area/district ▪ Measurement point 	<ul style="list-style-type: none"> ▪ concentration 	<ul style="list-style-type: none"> ▪ to be selected/developed 	<ul style="list-style-type: none"> ▪ meteo information ▪ network representation & characteristics ▪ pollutant emissions
Statistics	Air pollution	<ul style="list-style-type: none"> ▪ Daily impacts, mainly for primary pollutants (see EU 97/101 “Exchange of information”) ▪ Seasonal impacts, especially for O3 (secondary pollutants) ▪ Annual impacts, especially for benzene and PM10 	<ul style="list-style-type: none"> ▪ City area/district 	<ul style="list-style-type: none"> ▪ Statistical Report 	<ul style="list-style-type: none"> ▪ to be developed 	<ul style="list-style-type: none"> ▪ traffic data ▪ pollution dispersion table ▪ pollutant emissions
	noise	<ul style="list-style-type: none"> ▪ Daily impacts, ▪ Seasonal impacts 	<ul style="list-style-type: none"> ▪ City area/district 	<ul style="list-style-type: none"> ▪ Statistical Report • 	<ul style="list-style-type: none"> ▪ to be developed • 	<ul style="list-style-type: none"> ▪ traffic data ▪ noise emissions and parameters

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution	Sub-functions	Appropriate Model	Required Data
Way to display the information	Data on request	▪ On request	▪ City area/district	▪ Information Representation	▪ MMI to be developed	▪ DBMS traffic and pollutant information
	Visualisation of levels on maps	▪ Hourly, daily, on request	▪ City area/district	▪ Information Representation	▪ MMI to be developed	▪ DBMS traffic and pollutant information
Additional requirements	Traffic situation	▪ Hourly, daily, on request	▪ Network arc	▪ Information Representation	▪ MMI to be developed	▪ DBMS traffic information
	Traffic forecast	▪ Hourly, daily, on request	▪ Network arc	▪ Information Representation	▪ MMI to be developed	▪ DBMS traffic information
	Online help	▪ On request		▪ Operator Intervention	▪ MMI to be developed (not automatic access)	
	Access to data record	▪ On request	▪ City area/district	▪ Operator Intervention	▪ MMI to be developed (not automatic access)	▪ DBMS traffic and pollutant information
	Possibility to integrate meteorological information			▪ Dispersion modelling ▪ Interface module	▪ To be developed/selected	▪ Wind, meteo measurements, forecast
Decision support Scenarios / forecasts (dependent on developments in	Information on historical data in order to compare existing levels with historical	▪ To show present situation against a historical mean value (better or worse) ▪ Representation of	▪ Network arc	▪ Information Representation	▪ MMI to be developed	▪ DBMS traffic information

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution	Sub-functions	Appropriate Model	Required Data
Traffic Management Center)	levels	statistical analysis ▪ To show actual trend (curative or pejorative)				
	Modelling functions in order to evaluate the environmental effects of long term transport policies	To show the trend and the forecast improvement for adopted or studied measures (benzene)	▪ City area/district	▪ Scenarios simulation	▪ To be developed	▪ Scenario definition (traffic O/D, TDMS, timing)
	Health information system					

Table 25 Needs and functions (User Interface)

User Needs (WP4)		Functions (WP5)
What?	Module	Sub-functions
Windows	Windows - client	• Windows – client for querying, operating and using the DSS

Table 26 System Needs and functions (System Modules)

System Needs (WP5)				Functions (WP5)	
What?	Module	Time resolution	Spatial resolution	Sub-functions	Required Data
Traffic data from the UTC systems	Network Status Representation	Five minutes	Network arc	<ul style="list-style-type: none"> ▪ Data Collection 	<ul style="list-style-type: none"> ▪ Average speed, density, volume, queue, occupancy, data significance ▪ Duty cycle
				<ul style="list-style-type: none"> ▪ Data Validation & Aggregation 	<ul style="list-style-type: none"> ▪ Traffic parameters thresholds ▪ Traffic parameters historical profiles ▪ Collected data
				<ul style="list-style-type: none"> ▪ Traffic modelling 	<ul style="list-style-type: none"> ▪ Traffic parameters historical profiles ▪ Validated data
				<ul style="list-style-type: none"> ▪ Data Archiving 	<ul style="list-style-type: none"> ▪ Updated Traffic parameters historical profiles ▪ Validated data
Traffic demand modelling	Traffic O/D estimation	Hour	Network area/district	<ul style="list-style-type: none"> ▪ O/D estimation 	<ul style="list-style-type: none"> ▪ Previous O/D matrix ▪ Measured traffic volume profiles ▪ Network representation
Traffic assignment	Traffic assignment	Hour	Network arc	<ul style="list-style-type: none"> ▪ Traffic Assignment 	<ul style="list-style-type: none"> ▪ Current O/D matrix ▪ Network representation ▪ Network availability
Model - parameter from other sources	Interface to Meteo	Cyclical (minutes)	Network area, Street segment	<ul style="list-style-type: none"> ▪ interface to Meteo 	<ul style="list-style-type: none"> ▪ Meteo information ▪ wind directions ▪ wind speed
	MMI	Cyclical (yearly)	Street segment	<ul style="list-style-type: none"> ▪ Network configuration 	<ul style="list-style-type: none"> ▪ position of building ▪ profile
	Interface to environmental monitoring	Cyclical (postponed)	Measurement points	<ul style="list-style-type: none"> ▪ Interface to environmental monitoring 	<ul style="list-style-type: none"> ▪ Air ▪ Noise ▪ Background

System Needs (WP5)				Functions (WP5)	
What?	Module	Time resolution	Spatial resolution	Sub-functions	Required Data
Calibration of models	Calibration Module	cyclical	Measurement points	<ul style="list-style-type: none"> • Comparison of modelling results and measurement data 	<ul style="list-style-type: none"> • Modelling results • Measurement data
		cyclical	-	<ul style="list-style-type: none"> • Improvement of the models (tuning) 	-

Table 27 Required data (Environmental modelling)

Function (WP5)	Required data (WP5)	
Dispersion Modelling	Statistical data (temporal resolution >= 1 year)	
	Emission data CO, NO _x , C ₆ H ₆ , O ₃ spatially oriented	
	<p>Area source: An arial source is always in quadrants and lies parallel to an axes of a right angle co-ordinate system. This source is defined by:</p> <ul style="list-style-type: none"> • the co-ordinates of the lower left corner point • the corner length • die emission height <p>The emission height is per arial source is consistent for source groups. Die yearly emission is required for the 11 following source groups :</p>	<ul style="list-style-type: none"> • Car exhaust emission • Truck exhaust emission • Motorised vehicle evaporation emission • Distribution of combustibles • Solvent use • Industrial combustion process • Non-industrial combustion process • Production process • Crude oil processing industry • Inland waterway transport • Air traffic
	<p>Point sources: Point sources are defined by:</p> <ul style="list-style-type: none"> • the co-ordinates of the smoke stack • the height of the smoke stack • the exhaust temperature • the volume stream of the exhaust 	The yearly emission of the pollutants to be addressed. The point source will not differentiate between source pollutants.
	Profile of emissions for individual source groups	
	Data for the main road network	<ul style="list-style-type: none"> • Co-ordination of the road segment • Gradient including whether a one-way street • Site (residential area, city centre, main radial)

Function (WP5)	Required data (WP5)	
		<ul style="list-style-type: none"> • Height of the traffic lane • Width of the traffic lane • Number of traffic lanes • Capacity
	Data for the road segment	<ul style="list-style-type: none"> • Built infrastructure height, left-right • Distances of built infrastructure • Gaps in built infrastructure left-right • Site of the pollution concentration point (Measurement point)
	Dynamic data (temporal resolution ≤ 1 hour)	
	Traffic data for the main road network	<ul style="list-style-type: none"> • Traffic pollution • Number of light use vehicles • Number of heavy use vehicles • Number of motorcycle • Number of small motorcycles (mopeds, etc.) • Number of busses • Number of travel/tourism busses • Number of vehicles in Stop & Go
	Meteorological data (Situation across the city)	<ul style="list-style-type: none"> • Wind direction • Wind speed • Dispersion class
Noise Modelling	Statistical data (temporal resolution ≥ 1 year)	
	Data about road segment (additional for requirements for air)	<ul style="list-style-type: none"> • Type of road surface • Type of tram track • Data of tram frequency with profile • Classification of facade
	Dynamic data (temporal resolution ≤ 1 hour)	
	Traffic data for the main road network	<ul style="list-style-type: none"> • See air pollution

5.6 Pollution limits

Pollutant	Period of reference	Limit value ($\mu\text{g} / \text{m}^3$)	Timing mean	Note
SO ₂	Year (1 apr. / 31 march)	80 (median) 250 (98° percentile)	Day	Limit value DPR 203 / 88
	Cold six months (01 oct / 31 march)	130 (median)	Day	Limit value DPR 203 / 88
	Year (1 apr. / 31 march)	40 – 60 (aritm. mean)	Day	Guide value DPR 203 / 88
	Day	100 – 150	Day	Guide value DPR 203 / 88
	Day	125 (warning value) 250 (alarm value)	Day	Warning and alarm values DM 25.11.94
Particulate (gravimetric)	Year	150 (aritm. Mean 300 (95° percentile)	Day	Limit value DPR 203 / 88
	Day	150 (warning value) 300 (alarm value)	Day	Warning and alarm values DM 25.11.94
Particulate (black smoke))	Year (1 apr. / 31 march)	40 – 60 (aritm. mean)	Day	Guide value DPR 203 / 88
	Day	100 – 150 (aritm. mean)	Day	Guide value DPR 203 / 88
NO ₂	Year (01 Jan / 31 Dec.)	200 (98° percentile)	Hour	Limit value DPR 203 / 88
	Year (01 Jan / 31 Dec.)	50 (median)	Hour	Guide value DPR 203 / 88
	Year (01 Jan / 31 Dec.)	135 (98° percentile)	Hour	Guide value DPR 203 / 88
	Hour	200 (warning value) 400 (alarm value)	Hour	Warning and alarm values DM 25.11.94
O ₃	Hour	200	Hour	Threshold value DPCM 28.03.1983
	Hour	180 (warning value) 360 (alarm value)	Hour	Warning and alarm values DM 16.05.96
	8 hours	110 (mobile mean)	Hour	Level for Health protection DM 25.11.94
	Hour Day	200 65	Hour Hour	Level for Vegetation protection DM 25.11.94
NMH	3 hours	200 (aritm. mean)	Hour	Threshold value DPCM 28.03.1983
CO	Hour	40000	Hour	Threshold value DPCM 28.03.1983
	8 hours	10000 (aritm. mean)	Hour	Threshold value DPCM 28.03.1983
	Hour	15000 (warning value) 30000 (alarm value)	Hour	DM 25.11.94
Fluorine	Day	20	Day	Threshold value DPCM 28.03.1983
	Month	10 (aritm. mean)	Day	Threshold value DPCM 28.03.1983
Lead	Year	2 (aritm. mean)	Day	Threshold value DPCM 28.03.1983
PM ₁₀	Year	60 (mobile mean) 40 (mobile mean)	Day	Quality objective DM 25.11.94
Benzene	Year	15 (mobile mean) 10 (mobile mean)	Day on hourly basis	Quality objective DM 25.11.94
PAH (referring benzo(a)pyrene)	Year	0,0025 (mobile mean) 0,0010 (mobile mean)	Day	Quality objective DM 25.11.94

6 ROTTERDAM

6.1 User groups

To find out which user groups would be using which parts of the Rotterdam DSS, information was collected from:

- 13 Face-to-face interviews with professional users
- 13 Questionnaires filled in with professional users
- An expert-meeting with 20 representatives of city departments
- A group-session with 15 citizens
- A citizen's survey (n=10)

Table 28 Rotterdam user needs analysis : user groups by data collection method

User group		Method for data collection ->	Questionnaire		
		Questionnaire ->	B	C	C
		Method of administration ->	face-to-face	face-to-face	Survey
DSS-users	Environment	Regional Envir. (DCMR)	1		
		City Environment (GW-MR)	1		
		Province of South Holland (ZH)	1		
	Traffic	City Traffic Dep. (dS+V)	1		
	Health	City Health Service. (GGD)	1		
Information-users	Neighbouring municipalities	Schiedam		1	
		Ridderkerk		1	
	Rotterdam City planning	City Development Corp.		1	
		Port Authorities City Planning Department		1 1	
	Citizens	Citizens on Hot Spot			10
	National authorities	Ministry of Environm. & Plan.		1	
Ministry of Traffic (RWS)			1		
Regional bodies	ROM-Rijnmond		1		
Group sessions	Expert meeting				
	Citizens workshop				

For the Rotterdam Region the following DSS-user groups are distinguished:

DSS-Users:

- GW-Milieubeleid Rotterdam (GW-MR), Rotterdam Environmental department
- Province of South Holland, Environmental Department
- DCMR, Environmental Protection Agency Rotterdam Rijnmond
- DS+V (traffic), Rotterdam urban development and traffic service
- GGD, Rotterdam Health Service

The Rotterdam Environmental Department is responsible for the development of environmental policies in the city of Rotterdam. Each year a report on the air quality in the city has to be supplied to the Province of South Holland. This report must also address traffic on urban roads. The department has several tasks in the field of the noise pollution legislation. The department advises the executive board of the city council (especially the alderman for environment) on environmental matters.

The environmental department of the province of South Holland is responsible for monitoring the overall air quality in the province. To do so, it compiles the different city reports and if necessary adds additional measurements. Although this is not yet a formal requirement, the province also monitors the air quality along the national highways and regional roads. Formally there exists a void in the national legislation regarding the responsibility for the monitoring of air-quality along national highways. The department advises the deputy in the Provincial parliament on environmental matters.

The Province of South Holland and the municipalities in the Rijnmond Region have delegated a number of tasks in the field of environmental law to the regional environmental protection agency (DCMR). The DCMR carries out air-quality measurements (especially directed at industrial pollution); handles the stench and noise complaints of the citizens in their control room; and supplies the environmental permits to industry. Annually an overview is produced about the environmental situation in the Rijnmond region.

The Traffic and Transport unit of the department of Housing and Planning is responsible for transport policy, design of infrastructure, traffic demand management and transport research and advice in the city of Rotterdam. The Traffic and Transport unit is responsible for the policy development and the design and implementation of these projects and measures. The Department is important user of the information on traffic related pollution because of its tasks on traffic management. Within the unit the Transport Environment Chart (on air quality effects of long term transport policies) is operated. This information is also supplied to the environmental department of the city. The department advises the Rotterdam alderman for Transport and Traffic.

The Municipal Health Service for the Rotterdam Area (GGD) protects and promotes the quality of the health of the population of Rotterdam and the surrounding municipalities. This is done by providing good public health care and supporting the quality of the living and working environment. The Environmental Health Office has the specific task of protecting and promoting the health of citizens. This is achieved by limiting the exposure to environmental pollution and by stimulating a safe and hygienic environment. The Municipal Health Service Rotterdam Area (GGD) is an important user of the traffic related pollution data. Both real time and long term data supplied by the project will be used for decision support and policy making. The department advises the Rotterdam alderman for Health.

The **Information-Users** defined in the HEAVEN-project are:

- Ridderkerk, Municipality in Agglomeration South of Rotterdam
- Schiedam, Municipality in Agglomeration West of Rotterdam
- Gemeentelijk Havenbedrijf Rotterdam, Port Authority
- DS+V (planning) Rotterdam urban development and traffic service
- Rotterdam City Development Corporation
- VROM, Ministry of Planning and Environment
- RIVM, National Institute for the Environment and Health
- Rijkswaterstaat Zuid Holland, Department of Ministry of Transport
- ROM-Rijnmond
- Citizens on hot spots

The environmental departments of the neighbouring municipalities, like Rotterdam, have the responsibility to produce yearly reports on air quality. They are users of the regional Transport Environment Chart. These municipalities have also delegated the tasks described above to the Regional Environmental Protection Agency.

The different city planning departments have to consider the environmental effects (including air and noise) of their planning measures.

The national Ministry of Environment is responsible for the national legislation on air quality and noise and has to adapt national legislation to the European directives. The RIVM conducts research on environment and health. Rijkswaterstaat Zuid Holland is a department of the National Ministry of Traffic and is in charge of the national highways in the province of Zuid Holland.

ROM-Rijnmond is an intergovernmental body of co-operation, in which most of the organisations described above are represented. The co-operation is directed at the regional environmental issues in the Rijnmond region

Table 29 Overview of user groups Rotterdam

		Administrative Level		
	USER	Regional	City	District
A	Authorities			
A1	Traffic / Transport Departments		<ul style="list-style-type: none"> ▪ DS+V, traffic and transport 	
A2	Environment Departments	<ul style="list-style-type: none"> ▪ DCMR ▪ Province South Holland ▪ Neighbouring municipalities 	<ul style="list-style-type: none"> ▪ GW-MR 	
A2.1	Responsible for air pollution			
A2.2	Responsible for noise pollution	N/A.	N/A.	N/A.
A.3	Health Departments		<ul style="list-style-type: none"> ▪ GGD 	
B	Decision makers			
B1	Urban Development		Through DS+V, GHR and OBR	
B2	Traffic / Transport		Through DS+V	
B3	Environment	Through Province	Through GW-MR	
B4	Health		Through GGD	
C	Public + Interest Groups			
C1	Citizens		<ul style="list-style-type: none"> ▪ Citizens in Overschie 	
C2	Residents of hot spot areas			
C3	Patient groups			
C4	NGOs			
C5	Research institutions	<ul style="list-style-type: none"> ▪ RIVM 		
C6	Chamber of commerce			
	Urban Planning Departments		<ul style="list-style-type: none"> ▪ DS+V, Planning ▪ Port Authority (GHR) ▪ City Development Corporation (OBR) 	
	National Ministries	<ul style="list-style-type: none"> ▪ Ministry of Traffic ▪ Ministry for Environment and Planning 		

6.2 Objectives

6.2.1 Objectives of public administration

The main objectives of the directly involved organisations of public administration (City environmental department (GW-MR), city traffic department (dS+V), city health department (GGD), regional environmental authorities (DCMR) and the province of Zuid Holland (ZH)) are listed in the table below.

Table 30 Rotterdam objectives public administration

Main objectives	DSS-Users
Help for modelling the environmental effects of temporary transport policies/measures	City-environment., City traffic, Province, Reg. Environment
Health information system	City health, City Environment, Province, Reg. Environment
Information system on pollutants for the administration	City Environment, Province, Reg. Environment
Support for policy makers on future transport policies	City Environment, Province, Reg. Environment
Information system on pollutants for the citizens	City Health, Province, Reg. Environment
Help for modelling the environmental effects of long term transport policies	City traffic and city environment
Information system on noise for the administration	City and region. Environment

The objectives that are mentioned by four of the five main users are the help for modelling the environmental effects of temporary policies/measures and the health information system. Both the traffic- and the environmental department mention temporary traffic measures. The health information system is an objective of the health and environmental departments. Both the information system on pollutants for the administration and the information system for the citizens are listed by three organisations (environment and health). Modelling the environmental effects of long term transport policies is an objective for both the traffic and the environment department of the city.

Other consulted public users of the information are the regional branch of the national road authority (Rijkswaterstaat Zuid Holland); the national ministry for environment (VROM); urban planning departments of the city of Rotterdam and two neighbouring municipalities within the Rotterdam region (Ridderkerk and Schiedam).

For RWS-ZH the added value of the HEAVEN DSS would be assessment of pollution by stop-and-go and congested traffic, on the one hand. On the other hand there is a need for information on the importance of background pollution levels. Both objectives lay in the field of information system on pollutants (listed as third 3 in the table).

The national ministry for environment is not directly involved in the project but considers the project as an interesting experiment for trials with short-term/temporary traffic measures. This objective was also mentioned by almost all directly involved public organisations.

The planning departments can use the system as a source of information for decisions on the planning of roads and other build environment. This objective overlaps with the “modelling of long term transport measures” in the table above. The data requirements for these purposes are looked at in the next sections.

The two neighbouring municipalities mention the added value of the actual information on pollutants. This information is useful for their periodic monitoring.

6.2.2 Objectives of citizens

From the first eight citizens questionnaires that were returned by the 30th of May the following objectives can be derived:

Table 31 Objectives citizens

Main objectives	Number of times listed
Health information system/practical recommendations for citizens in alarm situations	4
Actual information as basis for government action/traffic management actions	4
Actual information system on pollutants/signalling bad air quality	3
Control and validation of previous air quality measurements	2
Improvement of air quality situation	1

The citizens that returned the questionnaires stressed the importance of practical recommendations in case of alarm situations regarding air quality. What should citizens do when threshold values are surpassed?

6.3 Functionalities of the system

6.3.1 Functionalities of the information system

Pollutants

NO_x, PM10, PM2.5, benzene and black smoke were mentioned most frequently as pollutants that should be monitored by the DSS. However, clearly all organisations are aware of both national and European laws and directives on air pollution and feel that the DSS should be able to monitor whether the thresholds for these directives are met.

National and EU limits exist for the following traffic related pollutants: NO₂, PM10, Benzene (C₆H₆) and CO.

Spatial aggregation

Municipal, regional and provincial organisations have a need for information on street level. From these, aggregations can be made, e.g. zone maps. Organisations operating on a national level have a need for data on a higher level of aggregation.

Time resolution

Many organisations feel that the time resolution of the information should be in line with EU directives and national law. Most organisations have a need for data to prepare their yearly reports on pollution. Only a limited number of organisations (i.e. city health and the province ZH) require information on an hourly base for monitoring purposes. Note that the current TEC is not suited to provide information on an actual yearly base, because it uses traffic data that were collected in 1997.

Parallel to national policy documents, organisations operating on a national level must provide every a thorough analysis every four years. This analysis can be based on the yearly reports.

The yearly reports must provide the following information:

- Yearly emissions of CO₂ by traffic (in ktonnes)
- Yearly emissions of NO_x by traffic (in ktonnes)
- Yearly emissions of SO₂ by traffic (in ktonnes)
- Yearly emissions of C_xH_y by traffic (in ktonnes)

Residential areas where:

- NO₂ limit (98-percentile hourly average of 135 :g/m³) is exceeded
- CO limit (98-percentile of 8-hour average of 6000 :g/m³) is exceeded;
- CO limit (99.9-percentile hourly average of 40 :g/m³) is exceeded;
- Benzene limit (yearly average of 10 :g/m³) is exceeded
- PM10 concept-limit (yearly average of 40 :g/m³) is exceeded
- PM10 limit (24-hour values of 140 :g/m³) is exceeded
- SO₂ limit (50-percentile 24-hour average of 75 :g/m³) is exceeded
- B(a)P limit (yearly average of 1 ng/m³) is exceeded
- O₃ limit (hourly average of 240 :g/m³ , 8-hour average of 160 :g/m³ and season average of 100 :g/m³) is exceeded

EU directives add the following information needs:

- NO₂ directive (99.8-percentile hourly average of 200 :g/m³ and yearly average of 40 :g/m³)
- PM10 directive (yearly average of 40 :g/m³) is exceeded (from 2005)
- PM10 directive (yearly average of 20 :g/m³) is exceeded (from 2010)
- Benzene directive (yearly average of 5 :g/m³) is exceeded
- CO directive (maximum of 8-hour average of 10,000 :g/m³) is exceeded

6.3.2 Information channels

Whether and in what form information should be given to citizens remains a much-debated issue in Rotterdam. Because no clear policies, measures or behavioural directives can currently be set into action as a response to critical pollution levels, the public sector (except for the city health service) remains hesitant to start to inform citizens widely on the actual urban pollution levels. It is feared that citizens would either start to increase the pressure on decision-makers to actually do something about the air quality in certain areas or even to sue the city for not doing enough to relief the problem.

User interfaces

To distribute information on pollution levels to citizens the following interfaces were mentioned: radio, TV, teletext, VMS, RDS-TMC, Internet website, public displays and newspapers.

6.3.3 Functionalities of the DSS

Information on historical data in order to compare existing levels with historic levels:

Objective: To support decisions and policy development to improve the urban air quality and to gather knowledge on (monitor) the effects of measures to improve the urban air quality.

Description: The information from near real time monitoring traffic, meteo an pollution monitoring in the demonstration area information will be retained in an historical database, which allows generation of yearly reports.

Expected impact: Common historical information on urban air pollution levels and easily accessible yearly reports on traffic related air pollution. Note that during the HEAVEN project lifetime this historical information will become available only for motorways and an urban corridor (i.e. the demonstration area).

Alarm levels and alarm functions

Objective: with real time information immediate actions can be taken (art. 48);

Description: smog-scenarios by RIVM and province;

Expected impact: decreased periods with critical pollution

Remarks: Though in general found interesting, it is politically sensitive to distribute real time information on urban pollution. Currently, there are no policies or measures to address pollution caused by traffic: prime political objectives are economic growth and remaining accessible. However, the HEAVEN DSS will stimulate the discussion on how to deal effectively with traffic related air pollution.

Automatic generation of optimal traffic measures when emission levels are reached

Objective: to protect the health of general public and sensitive citizens in particular;

Description: from near real time information on traffic flows, meteo data, and concentrations of pollutants traffic measures (scenarios) can be set into action.

Expected impact: As yet, no clear and politically acceptable traffic measures to decrease pollution are available. During the lifetime of the project the effects of at least two scenarios will be assessed with the DSS and the aim is to demonstrate at least one measure during the project lifetime. Feasibility depends on political willingness to take measures.

Modelling functions in order to evaluate the environmental effects of long term transport policies (also of area wide traffic schemes)

Objective: to evaluate ex ante the effects of traffic measures to reduce traffic related air pollution

Description: Improved emission and dispersion models will improve the quality of NO₂, PM₁₀, benzene, and CO pollution assessment

Expected impact: improved modelling tools to assess the effects of TDMS on urban air pollution.

Health information systems

Objective: to give near real time and valid information to citizens and sensitive groups about traffic related air pollution and to develop behavioural directives on how to deal with critical pollution, i.e. leading to breathing problems.

Description: A pollution zone map of Rotterdam will be developed with red/orange/green areas indicating the seriousness of pollution. Behavioural directives will be added.

Expected impacts: Better-informed citizens and improved information on the health effects of traffic related air pollution.

Remark: As yet, the information on the short and long term impacts of traffic related pollution is limited. It is necessary that more knowledge on the relation health-traffic related air pollution becomes available, either from large-scale epidemiological studies or other health information systems.

Information provision to citizens

Objective: to inform road users and residents about the air quality and to provide behavioural directives to improve the air quality or to diminish the adverse effects of critical pollution.

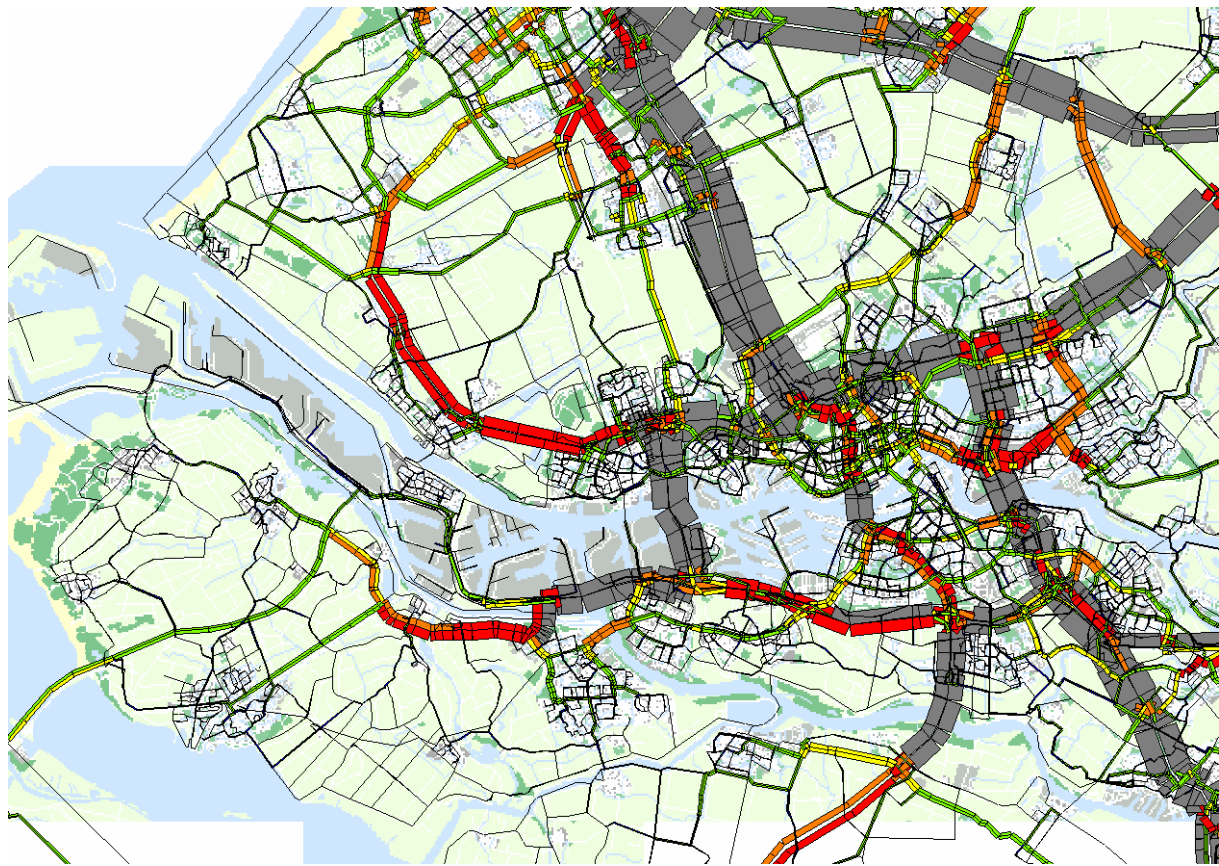
Description: Feasibility of en-route information provision using VMS will be assessed, and if positive demonstrated. This may also lead to measures like local speed reduction, detours of truck traffic, or P+R advice. The website will provide information on behavioural

Expected impacts: Demonstration of traffic measures and better-informed citizens.

6.4 Transport measure which can be supported by the DSS system

6.4.1 Traffic situation in the city

See TEC map of traffic volumes on the Rotterdam regional road network below



Colour Legend (volumes in veh/12h/direction) blue <1600; green 1600-6000; yellow 6000-8000; orange 8000-12000; red 12000-20000; grey > 20000

Figure 6-1 Traffic volumes on Rotterdam regional network (1997-1998)

Figure 6 shows that all roads with more than 20,000 vehicles (12-hour period) are national highways. There is only one exception, namely the Maastunnel right in the centre. The Maastunnel is part of the Pleinweg/Vaanweg corridor that leads from the A15 national highway in the south to the north bank of the river Maas.

The major congestion problems in the region are experienced on the national highways. A particularity in the region's geography is the river Maas that crosses the region from east to west. There are (only) five points in the region where the river can be crossed. Only two of them are on the national highways, namely the Van Brienoord Bridge in the East and the Benelux tunnel in the west. The other river crossings are located in the city centre and have a more local function (Willemsbridge, Erasmusbridge and Maastunnel).

6.4.2 Description of potential measures to improve the situation in the city

The main users of the system mentioned the following measures in the questionnaire as measures that would improve the air and noise quality in the Rotterdam region "extremely" or "very much".

Table 32 POSSIBLE TRANSPORT MANAGEMENT MEASURES TO IMPROVE AIR AND NOISE QUALITY IN ROTTERDAM ACCORDING TO MAIN USERS

Measures	Users
Access control	City & Reg. Environment, City health, City traffic
Lorry ban	City Environment, City health, City traffic
Vehicle emissions standard	City Environment, City health, City traffic
Parking control	City traffic, Province
Park and ride	City Environment, City health
Light rail transit system	City & Reg. Environment
Promotion of electric vehicles	City Environment, City health
Pedestrianisation	City Environment
Cycle routes	City Environment
Bus priorities	Province
Road pricing	Regional environment
Limiting times of deliveries	City health
Integrated policy	City Environment
Filters	City health

Note that the table gives an insight in possible effective measures but not in the practical and political feasibility. The measure which is mentioned most, access control, is for example not likely to be implemented in the near future. The same is true for the banning of truck traffic. Three organisations (traffic, environment and health) expect a considerable effect of lorry bans and vehicle emission standard. Besides the measures listed in the table, three organisations mentioned speed restriction as a measure that could have a moderate effect on air quality and noise. The other information using organisations were asked to list possible temporary and long term traffic measures to improve air and noise quality, in an open question. In the table we give an overview of the results.

Table 33 TRANSPORT MANAGEMENT MEASURES TO IMPROVE AIR AND NOISE QUALITY IN ROTTERDAM ACCORDING TO OTHER INFORMATION USING ORGANISATIONS

Measures	Number of times mentioned (N=8)
Partial traffic ban/access control	4
Re-routing (VMS)	4
Speed reduction (120 > 100 km/h or from 100 > 80 km/h)	4
Enforce/promote cleaner fuels/clean vehicles	4
Sound attenuation barriers	3
Inform road users (e.g. VMS)	3
Parking policy (pricing)	2
Park & ride	2
Concentrate traffic on appropriate routes	1
Discourage use of private car	1
Ramp metering	1
Ban truck traffic on certain routes	1
Prioritise types of traffic	1
Preference for clean trucks	1
High quality cycle routes	1
Underpasses/tunnels	1
Inform road users on in-car air quality	1

The most listed measures by the second group of public organisations are access-control, re-routing, speed reduction and clean fuels/clean vehicles.

Table 34 TRANSPORT MANAGEMENT MEASURES TO IMPROVE AIR AND NOISE QUALITY IN ROTTERDAM ACCORDING TO CITIZENS

Measures mentioned in discussion session	
Underpasses/tunnels	
Partial traffic ban (dynamic control of exits of highway)	
Speed reduction	
Discourage use of private car	
Park & ride	
Re-routing of truck traffic	
Inform road users (e.g. VMS)	
Improve fluidity of traffic to prevent congestion	
Ramp metering	
Measures mentioned in questionnaires	Number of times mentioned (N=9)
Underpasses/tunnels	4
Improvement of public transport	4
Park & Ride	4
Re-routing of truck traffic (during peak hours)	3
Partial traffic ban (access control for highly polluted areas)	3
Construction of alternative roads (outside living quarters)	3
(Partial) closing of Rotterdam Airport	2
Centralised city distribution centre for goods	2
Promote Teleworking and teleconferencing	2
More green areas along roads	1
Speed reduction	1
Car-sharing	1
Mechanical wind to disperse air pollutants	1
Clean and electric vehicles for goods distribution	1
Traffic calming (30km zones)	1

From measures mentioned by citizens it stands out that the majority are long-term measures. The two temporary measures concern: dynamic access control for highly polluted areas and re-routing of truck traffic during peak hours.

1.4.3 Benefits from the system

If agreement is reached on the way to supply real time information to the citizens and road users, the system is the appropriate channel to distribute the information through Internet and possibly VMS. The system will make it possible to evaluate temporary traffic measures on the roads that are included in the actual information platform (highway network in the region/and one major corridor of the urban road network). A possible measure to be experimented with during the lifetime of the project is speed restriction on the highway that crosses the Overschie quarter.

The long-term effects of the different planning measures can be evaluated from the outcomes of the traffic environment chart.

6.5 Description of Local Data Exchange Requirements

Table 35 A: User needs and functions (environmental modelling) – EIP Rotterdam

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution	Sub-functions	Appropriate Model	Required Data
reliable and up-to-date emission and dispersion data	CO, NO ₂ , PM ₁₀ , Benzene, BS, PM _{2.5} (“pollutants”)	Hourly	Motorway and corridor sections	EIP system	<ul style="list-style-type: none"> motorway: TNO traffic-model urban: CAR2 	
	ECOC, ozone, toluene, HC, SO _x , PAKs, B(a)P			will not be part of EIP		
alarm levels	automatic warning when value is exceeded	if relevant (ASAP)	Zones	EIP system	<ul style="list-style-type: none"> TNO traffic-model 	threshold values
automatic generation of traffic measures				will not be part of EIP		
information to citizens	qualitative information	Hourly	zones	EIP system + web-site		
health information	behavioural directives when limits are exceeded	Hourly	zones	web-site		
Historic data	CO, NO ₂ , PM ₁₀ , Benzene, BS, PM _{2.5}	daily and yearly	sections, aggregates	application in GIS	results from TNO traffic-model and CAR2	

Table 36 B: USER NEEDS AND FUNCTIONS (ENVIRONMENTAL MODELLING) – TEC ROTTERDAM

User Needs (WP4)				Functions (WP5)		
What?	Details	Time resolution	Spatial resolution	Sub-functions	Appropriate Model	Required Data
reliable long term emission and dispersion data	CO, NO ₂ , PM ₁₀ , Benzene, BS, PM _{2.5}	Yearly	street level	<ul style="list-style-type: none"> • combine static data (area, roads, etc) with static transport model • generate input for pollution-model • process output from pollution-model • presentation of maps/tables 	<ul style="list-style-type: none"> • static traffic-model of Rotterdam area • motorway: TNO traffic-model • urban: CAR2 	see table 5
modelling functions	to calculate effects of TDMS	Yearly	street level			variants of transport-model

Table 37 A: NEEDS AND FUNCTIONS (USER INTERFACE) - EIP ROTTERDAM

User Needs (WP4)		Functions (WP5)
Information channel	Module	Sub-functions
Internet	web site	<ul style="list-style-type: none"> • file transfer to web-site •
on-line direct access to DSS	client (EIP-client)	GIS application (interface) or front-end application
	data server (EIP-user data)	GIS application (server)
TeleText	(to be developed by city health)	
Variable Message Signs	(to be developed by city traffic)	
radio/RDS-TMC/Newspapers	(to be developed by city health)	
yearly reports	Historic database	GIS application: <ul style="list-style-type: none"> • store hourly data (inputdata to EIP about traffic and meteo, and output from pollution-model)

Table 38 B: NEEDS AND FUNCTIONS (USER INTERFACE) - TEC ROTTERDAM

User Needs (WP4)		Functions (WP5)
What?	Module	Sub-functions
Direct access to DSS and long term air pollution reports	Transport model (Omnitrans)	existing software
	static database (Promil)	existing software
	GIS	existing software

Table 39 SYSTEM NEEDS AND FUNCTIONS (SYSTEM MODULES) - EIP ROTTERDAM

System Needs (WP5)				Functions (WP5)	
What?	Module	Time resolution	Spatial resolution	Sub-functions	Required Data
Realtime motorway traffic-data (Monica)	(EIP server) interface-module Monica	1, 5 or 15 min	motorway section	<ul style="list-style-type: none"> fetch datafile from Monica network extract data for Rotterdam ring aggregate to 1 hour 	<ul style="list-style-type: none"> data for 3 vehicle types (passenger car, truck, truck and trailer): <ul style="list-style-type: none"> - flow - average speed
Realtime Rotterdam corridor traffic-data	(EIP server) interface-module corridor (dS+V)	1 min	corridor section	<ul style="list-style-type: none"> fetch data from Rotterdam network aggregate to 1 hour 	<ul style="list-style-type: none"> data for 2 or 3 vehicle types (2: shorter/longer 10 m; 3: car, truck, truck and trailer): <ul style="list-style-type: none"> - flow - average speed
Realtime meteo-data	(EIP server) interface-module meteo	1 min	Rotterdam area (station Rozenburg)	<ul style="list-style-type: none"> fetch data from Rotterdam network aggregate to 1 hour 	<ul style="list-style-type: none"> wind direction & speed temperature humidity
Traffic forecast-data	(EIP server) traffic forecast	Hourly	motorway + corridor section	<ul style="list-style-type: none"> establish forecast based on date (Mon-Sun, holiday) 	<ul style="list-style-type: none"> historic traffic data for 3 vehicle types: <ul style="list-style-type: none"> - flow - average speed
Meteo forecast-data	(EIP server) interface-module meteo forecast	Daily	Rotterdam area	<ul style="list-style-type: none"> fetch forecast 	<ul style="list-style-type: none"> wind direction & speed temperature humidity
Static data	(EIP server)	≥ yearly	sections / Rotterdam	<ul style="list-style-type: none"> input other data 	<ul style="list-style-type: none"> see table 5 (vehicle, road,

System Needs (WP5)				Functions (WP5)	
What?	Module	Time resolution	Spatial resolution	Sub-functions	Required Data
(other model – parameters and data)	interface-module other data		area		surroundings, etc)
Input for pollution-model	(EIP server) generate input files	Hourly	motorway sections	<ul style="list-style-type: none"> • generation of files for motorway calculations • generation of files for calculations on corridor 	<ul style="list-style-type: none"> • see table 5
Calculation of emissions and dispersion	Pollution-model	Hourly	motorway and corridor sections	<ul style="list-style-type: none"> • motorway calculations (emission and dispersion) of “pollutants” • corridor calculations (emission and dispersion) of “pollutants” 	<ul style="list-style-type: none"> • TNO (to be developed)
Output pollution-model	(GIS) process output pollution-model	Hourly	Sections and co-ordinates	<ul style="list-style-type: none"> • Process average emissions and dispersions for “pollutants” on motorway sections and co-ordinates • process average emissions and dispersions “pollutants” on corridor sections and co-ordinates 	<ul style="list-style-type: none"> • to be developed
Output to GIS	(EIP server) output to GIS	Hourly	sections and co-ordinates	<ul style="list-style-type: none"> • export static data • export dynamic data (traffic and meteo) 	<ul style="list-style-type: none"> • see table 5
Input from EIP server	(GIS) input from EIP server	Hourly	sections and co-ordinates	<ul style="list-style-type: none"> • export static data • export dynamic data (traffic and meteo) 	<ul style="list-style-type: none"> • see table 5
Output to web-	(GIS)	Hourly	sections and co-	<ul style="list-style-type: none"> • generation of map 	<ul style="list-style-type: none"> • bitmap

System Needs (WP5)				Functions (WP5)	
What?	Module	Time resolution	Spatial resolution	Sub-functions	Required Data
site	output to web-site		ordinates	(picture) • send data and picture to web-site	•
Web-site	(web-site)	Hourly	sections and co-ordinates		• picture •
Historic database	Historic data	≥ hourly	Sections and co-ordinates		•
Interface for manager	Manager interface	-	-		•
Interface for user	Users interface	-	-		•

Table 40 SYSTEM NEEDS AND FUNCTIONS (SYSTEM MODULES) - TEC ROTTERDAM

System Needs (WP5)				Functions (WP5)	
What?	Module	Time resolution	Spatial resolution	Sub-functions	Required Data
Traffic-data On Rotterdam network	(Promil) input transport- model	Morning peak, day	Links	<ul style="list-style-type: none"> input transport model 	<ul style="list-style-type: none">
Static data (other model – parameters and data)	(Promil) interface	≥ year	Links / Rotterdam area	<ul style="list-style-type: none"> user interface 	<ul style="list-style-type: none">
Model management	(Promil) interface	-	Links / Rotterdam area	<ul style="list-style-type: none"> management of static traffic models (model- variants) 	
Input for pollution-model	(Promil) generate input files	-	Links	generation of files containing information about links	<ul style="list-style-type: none">
Calculation of emissions and dispersion	Pollution- model	-	Links	<ul style="list-style-type: none"> motorway calculations (emission and dispersion) of “pollutants” urban corridor calculations (emission and dispersion) of “pollutants” 	<ul style="list-style-type: none"> TNO (to be developed)
Calculation of emissions and dispersion	Pollution- model	-	Links	<ul style="list-style-type: none"> motorway calculations (emission and dispersion) of “pollutants” urban corridor calculations (emission and dispersion) of “pollutants” 	<ul style="list-style-type: none"> TNO (to be developed)
Interface for manager	Manager interface	-	-		
Interface for user	Users interface	-	-		

