European Commission

Regional Balkans Infrastructure Study - Transport

Appendix 9 - Final Report

Management Information Systems

July 2003

REBIS transport
Joint Venture

European Commission

Regional Balkans Infrastructure Study - Transport

Appendix 9 - Final Report

Management Information Systems

July 2003

Report no.	2
Issue no.	Final
Date of issue	23 July 2003

Prepared	Ana Trpkovic, Jesper Mertner
Checked	Peter Christensen
Approved	Erling Hvid

Table of Contents

1 Summary and conclusions

Poor maintenance planning - e.g. due to a lack of information on the infrastructure system - often leads to inefficient use of the limited funds for infrastructure maintenance. In most of the REBIS countries it would thus be an economic advantage to introduce or improve management information systems for the infrastructure (roads and structures, rail and structures, ports, airports, inland waterways). This could include hardware and software, as well as technical assistance, in order to get the systems operating with data.

Management of infrastructure is based on the idea that the infrastructure is considered an asset which needs to be maintained and improved to ensure the maximum life service, as well as securing good performance and value for money of the infrastructure[1].

To ensure efficient maintenance of infrastructure through a properly managed series of works and activities, it is necessary to have up-to-date information about the features and conditions of the infrastructure, as well as on traffic and accidents. Additionally, when resources are scarce for maintenance of the infrastructure, it is important to have the necessary data to properly prioritise the maintenance work according to identified needs.

The management of infrastructure is thus based on information that needs to be continuously updated. Therefore, a survey of the management information systems has been carried out, and the purpose of this survey is to obtain an overview of the information systems for traffic and infrastructure data in the REBIS countries. The overview provides information on organisations having and collecting data, the level of updating of the data, and areas covered by the systems, e.g. data on traffic, structures, road, rail, port, airport and inland waterways conditions, etc.

Information on management information systems for infrastructure is collected centrally at the Ministry of Transport, e.g. in institutions such as a directorate for roads, railway directorate and government agencies for inland waterways and decentralised at ports and airports.

[1] Based on TRL and DFID, Guidelines for the design of operation of road management systems, Overseas Road Note 15, 1998.

Generally there are needs for improvement of the existing management information systems for most infrastructure types, either for updating data or, as in most cases, to computerise the information in a coordinated way. The rail, port, airport and inland waterway sectors generally have updated data on condition, traffic, and in most cases also on inventory, but mostly on paper. For the road infrastructure, the data on inventory is not updated in 3 countries and condition data is not updated in 2 countries. Most of the countries need to extend their traffic data collection to all roads and to update the information on especially the condition of structures. Generally the traffic accident data re collected by the police but there is no formal cooperation between the police and the road authorities, thus data is not systematically used to e.g. identify black spots etc.

With regard to management of the regional core network, the countries will generally not be able to supply necessary data or updates as envisaged for the foreseen South Eastern Europe Transport Observatory (SEETO).

1.1 Road management information systems

Croatia and Kosovo is far in the process of developing a central management information system for roads, and not much improvement and assistance seems to be needed.

In most of the other REBIS countries data exists, but is generally in separate systems, and some data is paper-based and some is computerised. In many of the countries, only some data is updated while other data is not.

Most of the other countries need some improvements of their information system, as summarised in Table 1.1 which may include a need for support projects. All the countries apart from Croatia and Kosovo need to extend their traffic counting system to cover the entire main road network. This could e.g. be through additional traffic counters, etc. Updated condition data of the structures is generally needed, as are functioning bridge management systems. The inventory data needs to be updated in FYRO Macedonia and in Albania, and in Bosnia and Herzegovina the condition and inventory data needs to be updated.

Generally, the paper-based data should be updated and computerised before a unified system is developed. The next phase could be to support all the countries except Croatia to unify the separate databases and provide a management information system as an umbrella for all the data.

All the countries have similar road safety procedures, where the police generally collect the road accident data. There is - apart from Kosovo - no formal cooperation between the police and the road authorities, thus data is not systematically used to e.g. identify black spots.

Projects to support cooperation between the police and road authorities with regard to improving road safety could be relevant in all countries. First of all

the same reference (location) system should be used by both authorities and a formal procedure to transfer data from the police to the road authorities should be ensured. Presently the police often write reports in order to be able to decide who is responsible for the accident. It may be relevant to add features to the police reports which enable further information on:

- location of accident
- cause of accident
- how many were involved
- severity of accident
- etc.

to be able to analyse the accidents. The aim should be that the road authorities may systematically reduce road accidents.

Table 1.1 Summary of need for road management information systems.

	Update inventory data	Update condition data	Update traffic data	Update accident data	Update structure data
Albania	Full update of inventory of the remaining approx. 70% of the network and computerise the remaining 96% of the network still missing.	Need to update condition data which is from 1996 and to computerise the data.	Need to ensure that the remaining 60% of the road network comes under regular traffic counts.	Need for proper data collection by police including location and transfer of information to the road authorities	Need for full update of structure inventory on the remaining approx. 70% of the network and computerise the remaining 96% of the network still missing. Need for a bridge condition system.
Bosnia and Herzegovina	Update and computerise data from 1991.	Need to update condition data which is paper-based and from 1991 and to computerise the data.	Need to ensure that the entire road network comes under regular traffic counts.	Need for proper data collection by police including location and transfer of information to the road authorities	Update condition data from 1999 which is paper-based and to computerise the data.
Croatia	-	-	-	Need for proper data collection by police including location and transfer of information to the road authorities	-
FYRO Macedonia	Update and computerise data from 1991 d.	-	Need to ensure that there are sufficient numbers of counters to include regional roads in the national counting system.	Need for proper data collection by police including location and transfer of information to the road authorities	Have developed own system but data is 3 years old, thus support is needed to update and computerise all the data.

	Update inventory data	Update condition data	Update traffic data	Update accident data	Update structure data
Serbia and Montenegro					
Serbia	-	-	Need to ensure that there are sufficient numbers of counters to include regional roads in the national counting system.	Need for proper data collection by police including location and transfer of information to the road authorities	Have new Bridge Management System but data is 10 years old data, thus support could be needed to update the data to the new system.
Montenegro	-	-	Need to ensure that there are sufficient numbers of counters - presently there are only 10 counters.	Need for proper data collection by police including location and transfer of information to the road authorities	The inventory and condition data is generally from 1990, but inventory is part of the COWI/BCEOM study[2], thus a study may be relevant to update condition data of the structures.
Kosovo[3]	-	-	Need some equipment and computerisation	May need some computerisation	Need some computerisation

1.1.1 Status of road management information systems in the countries

The status of the data collection and storage, and management information systems are presented for each country and summarised in Table 1.2.

Albania

There exists a reference system in Albania from 2000. The newly introduced Road Data Bank seems potentially appropriate to be the backbone of a Maintenance Information System. However, an inventory of 30% has been carried out on the national road network and 4% has been included in the system. The structures are part of the inventory. Updated condition data for neither roads nor structures has been included. Apart from annual visual inspections by the regions, no formal assessment of the road network is carried out and registered.

The traffic data is collected regularly on 40% of the network and assessed and stored through software provided by the supplier of the equipment, and thus not part of the Road Data Bank System.

[2] BCEOM - COWI, Preparation of Feasibility Study for the Ministry of Maritime Affairs and Transport Montenegro (FR Yugoslavia).

[3] Under international administration in line with UNSCR 1244 of 10 June 1999.

Road accident data is not formally collected and stored by the General Road Directorate. The traffic police register accidents in a database but this information does not contain information on e.g. location and is not used to e.g. identify black spots. There are no formal procedures to transfer road accident data to the General Road Directorate.

To move towards a full management information system, resources are needed to finalise input of data (including condition) into the Road Data Bank and to implement a formal system for condition assessment, e.g. through a Pavement Maintenance System. In the future also information on traffic etc. should be integrated.

Bosnia and Herzegovina
The existing reference system in Bosnia and Herzegovina is based on the system from the former FR Yugoslavia. There is no management information system for road inventory, condition, traffic and structure. Data is old and not updated. Most of the data is from 1991 and is in paper form. A master plan for Bosnia and Herzegovina was carried out in 2001 and no information has been updated since. There is new data in paper-form on bridges from 1999 based on visual inspection.

There are generally no traffic counts, and none are regularly carried out. The only traffic data is generally from one-day traffic counts carried out under the master plan from 2001.

Road safety data is under the jurisdiction of the local police (10 regions) and there is no cooperation between the Road Directorate and the police, thus the Road Directorate has to contact each region to receive data.

A donation has been received from the World Bank to develop a new information system for roads, bridges and tunnel, traffic counters and other equipment. There are plans to procure HDM 4. There are also plans to make one unique database for The Federation of Bosnia and Herzegovina and the Republic of Srpska.

Presently, the Federation of Bosnia and Herzegovina and the Republic of Srpska have a similar level of system, though the system may be a little more advanced in the Republic of Srpska.

Table 1.2 Summary of status of road management information systems.

	Inventory	Condition	Traffic	Accidents	Unit costs	Structures	Computerisation
Albania	Reference system from 2000. Inventory of approx. 30% carried out in paper form.	Not updated since 1996.	40% of road network under regular traffic counts.	Police collect accident data, but no formal cooperation between police and road administration.	No formal unit costs, but some are calculated for planning and budgeting.	No structure system, but included inventory for Road Data Bank.	New Road Data Bank not fully implemented - 4% of inventory in computer. Plan to later include condition etc. Traffic data in separate computer system.
Bosnia and Herzegovina	Reference system exists from former FR Yugoslavia. Inventory is paper-based from 1991.	Condition data last updated in 1991 on paper.	Traffic data last updated in 1991 on paper.	Accident data is at the police in 10 regions. No direct access for road administration.	Some unit costs are calculated for planning	Visual inspection of bridges from 1999 in paper form.	Generally information is paper-based.
Croatia	Reference system updated in 2003. Inventory data updated in 2003 in rolling updating.	Condition data updated in 2003 in rolling updating.	Traffic data is covered by traffic data in almost entire country (updated).	Police collect accident data, but no formal cooperation between police and road administration.	Pricelist for costs is updated regularly for annual planning.	Structures are part of the information system established, and is updated on inventory and condition.	They are fully computerised with new equipment and network which functions well and is continuously developed.
FYRO Macedonia	Reference system is based on former FR Yugoslavian system, from 1995 and not updated. Road inventory exists mainly on paper and is not updated.	They have condition data from 2001 in PMS.	Main network covered but too few counters to include regional roads. Have traffic database.	Police collect accident data, but no formal cooperation between police and road administration.	Prepare a pricelist for costs used in PMS and for annual planning.	Inventory on bridge exists as mixed paper-based and computerised. Have developed software for bridge, but data is 3 years old.	Have a PMS and traffic database but not a real inventory database. There are plans to digitalise and update the whole network with GIS but stopped due to lack of financing.

	Inventory	Condition	Traffic	Accidents	Unit costs	Structures	Computerisation
Serbia and Montenegro							
Serbia	Referenced according to system from former FR Yugoslavia. Road inventory is fairly updated based on video recording - last round finalised in 2002.	Road condition is fairly updated based on video recording - last round finalised in 2002.	Main network covered but less on regional roads. Have computerised traffic database.	Police collect accident data, but no formal cooperation between police and road administration.	Price-list for costs is updated regularly for annual planning. Also have some VOC cost for HDM4 model.	Bridge inventory exist but is 10 years old. New bridge management system but has mainly transferred old data.	Different and separate databases for road, traffic and bridge. No immediate plan to introduce an umbrella to coordinate all databases.
Montenegro	Referenced according to system from former FR Yugoslavia. Have paper-based inventory from 1990.	Road condition assessed as part of COWI/-BCEOM study from 2002.	Traffic data was last updated in 2002. Traffic data is computerised.	Police collect accident data, but no formal cooperation between police and road administration.	Prepare a price-list for costs.	Structure inventory and condition exist but last updated in 1990. Inventory part of COWI/-BCEOM study from 2002.	Traffic data computerised and maybe road data as part of COWI /-BCEOM study from 2002.
Kosovo[3]	Reference and inventory updated. Inventory is continuously updated.	Condition data is continuously updated.	Traffic data is continuously updated for motorised traffic, but the counting program is only partial dine due to lack of equipment.	Traffic police has since 2001 collected accident data and forwarded these to the Ministry of Transport.	Unit costs are continuously updated.	Structure inventory and condition data generally exists and are updated continuously. No BMS system.	Most data are computerised and they have a PMS. The computer system may require upgrading and connections to the regions. Accident and traffic data may not be fully computerised.

Croatia
The reference system in Croatia was updated in 2003. Inventory data and condition data were last updated in 2003 and were continuously updated in a rolling process.

There is a unique management information system run by Croatian Roads and the Ministry of Maritime Affairs, Transport and Communications. The system is fully computerised and the equipment is new. Operators collect information from the field and send it to Croatian Roads. The computers are connected in a network and data is managed centrally by Croatian Roads and the Ministry of Maritime Affairs, Transport and Communications. Some regions are not covered by a sufficient number of operators, which could cause a delay in data processing. Otherwise the system is functioning well.

Almost the entire network has been covered by traffic counters, and road traffic data is continually updated. This data is used for statistical purposes by the Federal Statistics Bureau and for global planning in the Ministry of Maritime Affairs, Transport and Communications and Croatian Roads.

The road accident database is run by the police. Generally there is no cooperation between the police and the Ministry of Maritime Affairs, Transport and Communications and Croatian Roads. Road safety data is thus not part of the road management system.

FYRO Macedonia
The reference system is based on the former FR Yugoslavian system, and is from 1995 and not updated. The road inventory and condition data covers all main and regional roads (not local roads). The road inventory data collected covers almost all information, but it is a paper-based database and not updated. Only new roads are updated in the road inventory database. Some of the data is computerised in AutoCAD and Excel, but a real road inventory database system does not exist. The collected information is used for a PMS (Pavement Measurement System).

A PMS is used for road condition data. Condition data is updated for the entire road network in FYRO Macedonia (first round finalised in 2001). All typical types of condition information are generally included in the database.

Inventory data of all structures on the national road network is available. The database is partly computerised and partly paper-based and is thus not one unique database. Structure inventory and condition are inspected with a specialised vehicle. Software was developed in 1998 for a bridge database which is in use. All bridges are in the database but information on the bridges is not fully updated. The database consists of three years old data and is in process of being updated.

The Roads Fund and the Ministry of Transport manage and administer the traffic database. The Macedonia Roads Traffic Department collects data and prepares an annual report and also uses the data. The main arterial road network

is covered by traffic counts, but the regional roads are not yet sufficiently covered.

The police collect the road accident data and handle a database on road accident data. An annual report is prepared by the police. The Roads Fund and Macedonia Road do not have a database.

There are plans to update the reference system database, and to digitalise and update the whole network. A GIS system was being implemented, but was stopped because of a lack of financial resources. Also a new system for a road inventory database is needed, because the existing system is mainly paper-based. The road condition database is updated but there is a need for new equipment.

Serbia
The present data collection and storage system is not one system. It is based on different and separate databases (traffic, road, and bridge), and data is entered into the HDM4 model to assess the road network.

The inventory and road condition data is fairly updated for the roads, and based on a video recording from the finalisation of the second round for main arterial roads in 2001. The inventory of the bridges exists but is approx. 10 years old. The condition survey of the bridges is not updated. Only 29 bridges out of 2600 were assessed last year. However, the Road Directorate plans to assess 500 bridges this year.

The traffic data is generally updated annually on the arterial main roads but the updating is lacking on many regional roads. Classified traffic counts are only carried out partially on the main arterial roads.

The road safety data is collected by the police and stored in their databases. The information is not transferred to the Road Directorate, and thus not used to reduce e.g. black spots or other accident-prone areas. The databases of the police and the Road Directorate use different reference systems. There is no Road Safety Department in the Road Directorate.

There are plans to introduce an umbrella of a management information system in Serbia using input from the data bases, but the Road Directorate has so far been cautious to introduce a big complex system, because it is difficult to maintain.

Montenegro
There is an old reference system, based on the FR Yugoslavian system from 1990. Road inventory and condition data covers all main and regional roads, but data has not been updated since 1990. The collected information does not include all information normally used in road management information systems. For purposes of a study (BCEOM - COWI) for the Ministry of Transport, most road condition data has been collected (COWI did this with the local consultant – Montenegro Roads) in 2002, to be used for HDM4 on the entire main road network, but the result is still not available to the Ministry of

Transport. The system is handled by the Ministry of Transport and the collection of data is done by Montenegro Roads. Data collected is in separate registers, some paper-based and some registered on computer and is only used for maintenance and budget planning. An updated, computerised and unique database for road inventory and its condition does not exist. A structure inventory and condition assessments exist but were last updated 1990. However, structures are part of the inventory of the COWI/BCEOM study, but not part of the condition assessment.

Montenegro Roads is responsible for collecting and maintaining traffic data, which was last updated in 2002. There is a computerised database and annual reports are prepared for the Ministry of Transport who uses it for analysis, future planning and budgets.

The road accident database is run by the police and there is no cooperation between Montenegro Roads and the police.

Kosovo
The reference system and inventory is updated in Kosovo. The inventory and the condition data as well as unit costs are continuously updated. Most data are computerised and there is a PMS in Kosovo. The computer system may require upgrading and connections to the regions.

The traffic data is continuously updated for motorised traffic and the traffic police has collected accident data and forwarded these to the Ministry of Transport since 2001. Accident and traffic data may not be fully computerised. The traffic counting programme is only partially carried out because of lack of equipment.

A structure inventory and condition data generally exists and are generally updated continuously but there is no BMS system in Kosovo.

1.2 Rail management information systems

All the former FR Yugoslavian countries largely follow the same principles for data collection and collect more or less the same information. Albania seems to be following similar principles. Usually, updated data exists on inventory, condition, traffic and structures on the entire rail network. The information is mainly paper-based though some data is also computerised.

The Federation of Bosnia and Herzegovina and the Republic of Srpska are in the process of tendering for a management information system as well as for computers. The financing has been secured through donations from Canada.

For the remaining REBIS countries (apart from Bosnia and Herzegovina), it could be relevant to find financing for software and hardware to computerise their information on the rail network systematically. This would help to get an overview of maintenance needs and corresponding financing needs which would be helpful in all countries.

1.2.1 Status of rail management information systems in the countries

The status of the data collection and storage and management information systems are presented for each country and summarised in Table 1.3.

Albania
There is no specific rail maintenance system. All data collected annually for the inventory and condition is in separate files and is generally paper-based for an annual report. All assessments are carried out manually.

Traffic data, such as information on passengers and freight, is collected regularly. All data is thus collected in the General Rail Directorate but in the different departments/sectors. There is a mirror system in the stations and in the General Rail Directorate that sometimes cross purposes.

There is no specific maintenance system for the structures, however, condition surveys of the bridges are now carried out annually. An annual report on the structures is prepared.

Bosnia and Herzegovina
There are two railway companies in Bosnia and Herzegovina. One is in the Federation of Bosnia and Herzegovina, called Bosnia and Herzegovina Railways, and one is in the Republic of Srpska, called Republic of Srpska Railways. The railway companies are both infrastructure managers and operators. The two companies are 100% owners of the railway infrastructure.

All inventory, condition, traffic and structure data exists in both companies. The present information system is working, but is not fully computerised and not centrally managed. Both companies need new equipment, network and new compatible and modern information system. A donation has been given for a new management information system from Canada. Documentation for the tender of the management information system has been initiated. The system will be unique and compatible for both companies.

Croatia
Data collection for rail inventory, condition, traffic and structure is carried out according to common regulations from former FR Yugoslavia and all data is updated. There is not one unique database and information is mostly paper-based. Furthermore, there is no management information system or GIS information.

The preparation of a new information system for the whole organisation is in process, and there are a number of projects for the development of the system in Croatian Railways. The system is handled by the Government Agency Croatian Railways.

There is a need for new computers and software for the planned information system.

Table 1.3 Summary of status of rail management information systems.

	Inventory	Condition	Traffic	Unit costs	Structures	Computerisation
Albania	Collects inventory data annually for annual report.	Collects condition data annually for annual report.	Collects information on passengers and freight.	Unit costs for infrastructure calculated annually.	Condition of bridges now annually for annual report.	All data in separate files and generally paper-based.
Bosnia and Herzegovina	Inventory data exists in both companies from 2002.	Condition data exists in both companies from 2002.	Traffic data exists in both companies from 2002.	Unit cost data exists for planning and investment.	Structure data exists in both companies from 2002.	Presently, system is not fully computerised, but funding is ensured for new information system.
Croatia	Inventory data is collected according to common regulation.	Condition data is collected according to common regulation.	Traffic data is collected according to common regulation.	Unit cost data exists for planning and investment.	Structure data is collected according to common regulation.	No unique database and information is mainly on paper.
FYRO Macedonia	Inventory data is collected according to common regulation.	Condition data is collected according to common regulation.	Traffic data is collected.	Unit costs for planning and investment.	Structure data is collected according to common regulation.	No unique database and information is mainly on paper.
Serbia and Montenegro						
Serbia	Inventory data is collected according to common regulation.	Condition data is collected according to common regulation.	Traffic data is collected.	Each sector has specific unit costs.	Structure data is collected according to common regulation.	No unique database and information is mainly on paper.
Montenegro	Inventory data is collected according to common regulation.	Condition data is collected according to common regulation.	Traffic data is collected.	Unit costs for planning purposes.	Structure data is collected according to common regulation.	No unique database and information is mainly on paper.
Kosovo	Inventory last updated in 2002 and is updated regularly.	Condition data is updated continuously.	Traffic data are collected and updated.	Unit cost data exist	-	No specific program to register inventory and condition data. Collected on paper and later on computer in excel and word. Traffic data are only collected in paper.

FYRO Macedonia

Data collection for rail inventory, condition, traffic and structures is carried out according to common regulations from former FR Yugoslavia and all data was

last updated in 2002. The track recording car is borrowed from Serbia. There is no unique database and information is mostly paper-based. There is no management information system or GIS information. A need for a management information system has been identified by Macedonian Railways.

The preparation of a new information system for the whole organisation is in process, and there are a number of projects for the development of the system in Macedonian Railways. The system is handled by Macedonian Railways.

Serbia
Data collection for rail inventory, condition, traffic and structure is carried out according to common regulations from former FR Yugoslavia and all data is updated. There is no unique database and information is mostly paper-based, but some data is also computerised. The structures are regularly controlled and the data collection and storage is paper-based. Traffic data is collected regularly in a combination of paper-based and computerised databases.

There are plans to extend the system. The Directorate for Rail has been introduced to new software prepared by the University of Delft. This should be useful to cover economic aspects, and could be used for budgeting and planning. These are not covered sufficiently in the existing system. There is a need to transfer data from the old system to new hardware and software, and for financial support to purchase a system. The Canadian government may contribute with financial support to an information system for Corridor X at first, and it is hoped that donors will provide further support.

The Directorate for Rail is also attending the HERMES project for the operation of wagons, because this system would provide better interaction between the client and the railway organisation. The planned change in the organisation will be in accordance with EU directive 440.

Montenegro
Data collection for rail inventory, condition, traffic and structures is carried out according to common regulations from former FR Yugoslavia and all data is updated. There is no unique database and information is mostly paper-based. Furthermore, there is no management information system or GIS information.

The Montenegro Railways has identified a need for a new information system for the entire organisation, e.g. computers and software. The ideas are in process but no specific financing has been found. The system is handled by Montenegro Railways.

Kosovo
Rail inventory was last updated in 2002 and is updated regularly. The condition data is also updated continuously and unit cost data exist. There is no specific program to register inventory and condition data. The information is collected on paper and later inserted in computers in excel and word.

Traffic data are collected and updated but only collected in paper.

1.3 Port management information systems

The survey on port management information systems was carried out for the seaports of Durres, Rijeka, Bar and for the port of Belgrade on the inland waterways. Other core ports were also discussed during the meeting with the ministries in Croatia and Albania. There are no core port in Bosnia and Herzegovina and no ports in FYRO Macedonia and Kosovo.

The Port of Bar has an almost complete port management information system and is planning to extend with GIS soon. The system is updated, although a need for more laptops has been identified to properly run the system.

In the other ports of the REBIS countries, traffic data is often computerised or partly computerised and partly paper-based, while condition and inventory data generally is paper-based.

For the remaining REBIS countries (apart from Montenegro) it might be relevant to find financing for software and hardware to computerise the information on the port systematically. This would help to get an overview of maintenance needs and corresponding financing needs, which would be helpful in all countries.

In Durres Port, a specific (German) system has been identified as a desired system and negotiations on financing etc are ongoing. In the Port of Belgrade, it is considered easy to implement a system using the existing as a backbone for new systems, but the management decision still needs to be made. The Port of Belgrade would like to begin with a special project to identify needs.

1.3.1 Status of port management information systems in the countries

The status of the data collection and storage, and management information systems are presented for each country and summarised in Table 1.4.

Albania
The seaport of Durres does not have a management information system yet. At the moment, most data on infrastructure is collected on paper. The Financial Department and the Commercial Department bring together their information in a paper report, but the port would like to handle data in a more coordinated way. The commercial traffic data is computer-based (WB financed) and port traffic data is continuously updated.

However, plans and negotiations are being made to purchase a system from Germany through an agreement for a system from the Port of Hamburg.

Table 1.4 Summary of status of port management information systems.

	Inventory	Condition	Traffic	Unit costs	Computerisation
Albania	Inventory data updated annually and some parts are computerised.	Condition data updated mainly on paper.	Traffic data collected continuously mostly on paper and some on computer.	Unit costs assessed case-by-case.	Presently mixed computer and paper-based. Plans to purchase a German Port Management Information System.
Croatia	Inventory data updated continuously and mostly paper-based.	Condition data updated continuously and mostly paper-based.	Traffic data collected continuously on paper and some in computer.	Some unit costs exist.	Presently no management information system. Started to use GIS and plans to extend its use.
Serbia and Montenegro					
Serbia	Inventory exists from 2000 from privatisation.	Condition inspected monthly.	Traffic data collected monthly.	Some unit costs exist.	Presently no management information system, but are well working with computers and network. Data is presently collected and could be used as backbone for new system.
Montenegro	Inventory data covers entire port and is computerised.	Condition data covers entire port and is computerised.	Traffic data is collected continuously and is computerised.	Unit costs exist and are computerised.	Have an information system which they plan to extend with GIS soon.

Croatia

The seaport of Rijeka carries out an inventory and condition survey of the entire port. The data collection is partly computerised and partly paper-based and information is continuously updated. A unique database for the entire port does not exist. GIS has started being used and is planned to be extended during the next years.

The port handles the condition and inventory data and stores it mostly in paper form. The data is used for some management purposes but not as a full information system. Information is also sent to the Ministry of Maritime Affairs, Transport and Communications. The traffic data is partly computerised and partly paper-based and is collected by the port and used by the Ministry of Maritime Affairs, Transport and Communications, the Federal Statistics Bureau and themselves.

Serbia

The Inland Waterway Port of Belgrade has no management information system yet. The inventory data was updated in 2000 for the privatisation process and condition data is updated monthly. There is not really any database but data is stored in e.g. Excel and Word. Traffic data is collected for statistical purposes on a monthly basis.

The hardware of the port is well developed but there is a problem with the organisation of data collection. The port has local networks and connections to the internet, etc. and also all data is collected but not all data is used. The data is presently collected and could be part of a future system which could be extended fast.

The existing system in the port is not one system and cannot be considered a port maintenance system. The facilities are maintained according to inspections. The port considers the existing information to be feasible as a basis for a new system. After the management decision, one year is considered enough by the port for the implementation of a new management information system. The port would like to begin with a special project to identify needs.

Montenegro
The condition and inventory data covers the entire Seaport of Bar. A computerised information system exists and the first computerised system was established in 1992. A completely new information system started in 1999 with a database, based on Windows and with new equipment. A contract was made with a company to develop the software named that is now in use containing all information.

For administrative purposes, the port has developed their own software, which is separate from the software developed by the company. The whole system is handled by the port of Bar. There are plans for extending the system, e.g. there are plans to start with GIS within the next six months. However, more computers are needed.

1.4 Airport management information systems

The airport management information systems survey concentrated on the airports such as Tirana Airport, Sarajevo Airport, Airport of Zagreb, Skopje Airport, Airport of Belgrade, Podgorica Airport and Pristina Airport. During the meeting with the ministries in e.g. Bosnia and Herzegovina, Croatia and Serbia and Montenegro other core airports were also discussed

There are generally no airport management information systems in any of the airports in the REBIS countries. Visual inspection of runways and other infrastructure is mainly done by the airports themselves, and more complicated assessment such as bearing capacity etc. is or will be done by e.g. the road directorates. The collected data is generally kept partly in a paper-based and partly in a computer-based system. However, the traffic data is generally computerised. Navigation and lighting systems are generally handled separately.

There are plans for new systems in Croatia, Serbia and FYRO Macedonia, while there are no specific plans in Bosnia and Herzegovina and in Albania. Montenegro has a completely new organisation but did not at the time of the meeting have an overview of existing data and on how to handle data in the future.

For all the REBIS countries it could be relevant to find financing for software and hardware to computerise their information on the airport systematically. In some of the countries, e.g. in Albania, updating of inventory data is necessary and a need exist to get the paper-based data computerised in FYRO Macedonia, Serbia and Montenegro. This would help to get an overview of maintenance needs and corresponding financing needs, which would be helpful in all countries. The needs in Montenegro depend on the information they receive from the former owners of the airports.

1.4.1 Status of airport management information systems in the countries

The status of the data collection and storage, and management information systems are presented for each country and summarised in Table 1.5.

Albania
At present, there is no actual airport management infrastructure system in Albania.

Data is collected for own use in each of the departments in the airport. However, a General Manager collects all infrastructure data to the archives - some on paper and some on computer. The data is used to prepare annual reports on needs. The traffic data is computerised.

There is only a maintenance system covering the electrical system as part of a new system provided by Siemens. The navigation system is operated separately.

There are presently no plans for a new system, only for the purchase of new equipment. This includes investments in a friction measuring machine, a cleaning machine and a lighting system.

ALB-Transport, the organisation running the airport, covers all investments and financing of civil works, equipment, etc.

Bosnia and Herzegovina
All the information on inventory and condition data exists. There is no unique database, but most of the information is computerised. Also, traffic data is continuously collected and updated. The navigation system is operated separately.

There are plans to extend the airport, and a better information system is seen as necessary, however, there are no specific plans for an airport management system.

Table 1.5 Summary of status of airport management information systems.

	Inventory	**Condition**	**Traffic**	**Unit costs**	**Computerisation**
Albania	Inventory of entire airport exists from 2000 as part of Airport Master Plan.	Condition data exists and is updated daily and most are paper-based. Navigation and lighting are continuously checked.	Traffic data continuously updated and computerised.	Unit costs exist but were last calculated I 2-3 years ago.	No airport management information system and data is partly paper-based and partly computerised in separate systems.
Bosnia and Herzegovina	Inventory data exists and is updated continuously and most are computerised.	Condition data exists and is updated daily and most are computerised. Navigation and lighting are continuously checked.	Traffic data continuously updated and computerised.	Unit costs used for planning and budgeting according to work needed.	No airport management information system but most data is computerised in separate systems.
Croatia	Inventory data exists and is updated continuously and most is computerised.	Condition data exists and is updated daily and most is computerised.	Traffic data continuously updated and computerised.	Unit costs used for planning and budgeting according to work needed.	No airport management information system but most data is computerised in separate systems.
FYRO Macedonia	Inventory data is collected continuously, and is partly paper and partly based.	Condition data is collected continuously, and is partly paper-based and partly computerised. Navigation and lighting are continuously checked.	Traffic data continuously updated and computerised.	Unit costs used for planning and budgeting according to work needed.	No airport management information system and data is partly computerised and partly paper-based in separate systems.
Serbia and Montenegro					
Serbia	Inventory data exists on paper and on computer.	Condition data exists in paper form and inspections are registered daily and major surveys annually. Navigation system has log file for condition.	Traffic data continuously updated and computerised. Data exist in former Federal Bureau of Statistics	No defined unit costs. Calculated costs according to work needed.	No airport management information system and data is partly computerised and partly paper-based in separate systems. Started to implement integrated airport operational database.
Montenegro	New organisation started on day of meeting - thus no overview of data and computerisation.	New organisation started on day of meeting - thus no overview of data and computerisation.	New organisation started on day of meeting - thus no overview of data and computerisation.	New organisation started on day of meeting - thus no overview of data and computerisation.	New organisation started on day of meeting - thus no overview of data and computerisation.
Kosovo[3]	Updated inventory of entire airport exist on paper as part of Airport Master Plan.	Condition data exist and is updated daily and is paper based.	Traffic data continuously updated and computerised.	No unit costs.	No airport management information system and data are mixed computerised and paper-based in separate systems.

Croatia
There is no airport management information system but all information on inventory and condition data exists. There is not one unique database but most of the information is computerised and continuously collected and updated. The traffic data is also continuously updated and computerised. Navigation and lighting systems are handled separately in a maintenance system.

The Technical and Construction Department of the Airport of Zagreb is responsible for collecting and maintaining airport inventory and condition data - except for information on navigation systems which is covered by the Operations Centre, Flight Control and the CAA.

There are plans to establish one unique management information system.

FYRO Macedonia
There is no airport management information system, but the airport does collect inventory and condition information on all items and most is computerised and continuously partly paper-based and partly computerised. The data is used for internal processes e.g. for analysis and planning purposes. The information is updated, but not in one system. Traffic data is continuously collected and updated.

The Airport Information Technology Department (AIT) handles the system. The system was computerised in 1991 and new in-house software was developed and has been in use since 1999. The Operational Centre updates the information in the database and the information is available for all users who may need it. The navigation system and the ATM are under the control of the CAA.

A tender for the improvement of the management information system is in process.

Serbia
There is no airport management information system in Belgrade. Information on inventory and condition is updated, but not in one system and is mainly paper-based. Only the navigation system has log files for assessment of condition.

Traffic data is continuously updated in a system called FIDS which has just been updated. The new system is not fully developed and is planned to be extended and finally become an AMS. The airport has started to implement an integrated airport operational database and it is planned to finally add an airport management system to this system.

Montenegro
The Airports of Montenegro (2 airports) is an organisation that has just started to operate. Airports in Montenegro were previously covered by JAT and the army, but on 23 April 2003, both Tivat and Podgorica Airports were transferred to be managed by Montenegro. There is presently no airport management system and a new system will have to be developed. At the time of the meeting,

an overview of the existing information and how they are handled was not yet available.

Kosovo
In Kosovo updated inventory of the entire airport exist on paper as part of Airport Master Plan. Also condition data exist and is updated daily and is paper based. There are no unit costs.

Traffic data is continuously updated and computerised.

There is not an airport management information system and data are mixed computerised and paper-based in separate systems.

1.5 Inland waterway management information systems

Only Croatia and Serbia has inland waterways which are part of the core network.

Both Croatia and Serbia have computerised their inland waterway management information system to some extent. Croatia has specific plans to extend their present system to a management information system by 2004, and in Serbia there are ideas and wishes to extend the system, but not yet any specific plans.

For Serbia, it could be relevant to find financing for software and hardware to computerise more of the information on the inland waterways systematically, and e.g. assist in the updating of the inventory and traffic data and, together with condition data and unit costs, to develop a management information system. This would help to get an overview of maintenance needs and corresponding financing needs.

1.5.1 Status of inland waterway management information systems in the countries

The status of the data collection and storage, and management information systems are presented for each country and summarised in Table 1.6.

Croatia
All information on inventory, condition and traffic exists. The Government Agency Croatian Waters Company and the Ministry of Maritime Affairs, Transport and Communications handle the information system. Collection and maintaining the data of inland waterways inventory and survey is the responsibility of the Croatian Waterways Company and Ports Management. Output is used by these companies and also by the Ministry of Maritime Affairs, Transport and Communications.

Traffic data is collected in the field and is updated, and is computerised as part of the new management information system.

Data is mostly computerised but some is paper-based. Oracle database, GPS, Windows, Word, Excel and AutoCAD are used. Data is not managed centrally, and there is thus no unique database for all information. The development of a new management information system is in process and should unify the databases. It is expected to be finished in 2004. A European project, CRORIS (Croatian River Information System), is in process.

Table 1.6 Summary on inland waterways management information systems.

	Inventory	**Condition**	**Traffic**	**Unit costs**	**Computerisation**
Croatia	Inventory data exists and is updated.	Condition data exists and is continuously updated.	Traffic data is up-to-date and computerised.	Unit costs exists for annual planning	Partly by computerised and partly paper-based.
Serbia and Montenegro					
Serbia	Inventory kept in books and 10 years old.	Condition data is generally collected regularly and information such as the cross-sections is computerised.	No traffic data is collected but is received from the ports through the Statistics Bureau.	Assessment of costs not part of system but based on actual needs.	Partly paper-based and partly computerised.

Serbia

The data on the condition of the inland waterway of the Danube and Tisa is generally collected regularly and information such as the cross-sections is computerised, but not in a single system.

Other information on condition is collected and assessed for an annual report on the condition of the inland waterways specially identifying the needs for improvement.

Generally there is information on the condition of the Danube and Tisa (apart from the section bordering Croatia) in databases and reports, but not in a coordinated way and in a single system. However the existing database for presenting the cross-sections could probably be the backbone in a future management information system for inland waterways. However, there are no specific plans yet to develop information system.

The inventory of the inland waterways is kept in books and has not been updated the past 10 years.

Inland waterway traffic data is not collected by the Government Agency for Maintenance and Developing of Inland Waterways, but is received from the Statistics bureau based on data from the ports.

2 Introduction and background

Poor maintenance planning - e.g. due to a lack of information on the infrastructure system - often leads to inefficient use of the limited funds for infrastructure maintenance. In most of the REBIS countries it would thus be an economic advantage to introduce or improve management information systems for the infrastructure (roads and structures, rail and structures, ports, airports, inland waterways). This could include hardware and software, as well as technical assistance, in order to get the systems operating with data.

The management of infrastructure is based on the idea that the infrastructure is an asset which needs to be maintained and improved, to ensure a maximum service life of the infrastructure as well as securing good performance and value for money of the infrastructure.[4].

In order to ensure efficient maintenance of infrastructure through a properly managed series of works and activities, it is necessary to have up-to-date information on the features and condition of the infrastructure and on traffic and accidents. In addition, when resources for maintenance of the infrastructure are scarce, it is important to have the necessary data to properly prioritise the maintenance work according to identified needs. Roads information includes the aspects presented in Table 2.1.

The management of infrastructure is thus based on the same pool of information that needs to be continuously updated. Therefore, a survey of the management information systems has been carried out, and the purpose of this survey is to obtain an overview of the information systems for traffic and infrastructure data in the REBIS countries. The overview provides information on organisations having and collecting data, the level of updating of the data, and areas covered by the systems, e.g. data on traffic, structures, road, rail, port, airport and inland waterways conditions, etc.

Information on management information systems for infrastructure is collected centrally at the Ministry of Transport in institutions such as a directorate for roads, railway directorate and government agencies for inland waterways and decentralised at ports and airports.

[4] Based on TRL and DFID, Guidelines for the design of operation of road management systems, Overseas Road Note 15, 1998.

The following sections give as examples brief descriptions of possible contents of road and rail management information systems.

2.1 Road management information systems

The management of roads can be perceived as a process integrating the cycles of activities involved in each of the management functions of planning (e.g. defining standards, budgets), programming (e.g. determining a work programme within budget), preparation (e.g. design of works, issuing of contracts) and operations (e.g. supervision). The aim of road management is to ensure that the road network can resist the damage caused by wear and tear, to prevent substandard conditions from developing, and to ensure that traffic can continue to run[4].

Table 2.1 Information for road management information system.

Element	Aspects
Road Inventory	Network/location Geometry Furniture/appurtenances Environs
Pavement	Pavement structure Pavement condition
Structures	Structures inventory Structure condition
Traffic	Volume Loadings Accidents
Finance	Costs Budget Revenue
Activity	Projects Interventions Commitments
Resources	Personnel Materials Equipment

Source: TRL and DFID, Guidelines for the design of operation of road management systems, Overseas Road Note 15, 1998.

The management cycle for road infrastructure typically includes the following steps:

- Define aims, e.g. setting maintenance policy, objectives and standards
- Classification and preparation of road register
- Assess needs, e.g. assessment of maintenance needs

- Determine actions
- Determine costs and priorities, e.g. calculation of resource requirements and assessment of priorities when resources are constrained
- Implement activities, e.g. scheduling and executing of works
- Monitor and audit, e.g. monitoring of performance.

Although these functions have different objectives, they are based on the same pool of information, which needs to be continuously updated. The typical type of information needed is presented in Table 2.1.

2.2 Railway infrastructure management information systems

In order to administer their possessions, all infrastructure owners need to keep track of their assets.

Traditionally, this has been done by de-centralised knowledge and delegated decision-making. However, this type of management has been and often still is heavily dependent on a single person's knowledge of the actual standard of a section on a rail network. In such cases, data might not be registered on paper or in any other form, although the information exists. The obvious disadvantage of this is that it is impossible to get an overall picture and hence to decide on priorities for the entire rail network.

One of the main issues for a railway management system is therefore to improve this situation by making information available to a wider range of decision-makers.

A railway management system can have different levels of completeness, from a basic level, close to the traditional one as described above, to a fully fledged system, maybe even GIS-based, with all facilities, including modules for decision support. The data for a railway management information system is described in separate levels or steps, the lowest basic one requiring relatively limited input and maintenance. Typical information needed to manage railway infrastructure is presented in Table 2.2.

Table 2.2 Information for rail management information system.

Level	Aspect
Basic Level - typical content at the basic level is global or semi-global line data such as:	• from-station to-station • total length • single, double or multi track line • signalling system (Train Control System, ATP etc) • power supply (catenary's or 3:rd rail or nothing) • name and place of stations on line (km from start) • maximum speed and speed-weight ratio • maximum allowable weight per metre • maximum allowable train length • clearance profile
Component Level - this level contains basic component data such as:	• type and age of component (for instance rail UIC60-900A installed 1996) • section where component is installed (from km X,x to km Y,y) • basic horizontal and vertical geometry (for instance straight from km A,a to B,b; clothoid from km C,c to D,d; radius E m with cant F mm from km G,g to H,h etc.) • turnout data (for instance UIC60-1:9-R300 at km I,i etc.) • signalling blocks (from-to)
Geographical Information Level - when establishing new computer based systems it is common to base them on a GIS structure. In such cases it forms the base of the system. If a GIS structure is not chosen, the following information can be linked to components, elements or sections on a line:	• coordinate information • yard and station plans
Alignment Quality Level - this can be seen as a part of the Inspection and Maintenance Level; however it is much more frequently available:	• automatically or manually evaluated data from track recording car
Inspection and Maintenance Level - for example:	• fault or failure statistics (type, time, cost and place of occurrence) • inspection remarks (type, time and place of occurrence) • maintenance activities (type, time, cost and place of occurrence) • trends
Other information - Traffic Information	• annual amount of tonnage and passengers • amount of trains in peak hours • total amount of trains per day in each direction • type of traffic (commuter, intercity, international, freight etc.)
Other information - Administrative Information	• line belonging to specific national or international network class • line maintenance organisation • investment plans etc.
Decision support	• Added on top of all this and integrated with various systems for decision support with various levels of sophistication.

3 Albania

In Albania information on the status of management information systems has been collected for:

- the road sector including its structures
- the rail sector including its structures
- Durres port
- Rinas airport, Tirana

There are no significant inland waterways in Albania and thus no significant inland waterway traffic.

The information for Albania has been collected through interviews with key persons in the Road Directorate in Tirana, the Directorate of Railways, the Ministry of Transport in Tirana and the General Directorate of Railways in Durres, the Port of Durres, the Civil Aviation Office in Tirana and the Rinas Airport of Tirana.

3.1 Road and road structure infrastructure management systems

The General Directorate of Roads is responsible for approx. 3200 km of roads of which approx. 1000 km are considered to be the core road network. Local governments and municipalities are responsible for the remaining roads, e.g. rural and urban roads.

The General Directorate of Roads has a total of 1000 employees including administrative staff. Of these, approx. 90 are employed at the central office and the remaining in the 7 regional offices and the approx. 25-28 districts. Six are employed in the Traffic Department which has a coordinating role and is running the road data base.

The General Directorate of Roads is divided into 9 Departments:

- Traffic Department (traffic, Road Data Bank, road safety)
- Maintenance Department
- Technical Department (design, bill quantities)
- Management of Contractors (domestic and foreign)
- Expropriation Department

- Programming and Planning Department
- Supervision Department
- Juridical Department
- Personnel Department (salaries etc.)

3.1.1 Road infrastructure data

The collection of information on management information systems for road infrastructure data covers whether:

- the national road network is referenced
- an inventory has been carried out and is updated
- information on the condition of the road network is carried out regularly and is updated
- all this information is stored and used systematically

Information is also collected on unit costs and on who collects, stores and uses the data.

Type of data stored and updating
The entire Albanian national road network is covered by one reference system. The reference system was organised approx. two years ago, during the preparation of a Road Data Bank project financed by the Swedish Government (SIDA).

The road network is divided into sections and each section has its own number or ID. The road network is described in terms of link/node and the basic components in the reference system are:

- Roads
- Nodes
- Links

For example number 1A20 = Road 1 in Shkoder Region (A), Node number 20.

The road network in Albania is classified but not yet divided according to the Albanian Road Code, in which the classification corresponds to the classification used in the REBIS project, e.g. primary (core + rehabilitated roads) and secondary roads. In addition, the roads are e.g. divided into highways, urban highways, 4 lanes, 2 lanes, etc.

The new Road Data Bank includes data and information on the following features:

- Length
  - Length of entire road network
  - Length of each section

- Alignment
  - Information about the location of junctions, culverts and bridges

- Longitudinal Profile
  - No information has been collected yet (no topographical data) - but might be in the future

- Cross section
  - Width of carriageway, shoulders
  - Number of lanes, width of lanes
  - Median type and width

- Pavement
  - No information has been collected yet - but might be in the future.

- Structures
  - Retaining walls, length
  - Protection walls, length
  - Culverts, type, diameter
  - Bridges, length

- Furniture
  - Road signs, type, position
  - Guardrails, length, position
  - Road markings, length, position

- Land Use
  - No information has been collected yet - but might be in the future

In principle, the road inventory data should cover all national roads and the Road Data Bank is kept open, with the intention of adding the Rural Network in the future. At present an inventory of about 30% of the National Road Network is covered in paper-form for the Road Data Bank.

The Road Data Bank is part of a project financed by SIDA which also covers a study on a road fund and on road maintenance. As the inventory is an ongoing process in Albania, updating is not yet relevant. It will probably take some time before the Road Data Bank is fully updated with the entire network, as only one person is typing the data and it is difficult to have the field work carried out.

As part of a World Bank project (Albanian Road Maintenance Project (RMP)), 800 km of roads have been stored in another database with pictures, alignment (including topographical data), inventory of roads, location of structures etc. This information is supposed to be transferred to the Road Data Bank within the near future. The maps in this database are in AutoCAD.

There are inspections to assess the conditions of the roads, but the data is not systematically stored (SWEROAD and GRD, Road Data Bank, Albania, Final Report, January 2003). In Albania, a system has not yet been established to collect condition data and there are no regular surveys of the road network, e.g.

every year. When the decision has been made to make an investment in a certain road section, engineering surveys by specialists are carried out.

Each region does, however, carry out a visual survey at the beginning of each year in order to be able to prepare a report on needs, which is sent to the central Road Directorate. There are no measurements by bump integrator, falling defector etc.

Apart from the annual visual inspections by the regions the last formal survey was carried out in 1996 by the Danish Road Directorate. In the long term, condition data should also be part of the Road Data Bank. Presently there are no regular surveys, and condition data is not yet part of the Road Data Bank.

The system itself (software, etc) is working and is up-to-date. The General Directorate of Roads is in the process of collecting data from the field for the Road Data Bank. Information on about 30% of the National Road Network has until now been collected on paper. Inventory data for approx. 130 km (4%) has been typed into the computer, information on 900 km has been collected on paper and is waiting to be typed, and data on approx. 2000 km is totally missing. No condition data has yet been included in the system.

There are procedures for referencing the road system, but an adequate budget for data collection is missing. This is considered a real obstacle for the development of the Road Data Bank by the General Roads Directorate.

Every year, the Technical Department updates the unit costs for each item described in the bill of quantity. This typically includes information as indicated below:

- Cost per m3 of materials
- Hourly rate
- Overhead
- Material costs

- Cost per km constructed
- Cost per km maintained
- Cost per km rehabilitated

There are presently no updated unit costs and the unit costs used are not declared as formal unit costs, but used for planning and budgeting based on a specialist assessment.

Organisation responsible for collecting and maintaining data and systems used

The reference system and the National Road Network are both in hard and soft copy. The software program can e.g. be used to show the features on maps in Arcview.

So far, most information has been kept on paper files in the Maintenance Department. The Road Data Bank project was completed in January 2003. In

the framework of the project, the Road Data Bank software was prepared as a data base (Microsoft Access 2000). All the input comes from the field and is registered in the Road Data Bank software and subsequently transferred electronically into Arcview.

The data collected by the Road Data Bank has not yet been used in the vast scale by other departments of the GRD (General Roads Directorate) because the system is not fully updated.

For the national road network, the data is collected by the Traffic Department in the General Roads Directorate. The Traffic Department is also responsible for the implementation of the referencing system.

When the General Roads Directorate needs to prepare priorities of e.g. investments, the planners use data from regional directorates, or the existing data collected by the National Road Administration.

The regions generally also carry out the annual inspection of the roads, whereas the districts generally carry out routine maintenance.

In principle, the Technical Department updates the unit costs every year but these figures are not fully updated.

Future plans for the development of systems
The reference system was established two years ago and there has thus not yet been any need to update it.

In the future, the output of the Road Data Bank will be used by other management systems and other departments of the General Roads Directorate. Since the Road Data Bank is not fully established, such output is not yet available.

Future plans include the extension of the Road Data Bank for secondary and tertiary road networks, where the collection of data has to be organised by the local government.

The General Roads Directorate would like the World Bank to continue financing a system for condition surveys to be carried out and included in the Road Data Bank and to establish a Pavement Management System. The Road Data Bank would be the backbone of such a system.

3.1.2 Road traffic data

Traffic data has been collected continuously for the last two years with new equipment and now covers about 40% of the National Road Network in Albania.

Type of data stored and updating
The traffic counts are carried out by automatic mobile equipment and the traffic counting programme consists of counts for 1-2 weeks annually per section on the main road network (40% of National Road Network).

Traffic data is updated on the main road network but long series of historical data is missing, because although traffic data was also collected previously, the information cannot be trusted. On the national roads, about 14 classes of vehicles except animals, pedestrians are counted.

The output of the traffic counts is AADT, hourly, weekly, variation per each direction, classification. Traffic forecasts are missing because of a lack of recourses.

There is no information collected or measured on axle loads. Because of the scarce resources, the GRD cannot organise the axle load surveys on a regular basis.

Organisation responsible for collecting and maintaining data and systems used
The organisation responsible for traffic data collection is the Traffic Department in the GRD. The Traffic Department has a total of 6 staff that, apart from traffic surveys, is also responsible for the Road Data Bank and road safety.

The information is collected by use of a computerised system. The software was supplied with the traffic counting equipment. The collected traffic data is reported each year, to be used e.g. by consultants during the design phase and also by other departments but has presently no connection to the data bank.

The system is considered to be functioning, but there is room for improvements. The Traffic Department e.g. finds it important to put permanent traffic stations in place, in order for traffic data to be collected continuously every month of the year.

Future plans for the development of systems
There are no specific plans, but the Traffic Department would like to use permanent traffic stations.

3.1.3 Road safety data

There is no formal transfer of information or data between the police and the Road Directorate on road accident data.

Type of data stored and updating
In the GRD, there is no database containing road accident data. If the GRD would like to have road accident information for a certain road or area, the regions have to collect the information from the police, and to agree on the location of the accident, as there is no reference system in the police database.

Organisation responsible for collecting and maintaining data and systems used
The police collect the road accident data, but the information is not detailed and the location is not precisely indicated. The main purpose for the police is to decide who is responsible - not e.g. to identify black spots. If people e.g. die after two days, this is not registered as a fatal accident.

Future plans for the development of systems
As far as the Traffic Department is informed, a road accident database is to be established within the framework of the maintenance project financed by the WB.

3.1.4 Structure infrastructure data

The inventory of the structures is presently carried out as part of the Road Data Bank.

Type of data stored and updating
The inventory on paper is 30% updated but the computerised inventory for the Road Data Bank presently covers approx. 4% of the network.

The condition data of the structures is only roughly assessed and the assessments are carried out by the regions. This is done as part of the visual inspections of the road network, but not as part of a formal procedure.

There is no formal calculation of unit costs and costs are assessed when needs are estimated.

Organisation responsible for collecting and maintaining data and systems used
The regions presently do a rough inspection and send the information to the Maintenance Department. Costs are calculated by the Maintenance Department.

Future plans for the development of systems
There is no Bridge Maintenance System (BMS) in the Albanian Directorate for Roads and there are no plans to invest in one. The top priorities are a working Pavement Management System (PMS) and a functioning Road Data Bank, and after this a BMS system could be considered.

3.1.5 Conclusion on road and road structure infrastructure management systems

The newly introduced Road Data Bank is potentially appropriate as the backbone of a maintenance information system. However, an inventory of 30% has been carried out on the National Road Network and 4% has been included in the system. No condition data for roads or structures has been included. Apart from annual visual inspections by the regions, no formal assessment of the road network is carried out and registered.

The traffic data is collected regularly on 40% of the network and assessed and stored, using software from the providers of the equipment, and is thus not part of the Road Data Bank System.

Road accident data is not formally collected and stored by the General Road Directorate. The traffic police register accidents in a database but this information does not contain information on e.g. location and is not used e.g. to identify black spots. There are no formal procedures to transfer road accident data to the General Road Directorate.

To move towards a full management information system, resources are needed to finalise input of data (including condition) into the Road Data Bank and to implement a formal system for condition assessment, e.g. through a Pavement Maintenance System. In the future, information on traffic etc. should also be integrated.

3.2 Rail and rail structure infrastructure management systems

The railways in Albania fall under the General Rail Directorates, which is a state-owned company under the Economic Ministry and administered by the Ministry of Transport, Council of Administration Executive Board.

There are approx. 2260 employees in the General Rail Directorate, of whom approx. 60 work in the main office in Durres, 600 work in the Technical Directorate, approx. 200 in the Infrastructure Department, 250 with maintenance of rolling stock, and the rest in stations etc.

The rail sector is still working as one organisation and has not yet been split into an infrastructure and commercial sector.

3.2.1 Rail infrastructure data

The collection of information on management information systems for rail infrastructure data covers whether:

- the national rail network is referenced
- an inventory of the rail network has been carried out and is updated
- information on the condition of the rail network is carried out regularly and is updated
- all this information is stored and used systematically

Information is also collected on unit costs and on who collects, stores and uses the data.

Type of data stored and updating
The inventory of the rail network is paper-based, is updated every year and covers the entire rail network.

Once a year, a general review of the rail network is carried out by the General Road Directorate (GRD). Additionally, a periodic control is carried out by stations. Approx. 40% of the rail lines are considered to have problems with e.g. trees, edges, etc.

The collected inventory and condition data is used in annual reports prepared by the Railway Infrastructure Department. The data is given by the Infrastructure Department to the Technical Director and then handed on to the General Director.

There are unit costs for passenger/km and goods/ton-km used by the Economic Department, as well as unit costs for infrastructure, which are calculated every year by the Infrastructure Enterprise.

Organisation responsible for collecting and maintaining data and systems used

Much of the data is in the General Directorate for Rail, which is divided into two sectors.

The Technical Sector falls under the Infrastructure Directorate which is under the General Rail Directorate. The Infrastructure Directorate has all information on work, maintenance and lines, e.g. how much work has been done and what needs to be done.

The Mechanical Sector is responsible for locomotives and rolling stocks. Additionally, there is a statistical and economic sector.

The General Rail Directorate collects all detailed data such as:

- technical data
- lines
- trains
- signal systems
- charge of goods

However, most information is generally at the low level. Each of the sectors has their own data. Summaries are submitted from each sector to the General Rail Directorate, who sends it to the Ministry of Transport. The ministry uses the data for annual statistics reports and the Finance Ministry uses it for budgets, and for policy-making.

The Railways have bases in 7 regions throughout the country. The regions also handle economic data and the Infrastructure Enterprise has rail infrastructure data.

The Economic Sector handles unit costs for passengers and freight, and the Infrastructure Sector assesses infrastructure costs. This data is used for balance sheets and monthly and annual reports.

Future plans for the development of systems
There are plans to soon implement a new structure and new ways of working. How this will be done depends on the structure of the organisation chosen.

3.2.2 Rail traffic data

Type of data stored and updating
The Railway Sector collects information on passengers, based on the number of tickets sold and the volume of goods, based on consignment notes. Every month, the traffic information is collected on passengers and goods.

Organisation responsible for collecting and maintaining data and systems used
The stations collect the traffic data and send it in generated form to the General Directorate Rail. The data includes:

- volume of traffic
- no. of passengers
- personnel data + salaries
- level of education
- gender distribution

The Ministry of Transport receives general data, i.e. no technical data, but e.g. traffic data, such as the number of passengers, volume of goods, ton/km and passenger/km as well as the number of employees, etc. The Ministry of Transport has a statistical sector collecting data from all sectors in the ministry.

The sector which the station belongs to, gives the data to a similar sector in the General Rail Directorate. Every month, an analysis is submitted on volumes, revenues, times of trains, shunting, etc.

Future plans for the development of systems
No plans were indicated to change the system.

3.2.3 Structure infrastructure data

The structures on the rail network in Albania are considered by the General Rail Directorate not to have major problems, but there is a need to assess the condition of the structures more carefully.

Type of data stored and updating
All bridges on the rail network are in the inventory. The condition of bridges and tunnels is checked annually. Before 1991, the bridges and tunnels were checked every 6 months.

Unit costs are only calculated in a case-by-case assessment by the Infrastructure Department/Sector to prepare budgets.

Organisation responsible for collecting and maintaining data and systems used
The Infrastructure Department/Sector (regional) carries out an annual check of bridges and tunnels.

The Infrastructure Department/Sector also calculates unit costs for annual budgets.

Future plans for the development of systems
No plans were mentioned to develop a system to handle the structures such as bridges and tunnels.

3.2.4 Conclusion on rail and rail structure infrastructure management systems

There is no specific rail maintenance system. All data is in separate files and is generally paper-based. All assessments are carried out manually.

All data is thus collected in the General Rail Directorate, but in the different departments/sectors. There is a mirror system in the stations and in the General Rail Directorate which is sometimes contradictory.

There is no specific maintenance system for the structures. An annual report on the structures is prepared.

3.3 Port infrastructure management systems

The Port of Durres is state-owned. The Ministry of Economics is the owner, and the Ministry of Transport is the administrator. The port is the owner of the cranes, equipment, warehouses, etc, while all stevedore businesses are private.

In the future, there is a plan to make the entire port a landlord and the equipment, etc. will then be privatised.

3.3.1 Port infrastructure data

The collection of information on management information systems for the port infrastructure data covers whether:

- an inventory of the port has been carried out and is updated
- information on the condition of the port is carried out regularly and is updated
- all this information is stored and used systematically

Information is also collected on unit costs and on who collects, stores and uses the data.

Type of data stored and updating
The entire port is registered in the inventory with e.g. size, piers, warehouses, equipment, types of ships, etc. This information is normally computer- based. The inventory of equipment was updated last year, and this is normally updated annually.

An inventory of piers and berths was last updated from January to March. This normally happens 3 times a year, according to the Port of Durres.

The physical conditions of piers are assessed through visual inspection by port people and foreign consultants as part of a rehabilitation project. The physical condition assessment covers the entire port.

There is a commercial unit cost for each type of cargo, e.g. bulk, as well as for the charges the ships pay at piers. There is a unit cost for the use of equipment and a unit cost for staying at piers, presented on paper. The costs are assessed every year.

For repairs etc., the costs are assessed case-by-case and not through fixed unit costs.

Organisation responsible for collecting and maintaining data and systems used
The Technical Department has a list of inventory in books, including cranes, forklifts, etc.

The Office of Development of Port Investments has an inventory of the Port, including breakwaters, piers, berths, etc. and the condition is reported on paper. A sector under this office is responsible for minor repairs.

The equipment is assessed by the Mechanical Sector under the Maintenance Section.

The Commercial Department has the costs for ships to stay at piers and for the handling of ships.

A number of people specialise in the estimation of costs, e.g. a mechanic for equipment, an electrician for light, a civil engineer for piers, berths, etc.

The Investment Office uses the assessed costs to prioritise investments - this assessment is paper-based.

Future plans for the development of systems
There are plans to purchase a German-developed computer programme, however, the programme has not yet been purchased. The programme can handle e.g.:

- inventory data
- condition data
- spare parts

The programme is used by the Port of Hamburg and was developed by a consultant firm which is part of the Port of Hamburg. The Port of Durres has been cooperating with the Port of Hamburg for some time.

The port is still negotiating with the specialist firm from Port of Hamburg to introduce the programme and for training. Financing is not in place yet.

The port would like to be able to handle data in a coordinated way, which should be possible with the new programme.

3.3.2 Port traffic data

Type of data stored and updating
The port traffic is generally up-to-date as it is continuously collected (month by month) and reported regularly.

There is data on e.g.:

- tonnage
- passengers
- vehicles
- no. of ferries
- no. of ships in and out
- dwelling time in ports
- type of cargo for export and import

The Marketing Department registers all traffic data for charging the tariffs for cargo/tonnage. Most is on paper and some on computer. A World Bank project is preparing software to handle tariffs and to register corresponding traffic data.

Organisation responsible for collecting and maintaining data and systems used
The Marketing Department and a group of statisticians prepare all information on the shipping documents, e.g. tonnage for export and import. They also register:

- no. of ships
- no of ferries
- no. of passengers
- no. vehicles
- the turnover is registered
- the dates for shipping
- port of loading from where to where

The World Bank has financed 5 computers which are connected in a network.

The Marketing Department prepares a monthly report for internal purposes on the amount of tonnage and cargo. This is often in the form of documents, and reports are prepared every 3 months and sent to the Ministry of Transport.

Future plans for the development of systems
There were no plans mentioned to develop or purchase a new system, though a World Bank project is preparing software to handle tariffs and to register corresponding traffic data.

3.3.3 Conclusion on port infrastructure management systems

The port does not have a management information system yet. Presently, most data on infrastructure is collected on paper. The Financial Department and the Commercial Department pool their information in a paper report, but the port would like to handle data in a more coordinated way.

However, there are plans and negotiations to purchase a system from Germany.

3.4 Airport infrastructure management systems

The Civil Aviation Authorities in Albania has the overall responsibility for air traffic in and around Albania. The special Department, National Air Traffic Agency (NATA), is responsible for air traffic, landings and take-offs, while the Rinas Airport is operated by ALB-Transport. All entities are state-owned companies.

The runway was reconstructed 2 years ago, and the southern and northern part of the apron rehabilitated. The central part is presently under tender as it is damaged.

3.4.1 Airport infrastructure data

The collection of information on management information systems for the airport infrastructure data covers whether:

- an inventory of the airport has been carried out and is updated
- information on the condition of the airport is carried out regularly and is updated
- all this information is stored and used systematically

Information is also collected on unit costs and on who collects, stores and uses the data.

Type of data stored and updating
There is an inventory covering the entire airport with information on length, size, etc. of landing strips, runways and aprons, as well as cross sections and pavement type. This is recorded according to the International Standard NX 14 and is mainly paper-based. The inventory of the airport was last updated in 2000 as part of the airport master plan.

The pavement is classified according to the maximum bearing capacity for planes landing and taking off. The classification of the runway is PCN 60/F/C/W/T and the apron is 60/R/C/W/T.

The runway is reviewed and the condition inspected and assessed visually several times a day. There is no equipment, e.g. a falling weight deflectometer, to assess the runway. All information on civil works is contained in documents, in a standard prepared by Siemens. If there is a problem, a report is prepared, and people are sent out to repair. Friction of the runway should be measured daily but this is not done presently.

The condition of the runway, taxiway and apron is checked daily the tower and the Technical Department of ALB-Transport. A report is prepared, stating any needs for improvements, and if there is a need, people are sent out to repair the damage.

The routine maintenance carried out was not considered sufficient by the airport - e.g. more cleaning is needed.

The airport lighting system is also checked continuously. The lighting system was made by Siemens in 1997. Siemens has a full safety detection system of the lights. There is a brigade of 10-15 people checking in three shifts.

The navigation system is run by the NATA and is continuously checked.

Unit costs for budget and planning are calculated; however, the last time the unit costs were calculated was some 2-3 years ago. There is information on how to calculate the costs, but it was not known whether the guidelines were actually used. All is based on paper, but spreadsheets etc. may be used.

A group of engineers assess needs for the annual budgets. This could be for projects and for civil works. For major construction there is a bidding and tender of the work.

Organisation responsible for collecting and maintaining data and systems used

The Civil Aviation is owned by the Ministry of Economics who prepares the strategies etc. and the CAA is administered by the Ministry of Transport and Communication, who takes care of technical problems, etc. Under the CAA there are two entities; NATA, responsible for navigation; and ALB-Transport, responsible for running the airport, e.g. as airport authority and also for handling etc. After a plane has landed, the tower will hand over operations to the Handling Department in ALB-Transport.

The Maintenance Department is responsible for the collection of inventory data in the airport.

The condition of the runways, apron and taxiway is checked visually by one employee from the tower and one from ALB-Transport. The Infrastructure Department is responsible for runways, aprons, taxiways, buildings, etc., i.e. all civil engineering work and planning. Inspections are carried out several times every day by the Infrastructure Department, and are reported several times daily. There is condition data for the entire airport; not in one system, but as

daily checks. The Infrastructure Department identifies needs - and if necessary stops the traffic - and will mainly solve the problems themselves.

A brigade of 10-15 people from ALB-Transport (Maintenance Department) is responsible for checking the lighting system in three shifts.

The navigation system is checked all the time. This is done by a special entity under the Civil Aviation; the National Air Traffic Agency (NATA). NATA is an enterprise managing air traffic over Albania, as well as operating landings and take-offs and operating the tower.

The Ground Service Department is responsible for the computer systems together with the Technical Department and coordinates operations at the airport.

The Technical Department is responsible for lighting, water supply, security and safety, the tower, bridges, etc.

Civil aviation prepares a draft on unit costs which is sent to ALB-Transport for comments, and then to the Ministry of Transport for approval.

Future plans for the development of systems
There are considerations by ALB-Transport to ask the General Road Directorate to assist with the checking of the runways, etc. for e.g. bearing capacity.

Presently, the airport is in the process of being privatised. The first phase of the process has been finalised, and the second phase is being started. It will probably be turned into a BOT or concessionaire. The timing depends on whether improvement works need to be carried out before privatisation. If no improvements are carried out first, the airport may be privatised after one year and if improvements are needed, then maybe after 3 years.

3.4.2 Airport traffic data

All flights and all passengers are registered and the traffic data is continuously updated. Flights are recorded continuously, both as landings and starts and also as flights over Albania.

Type of data stored and updating
ALB-Transport collects information on the number of passengers for statistics and to collect money from the airlines. Staff needs are also assessed according to passenger flows (peak hours etc.), type of aircraft, etc.

Also, the police and customs collect information on the number of passengers. However the different entities collect the data for their own use.

Another department in ALB-Transport collects information on freight tonnage etc. This data is stored in a combination of computer and on paper.

NATA collects all information on moving aircrafts, landings, take-offs and on flights over Albania. Information on peak hours etc. could be calculated, but the level is rather low, so there is no need for slot times etc.

ALB-Transport registers all landings and take-offs in order to charge of airlines. There are two charges. One is a landing fee for the development of the infrastructure after it is approved by the state. These go in to the state budget, but should be earmarked for the airport. The other one is a handling fee, which goes straight to ALB-Transport. Generally, ALB-Transport receives no subsidies and is considered to be a good business.

Organisation responsible for collecting and maintaining data and systems used
ALB-Transport records all landing and take-offs with the purpose of charging airlines and also uses the data for statistical purposes. The data is sent to the Civil Aviation who sends the data to the Economic and Statistical Directorate. The data is also sent to the Ministry of Transport. These statistics include:

- passengers
- take-offs and landings
- technical standards

The Handling Department registers traffic data in their departure control system daily. There are several computers for this, and information is submitted to Switzerland and USA as part of EDS. The information includes a list of passengers, loading, lost and found, etc.

NATA records all flight movements and sends the information to Switzerland.

Future plans for the development of systems
No plans were mentioned on the development of a system for traffic data.

3.4.3 Conclusion on airport infrastructure management system

Presently, there is no actual airport management infrastructure system in Albania.

Data is collected for own use in each of the departments. However, a General Manager collects all infrastructure data to the archives - some on paper and some on computer. The data is used to prepare annual reports on needs.

There is only a maintenance system covering the electrical system as part of a new system provided by Siemens.

There are presently no plans for a new system, only for the purchase of new equipment. This includes investments in a friction measuring machine, a cleaning machine and a lighting system.

ALB-Transport covers all investments and financing of civil works, equipment, etc.

4 Bosnia and Herzegovina

In Bosnia and Herzegovina information on the status of management information systems has been collected for:

- the road sector including its structures
- the rail sector including its structures
- Sarajevo airport

The information has been collected through interviews with key persons in the Road Directorate in Sarajevo, the Bosnia and Herzegovina Railways and Republic of Srpska Railways in Sarajevo, and the Airport of Sarajevo.

4.1 Road and road structure infrastructure management systems

Bosnia and Herzegovina is a complex country and is composed of two entities; the Federation of Bosnia and Herzegovina and the Republic of Srpska. Information presented in this paper is collected from the Road Directorate in Sarajevo and refers to the Federation of Bosnia and Herzegovina. According to the information, there are no big differences between the Federation and the Republic of Srpska in the context of management information systems for road infrastructure.

A master plan for Bosnia and Herzegovina and the Republic of Srpska was carried out in 2001 by a Japanese enterprise in cooperation with local consultants. Almost all the updated information is from that study.

The road network is divided into main arterial and regional roads under the responsibility of the Road Directorate, and local roads are under the responsibility of the municipalities.

The data collection, storage and handling and plans for future systems are described in the following sections for road infrastructure, traffic and structures.

4.1.1 Road infrastructure data

The collection of information on management information systems for road infrastructure data covers whether:

- the national road network is referenced
- an inventory has been carried out but it is not updated
- information on the condition of the road network exists but it is not updated

Information is also collected on unit costs and on who collects, stores and uses the data.

Type of data stored and updating
There is an old reference system from former FR Yugoslavia, which has not been updated since 1991. This system covers all regional and main arterial roads and consists of nodes (junctions) and sections (between nodes). The local roads under the responsibility of the municipalities are not covered in this reference system.

The road inventory data covers all main and regional roads (not local roads). The road inventory data collected covers almost all information from the questionnaire, but it is a paper-based database which has not been updated since 1991. Updated road inventory information exists only for new roads, but also in paper form.

The road condition database is old, in paper form and was last updated before the war (1991). Visual inspections of road condition were carried out two years ago and are the last data. The inspections did not cover all information from the questionnaire. The old database was not updated with the new information. The data used for classification of roads depends on its condition.

Organisation responsible for collecting and maintaining data and systems used.
The Road Directorate is the organisation responsible for collecting and maintaining data. The data is paper-based for road inventory and condition, and is more than ten years old. New data exists for new roads only, but not in a real database.

Future plans for the development of systems
A donation has been received from the World Bank for a new information system for roads, bridges and tunnels, traffic counters and other equipment. There are also plans to procure HDM 4. Also, there are plans to make a unified database for the Federation of Bosnia and Herzegovina and the Republic of Srpska.

4.1.2 Road traffic data

In 2001, one-day traffic counts were carried out on the entire territory of The Federation of Bosnia and Herzegovina and the Republic of Srpska. This data is the only new data existing.

Type of data stored and updating
Presently, traffic data is not collected systematically. A study was done in which AADT was presented, based on data from the master plan.

Organisation responsible for collecting and maintaining data and systems used
The organisation responsible for traffic data is the Road Directorate, but they do not have the information.

Future plans for the development of systems
As already mentioned, there are plans for the development of a new system.

4.1.3 Road safety data

The police are responsible for collecting data. The territory of the Federation is divided into 10 regions. Police from each region collect accident data. There is no centrally organised information on the safety condition of roads.

Type of data stored and updating
The police from each region collect the road accident data and handle their own database. The Road Directorate does not have a database. There is thus not one database for the entire Bosnia and Herzegovina.

Organisation responsible for collecting and maintaining data and systems used
The Police are responsible for collecting accident data.

Future plans for the development of systems
There is a need for better cooperation with police and easier access to road accident data.

4.1.4 Structure infrastructure data

There is inventory data on all structures on the national road network, but it has not been updated since 1991. Only for bridges does a new database from 1999 exist.

Type of data stored and updating
There is an old database for structures in paper form. There is only new data for bridges. The database consists of data which covers almost all information from the questionnaire, and it was updated in January 1999. It is also in paper form.

There are no special or formal surveys or databases to assess the tunnels.

Organisation responsible for collecting and maintaining data and systems used
The Road Directorate runs the system, and the construction company for bridges and tunnels is responsible for the collection of the structure inventory and condition data in the field. The output is used by the Road Directorate.

Future plans for the development of systems
There is a need for a new system.

4.1.5 Conclusion on road and road structure infrastructure management systems

There is no management information system for road inventory, condition, traffic and structure. Data is old and not updated. Most of the data is from 1991 and in paper form. A master plan for Bosnia and Herzegovina was designed in 2001. Information has not been updated since this project. Road safety data is under the jurisdiction of the local police and there is no cooperation between the Road Directorate and the police.

The World Bank has granted a donation for the development of a new information system for roads, bridges and tunnels, traffic counters and other equipment. There are plans to procure HDM 4. Also, there are plans to make one unified database for the Federation of Bosnia and Herzegovina and the Republic of Srpska.

4.2 Rail and rail structure infrastructure management systems

There are two railway companies in Bosnia and Herzegovina. One in the Federation of Bosnia and Herzegovina; Bosnia and Herzegovina Railways and one in the Republic of Srpska; Republic of Srpska Railways. The railway companies are both infrastructure managers and operators. The two entities are 100% owners of the railway infrastructure. Railways in Bosnia and Herzegovina suffered great damages, estimated to about US $ one billion, during the war. The railway network has a length of 1030 km and except for a section of 87 km, all other lines are single–track lines.

Rehabilitation of railway infrastructure in Bosnia and Herzegovina is planned to be carried out in three phases.

The railways of Bosnia and Herzegovina were reorganised according to the EU 440 recommendation. The new organisation system started in January 2003. The Railways of the Republic of Srpska are planning to implement the same organisation scheme this year.

4.2.1 Rail infrastructure data

Data collection is carried out on paper and covers the entire rail network which is about 1100 km long. The database contains a mixture of computerised and paper-based information.

There is a new organisation in the Bosnia and Herzegovina Railway Company.

Type of data stored and updating
The reference system of the whole rail network is the one which existed in former FR Yugoslavia.

Data collection for rail inventory is carried out to common regulations and all the information from the questionnaire is included. Data for the rail inventory database is continuously updated, last time in 2002. There is no GIS level information system.

Information from stations to sections about any changes on rail network conditions exists. These visual inspections are on an operational level and, together with an expert estimation, it is used to assess maintenance and improvement needs. This data is collected continuously from the field. The information includes all types mentioned in the questionnaire.

Organisation responsible for collecting and maintaining data and systems used
These two companies are responsible for collecting data and maintaining data. The Infrastructure Department is responsible for collecting rail inventory and rail condition data. They pass on the information to the management who uses it to assess needs locally, for global planning, and to produce annual plans for budgets and improvements.

The database contains a mixture of computerised and paper-based information, using Access and AutoCAD. Computerised data exists but there is no network connecting it.

Future plans for the development of systems
A donation from a Canadian company for a new information system has been given. The preparation of documentation for a tender for an information system has started. This should be unique and compatible for both companies.

4.2.2 Rail traffic data

There is updated rail traffic data, which covers all information from the questionnaire.

Type of data stored and updating
Data on rail traffic is collected daily. People from the sections collect data manually and send it to the Operations Department daily, monthly and annually (depending on the type of data). The department then makes an annual report.

Organisation responsible for collecting and maintaining data and systems used
People from the field collect data at the operational level. The system runs at the Operations Department and the output is used by themselves and management.

Data on unit costs exists. The department for Planning and Investment uses this information for budget planning.

Future plans for the development of systems
There is already a project for the development of an information system. The present information system works, but it is not fully computerised and not centrally managed. There is a need for new equipment, network and for a new compatible and modern information system for both entities.

4.2.3 Structure infrastructure data

Data exists and is updated in a combination of a paper-based and computerised system.

Type of data stored and updating
There is a list of structures and this is updated. All inspections are defined by regulations and there is monthly and annual control of rail structures and their condition. All information from the questionnaire is covered in these controls. The database contains a mixture of computerised and paper-based information and covers all structures on the national rail network.

Organisation responsible for collecting and maintaining data and systems used
The Infrastructure Department is responsible for collecting the data and data is used for maintenance and planning.

Future plans for the development of systems
There are plans to prepare a new information system for the entire organisation. There is a need for new software and new hardware.

4.2.4 Conclusion on rail and rail structure infrastructure management systems

There are two railways companies in Bosnia and Herzegovina. One in the Federation of Bosnia and Herzegovina; Bosnia and Herzegovina Railways and one in the Republic of Srpska; Republic of Srpska Railways. The railway companies are both infrastructure managers and operators. The two entities are 100% owners of the railway infrastructure.

All data on inventory, condition, traffic and structures exists in both companies. The present information system works, but is not fully computerised and not centrally managed. There is a need for new equipment, network and for a new compatible and modern information system for both entities. They have

received a donation for a new information system from a Canadian company. The documentation for a tender is being prepared for the information system, which should be unique and compatible for both companies.

4.3 Airport infrastructure management systems

4.3.1 Airport infrastructure data

All information on inventory and condition data exists. There is not one unique database, but most of the information is computerised.

Type of data stored and updating
The airport collects information on all items in the questionnaire (except for the navigation system, which is under the control of the CAA and Flight Control) and later stores it in a computer. It is a combination of a paper-based and computerised database. The data is used for internal processes, e.g. for analysis and planning purposes.

There is information about classification of the airport, runways, taxi lanes, cross sections, etc. as well as lighting. There are no structures (bridges) in the airport.

The daily assessment and survey of condition is carried out by the Airport Technical Department. The condition of the buildings is also under the control of the Technical Department.

The Civil Aviation Authority handles the navigation system. The light system is checked by the Airport Maintenance Department according to special procedures.

Data is collected continuously, every change is registered and all important changes are automatically sent to all users. Major condition surveys are carried out annually, and there are also daily routine inspections. The navigation system is continuously surveyed automatically. The lighting system is continuously checked. The entire airport is covered in the inventory. The airport has condition data for the entire airport, but not in one system.

Organisation responsible for collecting and maintaining data and systems used
There are several departments at the airport. The Maintenance Department is responsible for running and collecting data, and share the data with other users. The system is not fully automatic and there is no unique database.

Only the navigation system is carried out by the CAA and Flight Control.

The information is updated, but not in one system. It is used for annual master plans prepared by the Management Department, for construction and development as well as maintenance. The CAA and international flight organisations also use the information.

Future plans for the development of systems
There are plans for extending the airport. A better information system is also needed.

4.3.2 Airport traffic data

Traffic data is continuously collected and updated.

Type of data stored and updating
Passenger information is continuously collected from each flight, which allows the Traffic Department to prepare typical traffic statistics as mentioned in the questionnaire.

Organisation responsible for collecting and maintaining data and systems used
The Traffic Department handles the computerised system. The Traffic Department is responsible for updating the information in the database and information is available for all users who need it.

The unit costs are used when planning budgets etc., according to identified needs and plans for development. The Commercial Department generally collects the information and it is generally up-to-date. Generally, the Commercial Department runs the system for unit costs. The Planning Department and the management of the airport use the output.

Future plans for the development of systems
As already mentioned, there are plans to extend the entire airport.

4.3.3 Conclusion on airport infrastructure management systems

All information on inventory and condition data exists. There is not one unique database but most information is computerised. Also, traffic data is continuously collected and updated.

There are plans for extending the airport and a better information system would also be necessary.

5 Croatia

In Croatia, information on the status of management information systems has been collected for:

- the road sector including its structures
- the rail sector including its structures
- Rijeka port
- Zagreb airport
- the inland waterways sector

The information has been collected through interviews with key persons in the Ministry of Maritime Affairs, Transport and Communications.

5.1 Road and road structure infrastructure management systems

The road network in Croatia is divided into national, regional, local and unclassified roads. The government agency, Croatian Roads, is responsible for all national and regional roads, and local roads are under the jurisdiction of the municipalities. The government agency Croatian Roads invests in road maintenance and building. There is open tender to select the company that will be responsible for road maintenance.

The highways are under the responsibility of Croatian Highways which is also in charge of the maintenance of these roads.

The data collection, storage and handling and plans for future systems are described in the following sections for road infrastructure, traffic and structures.

5.1.1 Road infrastructure data

The collection of information on management information systems for road infrastructure data covers whether:

- the national road network is referenced
- an inventory has been carried out and is updated

- information on the condition of the road network is carried out regularly and is updated
- all this information is stored and used systematically

Information is also collected on unit costs and on who collects stores and uses the data.

Type of data stored and updating
The reference system for the national road network exists and was updated in February 2003. There are new numbers on the roads, but there is still no new chainage system. The preparation of a new regulation for the chainage system is in progress. The reference system is similar to the one that existed in former FR Yugoslavia.

The road inventory and condition data covers all roads except the unclassified. All relevant parameters for the inventory are collected, e.g. length, alignment, longitudinal profile, cross section, pavement, structures (major culverts, bridges and tunnels), furniture and land use and for the condition database, e.g. edge damage, left and right side (side drains, shoulders, edge step, edge damage), carriageway and furniture. There are visual inspections of road conditions, using digital cameras and then saving this data on a CD-rom. Road condition data was last updated in February 2003. Annually, about 100 km of national road network is renewed. All the information from the questionnaire is generally included in the database.

There is a unique information system run by Croatian Roads. It is fully computerised and they have new equipment. Operators collect information from the field and pass it on. The computers are in a network and data is managed centrally by Croatian Roads and the Ministry of Maritime Affairs, Transport and Communications. It was mentioned that some regions are not covered by a sufficient number of operators. This may cause some delay in data processing.

Organisation responsible for collecting and maintaining data and systems used
Croatian Roads is the organisation that handles the entire system, including the responsibility for collecting and maintaining the data. The municipalities are responsible for collecting data from the local roads.

Future plans for the development of systems
An information system exists which functions well and is continuously developed.

5.1.2 Road traffic data

Almost the entire road network has been covered by traffic counters, and road traffic data is continuously updated. There are both automatic and manual counts. All new roads are equipped with automatic counters. A specialised firm is responsible for collecting the data and preparing the report.

Type of data stored and updating
The classified counts are divided in 6 categories:

- Passenger cars
- Bus
- Light trucks (3-5T)
- Trucks
- Heavy trucks
- Semi-trailers

Almost all the parameters presented in the questionnaire, such as AADT, AADT seasonal, etc are included. It is also possible to receive missing parameters from the original data if needed.

There is information about axel loads on the national road network. Croatia Roads, in cooperation with the police, carry out inspections according to a schedule. There are daily inspections with mobile weighting stations which change their location according to the specified plan. All national and significant regional roads are covered. At the border crossings, there is also control of the weight.

Organisation responsible for collecting and maintaining data and systems used
The Croatian Roads and the Ministry manage and administer the database for traffic. There is a firm working for them to collect traffic data and prepare the report, as well as placing and maintaining the counters.

Croatia Roads, together with the police, carry out axle load surveys. All national and significant regional roads are covered.

Data is computerised and used by the Federal Statistics Bureau for the preparation of an annual report, and by Croatian Roads and the Ministry of Maritime Affairs, Transport and Communications for planning purposes.

Future plans for the development of systems
No plans were mentioned on development of the system.

5.1.3 Road safety data

Collection of road safety data is under the responsibility of the police.

Type of data stored and updating
The police have the road accident data and prepare an annual publication with different parameters, such as the number of accidents, accident distribution, etc. Generally, there is no cooperation between the police and the Ministry of Maritime Affairs, Transport and Communications and Croatian Roads. Road safety data is thus not part of the road management system.

The information collected by the police is normally not used for further assessment, e.g. for black spot identification, except for the specific project mentioned above.

Organisation responsible for collecting and maintaining data and systems used
The police collect the road accident data and handle a database on road accident data. There is no transfer of information or data between the police and Croatian Roads, and thus the Ministry and Croatian Roads do not have a database.

Future plans for the development of systems
There is a need for better cooperation with the police and for road accident data to be available.

5.1.4 Structure infrastructure data

Information on structure infrastructure exists, and covers all parameters from the questionnaire. The data is part of an information system that covers the road inventory and its condition. The system is updated and computerised.

Type of data stored and updating
All typical data from the questionnaire related to structure inventory and condition exists.

Organisation responsible for collecting and maintaining data and systems used
Croatian Roads and the Ministry of Maritime Affairs, Transport and Communications run the system. The same organisations also use the output from the structure database.

Future plans for the development of systems
As mentioned earlier, the information system is in the process of being developed.

5.1.5 Conclusion on road and road structure infrastructure management systems

There is a unique management information system run by Croatian Roads and the Ministry of Maritime Affairs, Transport and Communications. It is fully computerised and they have new equipment. Operators collect information from the field and pass it on. The computers are in a network and data is managed centrally by Croatian Roads and the Ministry of Maritime Affairs, Transport and Communications. Some regions are not covered by a sufficient number of operators, which could cause a delay in data processing.

Almost the entire network has been covered by traffic counters, and road traffic data is continually updated. The data is used for statistical purposes by the

Federal Statistics Bureau and for global planning in the Ministry of Maritime Affairs, Transport and Communications and Croatian Roads.

The road accident database is run by the police. Generally there is no cooperation between the police, the Ministry of Maritime Affairs, Transport and Communications and Croatian Roads. Road safety data is thus not part of the road management system.

5.2 Rail and rail structure infrastructure management systems

5.2.1 Rail infrastructure data

Data collection is carried out on paper and covers the entire rail network. The database is mostly paper-based.

Type of data stored and updating
A reference system of the entire rail network exists and is the one which existed in former FR Yugoslavia.

Data collection for rail inventory is carried out according to common regulations and includes all the information mentioned in the questionnaire. Data for the rail inventory database is updated. There is no GIS level information system.

There is information on any changes in rail network conditions. This visual inspection is on an operational level and is used for assessment of maintenance and improvement needs. The data is collected continuously from the field. The information includes all types mentioned in the questionnaire.

Data on unit costs exists and is used for planning and investment, and e.g. for budget planning.

Organisation responsible for collecting and maintaining data and systems used
The Infrastructure Department is responsible for collecting rail inventory and rail condition data. The management of the government agency Croatian Railways uses the data to assess needs locally and for global planning, to produce annual plans for budget and improvements. The database contains a combination of paper-based and computerised information.

Future plans for the development of systems
There are plans for the implementation of a new, modern and fully computerised information system, which will provide better conditions on Croatian Railways.

5.2.2 Rail traffic data

There is updated rail traffic data, which covers all information mentioned in the questionnaire.

Type of data stored and updating
There is data on rail traffic, which is collected daily. The data is collected manually and sent to the relevant department daily, monthly and annually (depending on the type of data). The department then makes an annual report.

Organisation responsible for collecting and maintaining data and systems used
People from the field collect data at the operational level. The system runs at the Operations Department, and output is used by themselves and management.

Future plans for the development of systems
There are a number of projects for developing the entire system for Croatian Railways.

The present information system works but it is mostly paper-based and not centrally managed. There is also a need for new equipment, a network and a new compatible and modern information system.

5.2.3 Structure infrastructure data

Data on structures exists and are mostly paper-based.

Type of data stored and updating
There is a list of structures and this is updated. All inspections are defined by regulations and all the information from the questionnaire is covered by the controls. The database is in paper form and covers all structures on the national rail network.

Organisation responsible for collecting and maintaining data and systems used
The Croatian Railways Infrastructure Department is responsible for collecting the data, and data is used for maintenance and planning.

Future plans for the development of systems
A new information system in the entire organisation is prepared. There is a need for new software and hardware.

5.2.4 Conclusion on rail and rail structure infrastructure management systems

Data collection for rail inventory, condition and structures is carried out to common regulations and covers the information from the questionnaire. There is not one unique database and the information is mostly in paper form and there is no GIS level information system. Preparation of a new information system in the entire organisation is in process, and there are a number of

projects for developing the entire system in Croatian Railways. The system is handled by the government agency Croatian Railways.

5.3 Port infrastructure management systems

5.3.1 Port infrastructure data

The collection of information on management information systems for the port infrastructure data covers whether:

- an inventory of the port has been carried out and is updated
- information on the condition of the port is carried out regularly and is updated
- all this information is stored and used systematically

Type of data stored and updating
The port has carried out an inventory of the port. The inventory covers the items mentioned in the questionnaire e.g. break waters, piers, etc. and also the possible size of ships, their capacity etc. The information is updated.

The port also has information on the navigation system, on type and on condition.

The condition data covers the entire port. The condition data is updated and based on inspections, but not as a unique system. Information on the condition of e.g. breakwaters, piers, etc. as mentioned in the questionnaire is collected by different departments. There are no structures (bridges and tunnels) in the port area.

The port has some unit costs and port tariffs. The costs are calculated by each of the departments, e.g. the Technical and Commercial Department.

Organisation responsible for collecting and maintaining data and systems used
The Port of Rijeka generally collects inventory data and stores it. It is not really a database, and is not used as a management information system.

The Technical Department handles the condition and inventory data and stores it, mostly in paper form. The data is used for management purposes, predictions, etc., but not as a full system. Information is sent to the Ministry of Maritime Affairs, Transport and Communications.

The Technical Department handles the condition and inventory data. Word and Excel are used for the computerised data processing, and some data is stored in paper-form. GIS is also used and is planned to be extended during the next years. The Technical Department uses the information for planning, maintenance and the development of infrastructure. The data is used for management purposes, e.g. predictions, but not as a full system. The

information is sent to the Ministry of Maritime Affairs, Transport and Communications.

Future plans for the development of systems
There are plans for the next two- ten years. In the next two years, it is planned to inspect the entire port infrastructure. GIS is also planned to be extended in the coming years.

5.3.2 Port traffic data

The port collects traffic data which is submitted to the Federal Statistics Bureau.

Type of data stored and updating
The port of Rijeka collects the traffic data as mentioned in the questionnaire and output is used by the Federal Statistics Bureau and the Ministry of Maritime Affairs, Transport and Communications.

Data collection contains a mixture of computerised and paper-based information and information is continuously updated.

Organisation responsible for collecting and maintaining data and systems used
The port of Rijeka is responsible for collecting the data. The port sends information to the Federal Statistics Bureau, who prepares an annual report on traffic, etc.

Future plans for the development of systems
No plans were mentioned on the development of a traffic data system.

5.3.3 Conclusion on port infrastructure management system

The port carries out the inventory and condition assessment of the port. All the items mentioned in the questionnaire are covered. Data collection contains a mixture of computerised and paper-based information, and information is continuously updated. A unique database for the entire port does not exist.

The port handles the condition and inventory data and stores it, mostly in paper form. The data is used for management purposes but not as a full information system. The information is sent to the Ministry of Maritime Affairs, Transport and Communications.

5.4 Airport infrastructure management systems

The following information is on Zagreb Airport, which is not the only airport in Croatia. It is assumed that the management information situation is similar in the other Croatian airports.

5.4.1 Airport infrastructure data

All information on inventory and condition data exists. There is no unique database, but most of information is computerised.

Type of data stored and updating
The airport collects information on all items in the questionnaire (except on the navigation system, which is under the control of the CAA and Flight Control) and later stores it in a computer. The database contains a combination of paper-based and computerised information. The data is used for internal processes, e.g. for analysis and planning purposes.

There is information on the classification of the airport, runways, taxi lanes, cross sections, etc. as well as lighting. There are no structures (bridges) in the airport.

The condition of the buildings is also under the control of the Technical and Construction Department.

The Operational Centre, Flight Control and the Civil Aviation Authority handle the navigation system.

The light system is checked by the Airport Technical and Construction Department according to special procedures.

Data is collected continuously. Every change is registered and every important change is automatically sent to all users. Major condition surveys are carried out annually, and there are also daily routine inspections. The navigation system is continuously surveyed automatically. The lighting system is continuously checked. The entire airport is covered in the inventory. There is condition data for the entire airport, but not in one system.

The daily inspections and survey of conditions are carried out by the airport Technical and Construction Department.

Organisation responsible for collecting and maintaining data and systems used
The Technical and Construction Department is responsible for collecting and maintaining the airport inventory data and airport condition data, except for information about the navigation system, which is covered by the Operation Centre, Flight Control and CAA.

Future plans for the development of systems
There are plans for establishing one unique information system.

5.4.2 Airport traffic data

Passenger information is continuously collected from each flight, which allows the airport to prepare statistics as mentioned in the questionnaire

Organisation responsible for collecting and maintaining data and systems used
The Traffic Department of the Airport of Zagreb handles the system. The system is mostly computerised, and the Traffic Department is responsible for updating the information in the database. Information is available for all users who need it.

The unit costs are used when planning the budgets etc., according to identified needs and plans of development. The Commercial Department generally collects the information and it is generally up-to-date. Generally, the Commercial Department runs the system for unit costs. The Planning Department and the management of the airport use the output.

Future plans for the development of systems
As already mentioned, there are plans for developing the system.

5.4.3 Conclusion on airport infrastructure management systems

All information on inventory and condition exists. There is not one unique database, but most of the information is computerised and continuously collected and updated.

The Technical and Construction Department of the Airport of Zagreb is responsible for collecting and maintaining airport inventory data and airport condition data, except for information on the navigation system, which is covered by the Operation Centre, Flight Control and CAA. There are plans to establish one unique information system.

5.5 Inland waterway infrastructure management systems

5.5.1 Inland waterway infrastructure data

Type of data stored and updating
Information on the categorisation of inland waterway exists, but not as an official document. It is prepared according to the UNECE standard and an international document on inland waterways.

All information from the questionnaire which deals with inland waterway infrastructure is available, and covers the entire national inland waterway network.

The inland waterway network has not changed significantly in the last ten years, so there has been no need for updating the general data on the network. But all technical parameters are covered by regular inspections and the data is updated continuously.

Inventory data like waterways, length, width, capacity, navigable inland waterways and navigation falls under the jurisdiction of the ministry as does

maintenance of the marking system. Data related to embankment and dismemberment location, loading and unloading facilities and location and the capacity of ports is collected by the port management. The entire infrastructure maintenance is under the responsibility of the Croatian Waterways Company.

Inland waterways condition data exists and is continuously updated. All information from the questionnaire exists. The Croatian Waterways Company is responsible for regular visual inspections of the inland waterways. Port management collects information on port condition, equipment and loading and unloading facilities. There is regular, weekly, inspection of the navigation system.

Organisation responsible for collecting and maintaining data and systems used
The Croatian Waterways Company and the Ministry of Maritime Affairs, Transport and Communications handle the information system. Collecting and maintaining the data on inland waterways inventories and surveys is the responsibility of the Croatian Waterways Company and ports management. Output is used by the companies and the Ministry of Maritime Affairs, Transport and Communications.

Data is mostly computerised, but there is also some paper-based information. The Oracle database, GPS, Windows, Word, Excel and AutoCAD are used. Data is not managed centrally, and there is no unique database for all information. A new management information system, unifying the databases, is in the process of being developed. It is expected to be finished in 2004. A European project; CRORIS (Croatian River Information System) is in process.

Future plans for the development of systems
There is a plan for a new management information system which will be fully computerised and centrally managed by the Ministry of Maritime Affairs, Transport and Communications.

5.5.2 Inland waterway traffic data

There is adequate and up-to-date traffic data.

Type of data stored and updating
There is information on inland waterway traffic parameters, such as inland waterway journeys, vessel-kilometres, vehicle-kilometres, etc. All information from the questionnaire is covered and updated. Data from the field is sent to the National Statistics Office who prepares an annual report. The report presents all relevant traffic parameters.

Organisation responsible for collecting and maintaining data and systems used
Data is collected in the field and is under the responsibility of the Port Traffic Department. There is not one database for traffic data, but it is part of the new

management information system mentioned previously. It is expected that one centrally managed database will be ready in 2004.

Excel and Word are used for the databases. The Ministry of Maritime Affairs, Transport and Communications and the Croatian Waterways Company handle the system and use the output.

Future plans for the development of systems
A new management information system, which will be fully computerised and centrally managed by the Ministry of Maritime Affairs, Transport and Communications, is planned for 2004.

5.5.3 Conclusion on inland waterway infrastructure management systems

All information from the questionnaire exists. The government agency, the Croatian Waters Company, and the Ministry of Maritime Affairs, Transport and Communications handle the information system. The Croatian Waterways Company and port management are responsible for collecting and maintaining the data on inland waterways inventory and surveys. Output is used by these companies as well as the Ministry of Maritime Affairs, Transport and Communications.

Data is mostly computerised, but some information is paper-based. An Oracle database, GPS, Windows, Word, Excel and AutoCAD are used. Data is not managed centrally and there is not a unique database for all information. The creation of a new management information system, unifying the databases, is in process. It is expected to be finished in 2004. A European project; CRORIS (Croatian River Information System) is in process.

6 FYRO Macedonia

In FYRO Macedonia, information on the status of management information systems has been collected for:

- the road sector including its structures
- the rail sector including its structures
- Skopje airport

The information has been collected through interviews with key persons in the government agency for main arterial and regional roads in Skopje and Macedonia Roads (Roads Fund and Macedonia Roads), the Macedonian Railways and the Civil Aviation Authority.

6.1 Road and road structure infrastructure management systems

The road network is divided into main arterial and regional roads, under the responsibility of the Road Directorate, and local roads under the responsibility of municipalities. There are approx. 900 km main arterial roads and approx. 3,000 km regional roads.

The government agency for main arterial and regional roads invests in road maintenance and construction. Macedonia Put is the main organisation responsible for maintaining and building roads. There are approx. 2000 employees.

The data collection, storage and handling and plans for future systems are described in the following sections for road infrastructure, traffic and structures.

6.1.1 Road infrastructure data

The collection of information on management information systems for road infrastructure data covers whether:

- the national road network is referenced
- an inventory has been carried out and is updated

- information on the condition of the road network is carried out regularly and is updated
- all this information is stored and used systematically

Information is also collected on unit costs and on who collects, stores and uses the data.

Type of data stored and updating
A reference system based on the Serbian reference system covers all regional and main arterial roads. The reference system consists of nodes (junctions), sections (between nodes) and directions. Each road, section and node has its own unique number. The reference system was established in 1995 and is not updated. The local roads fall under the responsibility of the municipalities and are not covered in this reference system.

The road inventory and condition data covers all main and regional roads (not local roads). The road inventory data collected covers almost all information from the questionnaire, but it is a paper-based database and it is not updated. One A3-paper covers 3 km and all information on the section is recorded. The paper contains all data for the section on the level of the main project. Approx. 1200 km of national network are covered in the same way. An updated road inventory database exists for new roads. There is also some computerised data in AutoCAD and Excel, but a real road inventory database system does not exist. The information is used for a PMS system (Pavement Management System).

A PMS is used for road condition data, and there are two teams and two vehicles for this purpose. All the information from the questionnaire is generally included in the database. The first round of data collection for the PMS system for the main arterial and regional roads was finalised in 2001, and the second round continued in 2002. Approx. 700-800 km are covered every year.

Macedonia Roads prepares a pricelists for costs of civil engineering road work, e.g. construction, rehabilitation, routine maintenance. The pricelist is updated regularly. It is for economic purposes and the ROSY programme is used. All data from the PMS system is entered into the ROSY programme and, together with unit costs is used for annual reports. The unit costs are also used for the yearly planning by the Roads Fund and the Ministry of Transport.

Organisation responsible for collecting and maintaining data and systems used
The government agency, Roads Fund, handles the system and Macedonia Put is responsible for collecting and maintaining data, as well as for managing data on the operational level. According to annual reports by the Macedonia Roads Company, the government agency Roads Fund makes the list of priorities for the following year. Macedonia Roads is also in charge of road maintenance.

Future plans for the development of systems
There are plans to update the reference system database, and to digitalise and update the entire road network. They have started with GIS, but have now stopped because of a lack of financial resources.

Also, a completely new system for a road inventory database is needed, as the one in use is mainly paper-based. The road condition database is updated, but there is a need for new equipment.

6.1.2 Road traffic data

Macedonia Roads has 60 automatic counters on the main network. There are also manual traffic counts 5 days each year.

Type of data stored and updating
The main arterial road network has been covered by traffic counts, but the regional roads are not sufficiently covered. The Roads Fund receives an updated database annually.

The classified counts are divided into 6 categories:

- Passenger cars
- Bus
- Light trucks (3-5T)
- Trucks
- Heavy trucks
- Semi-trailers.

The annual report presents AADT, but in the original data it is also possible to get other parameters if needed. Word and Excel are used for processing the data.

There is no information about axel loads on the national road network. There is one mobile weighting station, which changes location according to an annual plan. It is run in cooperation with the police. At the border crossings, there is also control of weight. ESA's are not calculated.

Organisation responsible for collecting and maintaining data and systems used
The Roads Fund and the Ministry of Transport manage and administer the traffic database. The Macedonia Roads Traffic Department collects data and prepares an annual report and also uses the data. Some construction firms use the data, too.

Future plans for the development of systems
There are plans for extending the system and there is a need for a new system.

6.1.3 Road safety data

There is no transfer of information or data between the police and the Roads Fund or Macedonia Roads.

Type of data stored and updating
The police are responsible for collecting road accident data and for running a data base with accident data. However, the police have their own reference system, which is not in accordance with the reference system used by the Road Directorate. Accident problems are thus not indicated by the police or identified for the Roads Fund and Macedonia Roads.

Generally, there is no cooperation between the police and the Roads Fund. Road safety data is thus not part of the road management system.

The police prepare an annual report where data is used for the location of black spots.

Organisation responsible for collecting and maintaining data and systems used
The police collect the road accident data and handle a database on road accident data. The Roads Fund and Macedonia Roads do not have a database.

Future plans for the development of systems
At present, Macedonia Roads has no plans to start running or regularly receiving road accident data.

6.1.4 Structure infrastructure data

There are about 900 bridges on the FYRO Macedonian road network. The definition of a bridge is that the span is more than 5 m.

Type of data stored and updating
There is inventory data on all structures on the national road network. The database contains a combination of paper-based and computerised information. Almost all information from the questionnaire exists. It is not one unique database. Inspections of structures for inventory and condition assessment are carried out with a specialised vehicle. They are carried out by Macedonia Roads - the Department for Road Protection and Maintenance - once a year.

Software was developed in 1998 for a bridge database which is in use. All bridges are included in the database, but are not fully updated. The database consists of three years old data, but the department is working on updating the database. The paper-based system for bridge condition data is updated, and the updating of the computerisation is being finalised. Evidence of every bridge inventory and condition exists with photo documentation.

There are no special or formal surveys or databases to assess the tunnels. This is done as part of the monitoring of the roads, where work needed for routine and periodic maintenance is reported.

Organisation responsible for collecting and maintaining data and systems used
Macedonia Roads is responsible for collecting the structure inventory and condition data. The data is collected in the field. Macedonia Roads updates the unit costs. Output is used by Macedonia Roads and the Roads Fund for annual budget planning.

Future plans for the development of systems
There are plans to use GIS and it has been mentioned that a new system is needed.

6.1.5 Conclusion on road and road structure infrastructure management systems

The road inventory and condition data covers all main and regional roads (not local roads). The road inventory data collected covers almost all information from the questionnaire, but it is a paper-based database and it is not updated. For new roads there exists an updated road inventory database. There is also some computerised data in AutoCAD and Excel, but a real road inventory database system does not exist. The information is used for the PMS (Pavement Measurement System) database.

A PMS is used for road condition data, and two teams and two vehicles are used for that purpose. All the information from the questionnaire is generally included in the database.

Inventory data of all structures on the national road network is available. The database contains a combination of paper-based and computerised information. Almost all information from the questionnaire exists. It is not one unique database. Inspections for the structure inventory and condition assessment are carried out with a specialised vehicle. Software was developed in 1998 for the bridge database which is in use. All bridges are in the database, but it is not fully updated. The database consists of three years old data and is in the process of being updated.

The Roads Fund and the Ministry of Transport manage and administer the traffic database. The Macedonia Roads Traffic Department collects data and prepares an annual report and also uses the data. The main arterial road network has been covered by traffic counts, but the regional roads are not sufficiently covered.

The police collect the road accident data and handle a database on road accident data. Also, an annual report is prepared by the police. The Roads Fund and Macedonia Roads do not have a database.

There are plans to update the reference system database, to digitalise and update the entire network. A GIS-system was introduced, but stopped because of a lack of financial resources. A completely new system for the road

inventory database is needed, as the one in use is mostly paper-based. The road condition database is updated but there is a need for new equipment.

6.2 Rail and rail structure infrastructure management systems

6.2.1 Rail infrastructure data

Type of data stored and updating
Data collection is carried out on paper and covers the entire rail network. It is partly computerised, but there is no network for data distribution.

The reference system for the entire rail network has been implemented; it is the one which existed in former FR Yugoslavia. There is a new reference system.

Data collection for the rail inventory is carried out according to common regulations and includes all the information from the questionnaire. Data for the rail inventory database is continuously updated. There is no GIS level information system.

Rail condition data is collected from a specialised track recording car, which is borrowed from Serbia. Data is collected once a year using this car. Also, there is information from stations to sections about any changes on the rail network conditions. The visual inspections are on the operational level and, together with expert estimation, are used for assessment of maintenance and improvement needs. The data is collected continuously from the field. The information includes all types mentioned in the questionnaire.

Organisation responsible for collecting and maintaining data and systems used
Macedonian Railways is responsible for collecting and maintaining data. The work is organised like in Serbian Railways; stations, sections and sectors. Data from the stations and sections is given to relevant sectors, and then from each sector finally to the Management Sector who uses it for planning purposes, for budgets, improvements and annual reports.

The database is mostly paper-based. Some of the information has been entered into computers, which are not in a network.

Future plans for the development of systems
There are a number of plans for development. First, there is a plan for establishing a database system for rail inventory and its condition. There is a need for new software and hardware support, and finally an entirely new information system for Macedonian Rail.

6.2.2 Rail traffic data

There is updated rail traffic data, which covers all information from the questionnaire.

Type of data stored and updating
The data on rail traffic is collected daily. The people from the sections collect data manually and send it to the Traffic Sector daily, monthly and annually (depending on the type of data). The Traffic Sector prepares an annual report.

Organisation responsible for collecting and maintaining data and systems used
Data is collected at the operational level at the stations and sections. It functions for monitoring but not as a management system. The system runs at the Traffic Sector, and output is used by the Management and Traffic Sectors.

Future plans for the development of systems
There are a number of plans for a new system.

6.2.3 Structure infrastructure data

There are 42 tunnels and 189 bridges on the entire rail network. Data exists and is updated, but is mostly paper-based.

Type of data stored and updating
There is a list of structures and it is updated. All inspections are defined by regulations, and there is monthly and annually control of the rail structures and their condition. All information from the questionnaire is covered by these controls. The database is mostly in paper form and covers all structures on the national network.

Organisation responsible for collecting and maintaining data and systems used
The Maintenance Sector is responsible for collecting the data and data is used by the Maintenance and Management Sectors for planning.

Future plans for the development of systems
There is a need for a new information system in the entire organisation, and for new software and hardware.

6.2.4 Conclusion on rail and rail structure infrastructure management systems

Data collection for rail inventory, condition and structure is carried out to common regulations and includes all information from the questionnaire. There is not one unique database, and information is mostly paper-based. There is no management information system and GIS level information system. There is a need for a new information system in the organisation, and a number of projects for developing the entire system in Macedonian Railways are in process. The system is handled by Macedonian Railways.

6.3 Airport infrastructure management systems

6.3.1 Airport infrastructure

All information from the questionnaire is covered by data. The databases on airport infrastructure contain a combination of paper-based and computerised information, depending on the type of information. Condition data is collected continuously.

Type of data stored and updating
The airport collects information on all items in the questionnaire (except for the navigation system and the ATM which are under the control of the CAA) and later stores it in a computer, using e.g. AutoCAD and Word. There is a database containing a combination of paper-based and computerised information. The data is used for internal processes, e.g. for analysis and planning purposes.

There is information on the classification of airport, runways, taxi lanes, cross sections, etc. as well as lighting. There are no structures (bridges) in the airport.

The daily assessment and surveys of condition are carried out by the Airport Technical Department. The condition of buildings is also under control of the Technical Department.

The Civil Aviation Authority handles the navigation system and the light system is checked by the airport according to special procedures.

Data is collected continuously. Every change is registered and every important change is automatically sent to all users. Major condition surveys are carried out annually, and there are routine inspections every day. The navigation system is continuously and automatically surveyed. The lighting system is continuously checked. The entire airport is covered in the inventory. There is condition data for the entire airport, but not in one system.

Organisation responsible for collecting and maintaining data and systems used
There are few departments in the airport. The Technical Department is responsible for running and collecting data, and shares the data with other users. The system is not fully automatic. They have their own files for the inventory.

All condition data is in paper form. Every day there are reports on needs which are circulated to all departments. Only assessment of the navigation system is carried out by the CAA.

The information is updated, but not in one system, and is used for annual master plans for construction and development as well as maintenance.

Future plans for the development of systems
A tender for improvement of the information system is in process.

6.3.2 Airport traffic data

Type of data stored and updating

Traffic data is continuously collected and updated. The passenger information is continuously collected from each flight, which allows the airport to prepare statistics as mentioned in the questionnaire. The information on take-offs and landings are collected daily, monthly and annually.

All passengers are registered in the system, for commercial reasons. The data is e.g. received from the air companies. This is handled by the Commercial Department.

Organisation responsible for collecting and maintaining data and systems used

The Airport Information Technology Department (AIT) handles the system, which was computerised in 1991. New software, developed in-house has been in use since 1999. The Operational Centre updates information in the database and information is available to all users who need it.

The unit costs are used for planning, budgets etc. according to identified needs and plans for development. The Commercial Department generally collects the information and it is generally up-to-date. Generally, the Commercial Department runs the system for unit costs. The Planning Department and the management of the airport use the output.

Future plans for the development of systems

A tender for improvement of the information system is in process.

6.3.3 Conclusion on airport infrastructure management systems

The airport collects information on all items in the questionnaire (except for the navigation system and the ATM, which is under the control of the CAA). There is a database containing a combination of paper-based and computerised information. The data is used for internal processes, e.g. analysis and planning. The information is updated, but not in one system. Traffic data is continuously collected and updated. The Airport Information Technology Department (AIT) handles the system. The system was computerised in 1991. New software, developed in-house, has been in use since 1999. The Operational Centre updates the information in the database and information is available to all users who need it. A tender for improvement of the information system is in process.

7 Serbia and Montenegro

This section describes the management information systems used in Serbia and Montenegro, consisting of the Republic of Serbia, Kosovo[5] and the Republic of Montenegro.

7.1 Serbia

In Serbia, information on the status of management information systems has been collected for:

- the road sector including its structures
- the rail sector including its structures
- Belgrade port
- Belgrade airport
- the inland waterways sector.

The information has been collected through interviews with key persons in the Road Directorate in Belgrade, the Rail Directorate in Belgrade, the Port of Belgrade, the Airport of Belgrade and the government agency for Maintenance and Development of Inland Waterways.

7.1.1 Road and road structure infrastructure management systems

There are approx. 14,000 km of national roads in Serbia and 2,600 bridges, excluding the roads and bridges in Kosovo (approx. 3,000 km).

The road network is divided into main arterial and regional roads under the responsibility of the Road Directorate, and local roads under responsibility of municipalities. There are approx. 4,800 km main arterial roads and approx. 9,000 km regional roads.

There are a total 1000 employees in the Road Directorate. Of these, approx. 800 are employed at the pay toll stations. 7 are employed in the Road Information System Department.

[5] Under international administration in line with UNSCR 1244 of 10 June 1999

Approx. 20-25% of the total revenue is from toll roads, which cover the main highways.

The data collection, storage and handling and plans for future systems are described in the following sections for road infrastructure, traffic and structures.

Road infrastructure data
The collection of information on management information systems for road infrastructure data covers whether:

- the national road network is referenced
- an inventory has been carried out and is updated
- information on the condition of the road network is carried out regularly and is updated
- all this information is stored and used systematically

Information is also collected on unit costs and on who collects, stores and uses the data.

Type of data stored and updating
There is a common reference system for all former Yugoslavian Republics, covering all regional and main arterial roads. The reference system consists of nodes (junctions), sections (between nodes) and directions. Each road, section and node has its own unique number. E.g. Road M-1.12, section 053, between node 0132 and node 0133. Additionally, the location of the two nodes is described as is the length of the section. Finally, there is a field for remarks. There are 1500 road notes, 1200 sections and 300 road sections. The reference system was established in 1991 and updated in 1997. The local roads under the responsibility of the municipalities are not covered in this reference system.

The road inventory and condition data covers all main and regional roads (not local roads). The whole road network is on video tapes (VHS), recorded with a video vehicle driving at speeds of 40-80 km/h. Before the video vehicle records a section, the culverts and other items which need to be registered are marked with painting. The operator can then record culverts etc. at the correct location, and by watching the video also type the relevant parameters for the inventory (length, alignment, longitudinal profile, cross-section, pavement, structures (major culverts, bridges and tunnels), furniture and land use) and condition database (edge damage, left and right side (side drains, shoulders, edge step, edge damage), carriageway and furniture). All the information from the questionnaire is generally included in the database. The operators also register the urban and non-urban areas, however, this is not used.

The Road Directorate then uses the HDM4 model (previously HDM3) for network analysis.

Falling weight deflection measurement and skid resistant measurement by pendulum on specific links are also carried out to assess the condition of the road.

The first time videos were recorded for inventory was in 1991 to 1996, when Kosovo was included. The second round for the main arterial roads was finalised in 2002 with the last 1,800 km, and the second round for the regional roads is now continuing - 5,000 km of regional roads are planned to be covered this year.

A new system from New Zealand called ROMDAS (Road Measurement and Data Acquisition System) with new equipment is to be used for these 5,000 km. It uses a special vehicle which may measure different parameters e.g. longitude alignment, horizontal alignment by GPS and GIS instead of gyroscope. So far, ROMDAS has only been used for feasibility studies on 1200 km of roads.

There are different pricelists for costs. The Road Directorate prepares a pricelist for civil engineering road work, e.g. construction, rehabilitation, routine maintenance, etc. The pricelist is updated regularly. The unit costs are e.g. used for the yearly planning, but not specifically in a road infrastructure management system.

The Traffic Department collects input to be used to calculate VOC, e.g. the price of vehicles, fuel, etc. for the assessment of benefits. There are also unit costs used for safety, e.g. EUR 75,000 for accidents causing fatalities, EUR 2,000 for accidents causing injuries, and EUR 800 for accidents causing material damage only. The average accident price is EUR 5,000. This data is used as input to the HDM4 model assessments.

Organisation responsible for collecting and maintaining data and systems used

The Road Directorate manages and administers the databases for traffic, road and bridges. There are three institutes working for the Road Directorate to collect data, using separate models for data collection:

- The Highway Institute
- The IMS (The Institute for Testing of Material)
- The Centre for Roads of Vojvodina.

The Highway Institute is responsible for measuring geometrical characteristics, etc. with a gyroscope as well as condition of the road, through falling weight deflection measurement and skid resistance. In the future, they will also be responsible for the ROMDAS system and the ROMDAS vehicle.

The IMS is mostly responsible for inventory data through the video recording of the roads and the following typing of key elements into a data base. The IMS has the vehicle for video recording.

The Centre for Roads of Vojvodina is responsible for data collection in the northern region Vojvodina.

The Department for Road Infrastructure Systems at the Road Directorate receives an updated version of the databases annually. The data in the databases

is used for the assessment of roads by taking data from the databases and entering it into the HDM4 model (previously HDM3).

The Traffic Department collects unit costs for VOC. Other unit costs which are related to benefits (cost per km driven, cost of time saving, etc.) are provided to the Road Directorate by the Traffic and Transportation Faculty, annually. The unit costs for civil engineering work are collected by the Road Directorate Department for civil engineering.

Future plans for the development of systems
There are plans to introduce databases for landslides and tunnels. One system for land slides was considered to require data which is too complex, so an appropriate system is being investigated.

There are also plans to introduce an umbrella-system as a management information system covering Serbia. This system would use input from the databases, but the Road Directorate is cautious about introducing a big, complex system, as they are difficult to maintain.

Road traffic data
The Road Directorate has 140 automatic counters on the main road network, of which 40 classify the vehicles and the rest count the number of vehicles passing. Additionally, there are regular counts at the pay tolls. Manual traffic counts are only carried out for specific projects.

Type of data stored and updating
The entire main arterial road network has been covered by traffic counts for the past 10 years, but the regional roads are not sufficiently covered. The Road Directorate receives an updated database annually, however, monthly reports on traffic are also prepared by SERBIA-Put.

The classified counts are divided into 6 categories:

- Passenger cars
- Bus
- Light trucks (3-5T)
- Trucks
- Heavy trucks
- Semi-trailers

The annual report presents AADT and AADT seasonal. In the original data, it is also possible to get other parameters, because the counters have two channels and count hourly by direction.

There are two static weighing stations and three mobile weighting stations to measure axle loads. The static weighting stations are located at Bubanj, Potok and Nis toll stations. The three mobile weighting stations are stationed around Kraljevo, Beograd and Nis. These change location every day, according to a monthly plan.

Results show that in e.g. March, approx. 30% of the trucks were overloaded. The axle load surveys are carried out to punish drivers for overloading, not for e.g. design purposes or assessment of the deterioration of roads. The axle loads are measured according to the national standard JUS U.C4.010. The Road Directorate considers the fine for overloading far too low.

The calculation of ESA's for e.g. road design is based on traffic counts, and the standard weight of vehicles to calculate 8,4 t. equivalent standard axle load, and they plan to introduce 11,4 t. Overloaded vehicles are thus not included for e.g. the design of roads.

Organisation responsible for collecting and maintaining data and systems used

The Road Directorate manages and administers the database for traffic. There are three institutes working for the Road Directorate to collect traffic data and axle load data:

- SERBIA - Put
- The IMS (The Institute for Testing of Material)
- Police.

SERBIA-Put maintains the counters and collects the traffic data in the field and is the owner of the counters, although the counters are paid by the Road Directorate. Every month, SERBIA-Put brings the collected traffic data to the IMS.

The IMS checks the data and makes annual reports which are also presented on CD-roms. The IMS runs the database and the Road Directorate receives an updated version of the traffic database annually. This process started 10 years ago.

Together with the police, SERBIA-Put carries out axle load surveys. These are, however, not part of a system but are used for fines for overloads.

Future plans for the development of systems

The counters are mainly located on the main arterial roads and there are few on the regional roads. Hence, the 4,000 km arterial roads are generally covered, but the remaining regional roads are not sufficiently covered.

There was no mention of the development of a new system or of extending the system.

Road safety data

There is no road safety department in the Road Directorate, nor any transfer of information or data between the police and the Road Directorate.

Type of data stored and updating

The police are responsible for collecting road accident data and for running a database with accident data. However, the police have their own reference system, which is not in accordance with the reference system used by the Road

Directorate. Accident problems are thus not indicated by the police or identified for the Road Directorate.

During a project last year, the Road Directorate gave their reference system to the police for use in a project for the main arterial roads run by the Traffic and Transport Faculty. It began on corridor X in 2000 and continued on the main network in 2002. It was used to identify e.g. black spots.

Generally, there is no cooperation between the police and the Road Directorate. Road safety data is thus not part of the road management system.

If the police are asked to provide information on specific projects, e.g. a specific road, they will comply, but it may be difficult to obtain the information, and there are problems with the location of the accidents.

The information collected by the police is normally not used for further assessment, e.g. for black spot identification, with the exception of the specific project mentioned above.

Organisation responsible for collecting and maintaining data and systems used
The police collect the road accident data and handle a database on road accident data. There is neither a road safety department in the Road Directorate nor any transfer of information or data between the police and the Road Directorate. Thus, the Road Directorate does not have a database.

Future plans for the development of systems
At present, there are no plans for the Road Directorate to start running or regularly receiving road accident data. It was, however, mentioned that it would be relevant with e.g. an environmental department and a road safety department. For the Road Directorate to be able to use data from the police, a common reference system should be agreed.

Structure infrastructure data
There are 2600 bridges on the Serbian road network (excluding Kosovo). The definition of a bridge is that the span is more than 5 m.

Type of data stored and updating
Presently rough inventory data is collected through a paper-based condition survey. There are problems with measuring the bearing capacity of the bridge and no feasible method has yet been found.

There is old inventory data on all bridges, however, there has not been much updating of the condition data for the past 10 years. Data has mainly been transferred from the old database from 1991-1996. There are plans to asses 500 bridges this year.

The data from 1990 has been transferred from a C++ database to a new Access database. The bridge management system is run by the Highway Division. The

new system developed is based on an American system from a Highway Institute. This is then adapted to local conditions.

The management system is not yet fully updated, because there are difficulties finding funds, in spite of the fact that updating the system would only cost 1-2 % of maintenance funds. Information for 29 bridges on the national network has been updated.

Each bridge is assessed according to 16 overall components. Each component is given a different condition rating from 1 to 5 (bad to good). Each condition is connected to an average cost for improvement. The importance of the network where the structure is located is prioritised. This can be used to plan the work. Unit data (average cost) is part of the new database and is regularly updated.

There are no special or formal surveys or databases to assess the tunnels. Tunnels are assessed as part of the monitoring of the roads, where work needed for routine and periodic maintenance is also reported.

Organisation responsible for collecting and maintaining data and systems used

The Highway Division is responsible for collecting the bridge inventory and condition data. The data is collected in the field. The Highway Division also updates the unit costs.

There are a BMS (Bridge Management System) system and procedures on how to use it. However, it has proved difficult to implement the system in full scale.

Future plans for the development of systems

It is the plan to use the new BMS when carrying out condition surveys of the bridges. It is planned that 500 bridges will be assessed in 2003.

Conclusion on road and road structure infrastructure management systems

The present data collection and storage system is not one system. It is based on different and separate databases (traffic, road, and bridge), and data is entered into to the HDM4 model to assess the road network.

The inventory and road condition data is fairly updated for the roads. The inventory of the bridges exists but is approx. 10 years old. The condition survey of the bridges is not updated. Only 29 bridges out of 2600 were assessed last year. The Road Directorate plans to assess 500 bridges this year.

The traffic data is generally updated annually on the arterial main roads, but lacking on many regional roads. Classified traffic counts are only partially carried out on the main arterial roads.

The road safety data is collected by the police and stored in their databases. The information is not transferred to the Road Directorate and thus not used to reduce e.g. black spots or other accident-prone areas. The databases of the

police and the Road Directorate use different reference systems. Furthermore, there is no road safety department in the Road Directorate.

There are plans to introduce an umbrella of a management information system in Serbia using input from the databases, but the Road Directorate has so far been cautious to introduce a big, complex system, because it would be difficult to maintain.

7.1.2 Rail and rail structure infrastructure management systems

Data collection is carried out on paper and covers the entire rail network. Part of it is computerised, but it is not used on all sections. There is no IT-network to distribute the data.

It is hoped that donors, e.g. the Canadian government will cover parts of the investment in a new system. Corridor X is planned to be the first to be covered by an organised information system.

A tender has been submitted for the HERMES project for the operation of wagons.

Rail infrastructure data
The collection of information on management information systems for rail infrastructure data covers whether:

- the national rail network is referenced
- an inventory of the rail network has been carried out and is updated
- information on the condition of the rail network is carried out regularly and is updated
- all this information is stored and used systematically

Information is also collected on unit costs and on who collects, stores and uses the data.

Type of data stored and updating
Railway infrastructure and condition data exists, but it is generally based on paper, however, some data is computerised. The work is based on individual qualifications and stand-alone computers. Data collection is carried out according to common regulations.

The information includes all types mentioned in the questionnaire. The inventory is continuously updated and the whole network is covered.

Project documents are prepared on CD-roms by the section with some of the information. The CD-rom is given to the appropriate sector physically, due to the lack of a network. Basic level information is collected and computerised in Oracle, Corel Draw, AutoCAD, etc.

There is a complete component level information system, but it is entirely based on paper. Also graphics are prepared by hand.

There is no GIS level information system, however, a pilot project has been carried out on the Belgrade-Bar network using ORACLE and MAPINFO. The project was developed together with Pupin (a research institute which develops small parts for the electronic industry)

Condition data for alignment quality level exists. There is an Austrian track-recording car with sensors. Data collected from this car is entered into AMAX software developed in former FR Yugoslavia. Output is geometrical condition data on the railway network described with 8 main parameters, which this programme recognises. Some are presented graphically and some are presented numerically. With this system, problem spots can be precisely located by their coordinates. The programme ADA 2 is used to notify if there are problems with those 8 parameters (if they exceed thresholds).

There are plans to introduce a new track recording car (MSAT-120) with sensors and connected software. This car also provides geometrical data from the railway network. It is possible to have 3-D presentations. But the machine is very sensitive and if it is to be used, the quality of the rail network will have to be improved. It will arrive in Belgrade in April 2004. The real problem is that the recording car is only capable of improving 14 km per year instead of 200 km, which is the real need.

Safety is a high priority, and works are always carried out, but there is not enough money for improving speed and comfort (the Ministry of Serbia is responsible for safety aspects).

There are also visual inspections carried out at the operational level which, together with expert estimation, assess the maintenance and improvement needs.

The rail condition assessment covers the entire rail network (3800 km), apart from industrial lines (managed by owners) and lines in Kosovo (700 km) (managed by UNMIK). Annually, 1300 km are maintained.

Organisation responsible for collecting and maintaining data and systems used

The data collection is contains a combination of paper-based and computerised information. A base (computer system IBM S 390) from 1980 and ORACLE software are used.

The system is used for monitoring and preparing reports, but not as a management information system.

Inventory and condition data is collected by the sections, and then sent to the sector. As a minimum, the main data is passed on to the Planning Sector, which is responsible for making an annual report.

The work is organised at different levels: Stations, sections, and sectors. Also, there are three different sectors; civil Engineering, electricity and technical, exploitation (traffic and regulation). Data is collected for each of these sectors. This is given by station or section, depending on the type of information. One section covers approx. 20 stations. Data from the three sectors is given to the Planning Sector, which uses it for annual reports.

Future plans for the development of systems
The system is functioning and updated, and there are plans to extend the system. New hardware and software are needed to transfer the data from the old system into a new.

A project with software developed by the University of Delft has been introduced. This should be useful because it covers economic aspects, which are not sufficiently covered in the existing system. The system provides information on quality analysis of the network, and could be used for budgeting and planning, but financial support is needed to purchase the system.

It is hoped that donors, e.g. the Canadian government will cover parts of the investment in a new system. Corridor X is planned to be the first to be covered by an organised information system. Also, a tender has been submitted for the HERMES project for the operation of wagons and a new organisation system is being prepared according to EU directive 440.

Rail traffic data
The traffic information is updated daily and the whole network is covered.

Type of data stored and updating
There is data on rail traffic, which is collected daily. A computer processes the data. All data mentioned in the questionnaire, e.g. on frequency, annual amount of tonnage etc. exists.

The actual axle load data is processed statistically and the permitted axle loads from the timetable. There are plans for two separate projects for databases for actual and permitted axle loads.

Organisation responsible for collecting and maintaining data and systems used
The system runs at the Traffic and Transport Sector and output is used by the central railway organisation.

The directorates of passenger and freight traffic are responsible for collecting rail traffic data.

The collection of data is a combination of paper-based and computerised information. The hardware is from 1980, the software is DB II. It functions for monitoring but not as a management information system.

Data is collected at the operational level at the sections. The data is not used for prioritising or determining needs for maintenance etc.

Future plans for the development of systems
The system functions and there are plans to extend the system, e.g. the HERMES programme, because it could provide better interaction between the client and the railway organisation.

Structure infrastructure data
There is a list of the structures and it is updated, and every change is registered. The entire national rail network is covered.

Type of data stored and updating
There exists an inventory of the railway objects, but it is generally based on paper, however some data is computerised. The work is based on individual qualifications and stand-alone computers.

There are monthly controls at section level for smaller works. The sections are 300-500 km for civil engineering maintenance. There is also an annual control by sections and bi-annual controls on large objects by the sector. The structure inventory data covers all structures on the national rail network.

All the condition data is contained in a book of exploitation, and includes all the information mentioned in the questionnaire, e.g. wing walls, superstructure, etc. The frequency of updating of the condition data is monthly by section for minor items, annually by section, and bi-annually by sector for major items.

Organisation responsible for collecting and maintaining data and systems used
Inventory and condition data is collected by sections, and then sent to the sector. As a minimum, the main data goes to the planning sector responsible for preparing an annual report.

Future plans for the development of systems
There are plans to develop the system as mentioned earlier.

Conclusion on rail and rail structure infrastructure management systems
Data collection for rail inventory, condition and structure is carried out to common regulations and includes all the information from the questionnaire. There is not one unique database and information is mostly paper-based. There is no management information system, nor a GIS level information system.

The system functions and is updated, and there are plans to extend the system. There is a need for new hardware and software to transfer the data from the old system into a new.

A project with software developed by the University of Delft has been introduced. This should be useful because it covers economic aspects, which are not sufficiently covered in the existing system. The system provides information on quality analysis of the network, and could be used for budgeting and planning, but financial support is needed to purchase the system.

It is hoped that donors, e.g. the Canadian government will cover parts of the investment in a new system. Corridor X is planned to be the first to be covered by an organised information system. Also, a tender has been submitted for the HERMES project for the operation of wagons and a new organisation system is being prepared according to EU directive 440.

7.1.3 Port infrastructure management systems

In Serbia there are only ports on the inland waterways, and thus no seaports. The Port of Belgrade has a total of 600 employees. The port was privatised in 2000, when 60% of the shares were sold.

The data collection, storage and handling and plans for future systems are described in the following sections for the port infrastructure and traffic data.

Port infrastructure data
The collection of information on management information systems for the port infrastructure data covers whether:

- an inventory of the port has been carried out and is updated
- information on the condition of the port is carried out regularly and is updated
- all this information is stored and used systematically

Information is also collected on unit costs and on who collects, stores and uses the data.

Type of data stored and updating
The port has recently carried out an inventory of the port as it was updated, due to the privatisation in 2000.

All the inventory data is generally stored in Excel and in some cases also Access. The inventory covers the items mentioned in the questionnaire e.g. break waters, piers, etc. and also on possible size of ships, their capacity etc.

The port has no navigation system but information on ships is available on paper and via radio. A new EU project called RIS (River Information System) has been introduced and is partly followed, but is very new.

The condition data covers the entire port. The condition data is updated and based on monthly inspections, but not as a unique system. Information on the condition of e.g. breakwaters, piers, etc. as mentioned in the questionnaire is collected by different departments. Word is often used for the description of the condition of the port.

There are no structures (bridges and tunnels) in the port area.

The inventory was last updated in 2000. This is considered to be updated, as nothing has changed and it covers large investments. Condition inspections are carried out monthly.

The port has unit costs and port tariffs. The costs are calculated by each of the departments, e.g. the Technical and Commercial Department. The unit cost may easily be obtained from the other departments.

Organisation responsible for collecting and maintaining data and systems used
The Port of Belgrade generally collects inventory data and stores it in e.g. Excel and Word, thus it is not really a database and it is not used as a management information system.

The Port of Belgrade has a Department for Information Systems, but the department only maintains the software system, and does not manage and run the databases. Each of the departments in the port runs their own systems, which are not connected and organised as one system. Presently, the inventory data is only used for statistics and predictions.

The Technical and Development Sectors handle the condition data for each of their own areas. The condition data was computerised in 1989 in Word and Excel. The data is used for management purposes, e.g. for predictions, but not as a full system.

The Technical Department calculates the prices according to the identified needs from the condition surveys. These prices are used for budgeting and planning purposes.

For administrative purposes the Progress database is used, e.g. to handle salaries.

Future plans for the development of systems
The information is updated. The port has plans to extend the system, but to get started, a project defining the processes necessary to extend the system is needed.

Port traffic data
The ports collect traffic data which is submitted to the Federal Statistics Bureau.

Type of data stored and updating
The port of Belgrade collects the traffic data as mentioned in the questionnaire for statistical purposes. The data is collected on a monthly basis.

Generally, the port also has a good knowledge of actual reloading and modal split.

Organisation responsible for collecting and maintaining data and systems used
The Commercial Department collects the traffic data. The data has been stored on computers since the end the 80´s in Excel and FoxPro.

The Commercial Department sends reports to others who are interested in the data, e.g. other departments.

All the river ports send information to the Federal Statistics Bureau. Each port also prepares an annual report on traffic etc.

Future plans for the development of systems
The Port of Belgrade would like to extend the system, but will need a special project identifying needs.

Conclusion on port infrastructure management systems
The hardware of the port is relatively advanced, but there is a problem with the organisation of it. The port has local networks and connections to the internet, etc., and all data is collected, but not all data is used. The data is presently collected and could be part of a future system. As soon as management has decided for on a system, one year would be enough to extend the system.

The existing system in the port is not one system and cannot be considered a port maintenance system. The facilities are maintained according to inspections.

7.1.4 Airport infrastructure management systems

There is information on all items in the questionnaire. Data is stored on computer, on e.g. AutoCAD and Word. The data is used for internal processes, e.g. for projects.

Airport infrastructure data
The entire airport is covered in the inventory and there is condition data for the entire airport, but not in one system.

Based on the data collected, the Federal Flight Traffic Control prepares a monthly publication according to law and international standards, showing classification, runways, etc.

The airport collects data and sends it to the Federal Flight Traffic Control, who is responsible for processing the data and making the monthly report. The data can be returned on a CD-rom if wished.

Type of data stored and updating
There is information on the classification of airports, runways, taxi lanes, cross sections, etc. as well as lighting. There are no structures (bridges) in the airport.

In winter, the runways are inspected every ½hour for friction. The daily assessment and survey of condition are carried out by the airport themselves.

For more detailed assessments, the service of the Highway Institute is used. They have measurement instruments and periodically (annually, sometimes less) do the survey. They prepare a report for the airport to be used to assess needs. The condition of the buildings is carried out by the Technical Department.

The navigation system is handled by the Federal Air Control and is continuously and automatically surveyed. The lighting system is continuously checked by the airport according to special procedures. There is a plan for automatic control within the next 6 months.

Data is collected monthly, and every change is registered and every important change is automatically sent to all users.

Major condition surveys are carried out annually, and there are daily inspections.

Organisation responsible for collecting and maintaining data and systems used
There are technical, traffic, financial, commercial, retail and cargo departments in the airport.

The Technical Department is responsible for running and collecting data, and uses the data as along with other users.

The system is not fully automatic. For their own purposes, they have their own files for inventory, e.g. AutoCAD, Word and spreadsheets. There exists a database for storage of input, but it only covers traffic data. There is a flight information system for traffic.

There is no historical data on condition, but there is day-by-day information. All condition data is in paper form. Every day a report on needs is prepared, and circulated to all departments.

Only the navigation system has a log file for condition.

The information is updated, but not in one system. It is used for annual master plans for construction, development and maintenance.

Future plans for the development of systems
An integrated airport operational database (AODB) is being implemented. Standardisation of the data, software and hardware is in process.

The final plan is to add an airport management system. The business part is 80 % finalised and is expected to be finished in two years. The technical part or entire system will be finalised in approx. 10 years.

Airport traffic data

Type of data stored and updating
Passenger information is continuously collected from each flight, which allows the airport to prepare statistics as mentioned in the questionnaire.

There is no automatic system to register dwell time for cargo, but a system is being developed.

The information on take-offs and landings are collected daily, monthly and annually. There is a system called FIDS, a Flight Information Display System which runs in the programme ORACLE. It has just been updated. All data is collected and maintained, but not used to calculate peak hour movements, etc. The information is registered so that different statistical work can be provided.

Traffic data is continuously updated and all flights and passengers are registered.

Organisation responsible for collecting and maintaining data and systems used
The data is computerised in the FIDS which have recently been updated. The FIDS is part of a new database where all staff is connected to the database. All departments will have their own interface.

The different departments will collect relevant data and information for their field and enter it into the database. The data is not distributed but can be received through the system. All departments are users of the database.

Future plans for the development of systems
The system is new and not fully developed so it needs to be extended. The system will be used for planning, budgeting, etc. where FIDS is the basis. It will finally become an airport management system.

Conclusion on airport infrastructure management systems
The entire airport is covered by the inventory and there is condition data for the entire airport, but not in one system.

Traffic data is continuously updated in a system called FIDS, which has just been updated. The new system is not fully developed and is planned to be extended and finally become an AMS (Airport Management System). The airport is implementing an integrated airport operational database, and it is planned to finally add an airport management system. The business part is 80 % finalised and is expected to be finished in two years. The technical part and the entire system will be finished in approx. 10 years.

In the present plans to completely reorganise the airport this year, there are considerations to have a Department for Planning and Investment.

7.1.5 Inland waterway infrastructure management systems

Serbia has three main inland waterways which are navigable: The Danube, Tisa and Sava. Additionally, there are some minor channels that are managed by the DTD (Danube, Tisa, Danube) organisation in Novi Sad. The Danube is the longest and widest river, and is also an international river with 588 km in Serbia.

The government agency for Maintenance and Developing of Inland Waterways was established in 1963 and has a total of 180 employees. Approx. half work in the field and 50-60 work in the office in Belgrade. The agency is a fully government-based organisation.

Inland waterway infrastructure data
The collection of information for management information systems on inland waterway infrastructure data covers whether:

- inventory of the inland waterways has been carried out and is updated
- information on the condition of inland waterways is collected regularly and is updated
- all this information is stored and used systematically

Information is also collected on unit costs and on who collects, stores and uses the data.

Type of data stored and updating
Inventory and condition data is collected for the Danube and Tisa rivers and the information is up-to-date for most sections. Some of the information is registered in books and reports, and other in databases.

The Inland Waterways (IWW) in Serbia are classified according to the international classification system, and in Serbia they are generally classified as 6 and 7 and a few as 5.

Generally, there is information on the waterways (e.g. length, widths, etc.) location of ports, etc. as well as on the condition of the waterways. The condition of the cross-section of the Danube and Tisa is assessed every year in a report prepared by the Project Department, comparing - in paper form - the changes of the cross-sections between last and present year and identifying problem sections.

Water levels are measured and announced daily and the ports are registered in books which are published regularly.

Information on the cross-sections has been collected for the past 30 years for the Danube and for the past 13 years stored digitally. There are a total of 855 cross-sections on the Danube divided into 3 categories:

- evidential cross-sections (700-800 m between)
- additional/control cross-sections (very detailed at groins)

- cross-sections at low depths - not regulated profiles at shallows

Presently, there are no updated cross-sections on the river sections between Serbia and Croatia, because the border line has not yet been agreed.

The surveys for the Danube are stored in a database. The database is based on the principles developed in a report prepared by a student, suggesting a full system which includes e.g. GIS. Presently, only the cross-sections have been stored in the system, and only the cross-sections are surveyed with respect to condition. The maps of the Danube have been scanned and connected to the database, showing key information on profiles and cross sections. The Danube is generally in good condition, because the waterway was already improved between Belgrade and the Hungarian border, when two hydrostations were constructed in the south-eastern part of Serbia, raising the water almost all the way to Belgrade.

The groins and embankments of the Danube are registered in books which are 10 years old. Nothing has been done or changed in the last 10 years, so the data is still considered fairly updated.

There are approx. 150 main cross-sections covering the entire Tisa. The Tisa has by nature sufficient water level and is thus generally good for navigation.

The marking system of the inland waterways on the Danube and Tisa is in accordance with the FR Yugoslavian law from 1992 and with recommendations from the Danube Commission, the latest issue being from 2002. The marking system is published annually to all interested users and the Danube Commission.

There is some navigation equipment on the inland waterways, e.g. radar reflectors on bridge pillars and radars on ships. There are plans to implement a new navigation system, and thus there is a study on a new telecommunication system.

Every year, a budget plan is prepared, assessing the prices of construction and maintenance. The calculation of cost for the annual plan is based on the analysis of the identified needs and a budget is always suggested. The assessment of costs is thus not part of a system, and costs are not based on market value as work is done by themselves.

The real market prices for e.g. freight tariffs and passenger fares are assessed by the navigators on a commercial basis.

No systematic data collection is carried out on the Sava and there is thus not much information - e.g. no cross-sections, which is considered a problem by the Government Agency for Maintenance and Developing of Inland Waterways. Only maps are used on the Sava.

There is only little navigation on the Sava and this is done on own risk. The government agency for Maintenance and Developing of Inland Waterways

consider the Sava as potentially good for navigation, because there are many cities and many industrial zones which may be served by the river.

There is no information on the channels in northern Serbia and on the river Begej.

Organisation responsible for collecting and maintaining data and systems used
The main surveying of the river starts in April/May to assess the cross-sections, and it takes a few months to collect all data. This is handled by the Surveying Sector under the Technical Department.

The Project Department is one of the users of the output from the fieldwork as input to their annual report called "Analysis of Waterways According to Cross-section". This report is considered very useful by the Government Agency for Maintenance and Developing of Inland Waterways. The Project Department also assesses the cost of construction.

The collection and storage of data is a combination of paper-based and computer-based information. The database used is Access and AutoCAD is used for the maps.

The Sava is covered by another company, but generally no information is collected and stored.

Future plans for the development of systems
The Government Agency for Maintenance and Developing of Inland Waterways would like to develop the system, but there are not yet any specific plans. The work assessed to be needed to complete the system is to add more data into the database, and then teach people to use system and to publish the information.

Inland waterway traffic data
Generally, traffic data on the inland waterways is not collected by the Government Agency for Maintenance and Developing of inland waterways but is received through the ports.

Type of data stored and updating
There is information on traffic data on the inland waterways, but the traffic data is collected by the ports and given in digital form to the Statistics Bureau. The data is given monthly to the IWW from the Statistics Bureau. The number of ships passing the hydrostations is also registered, but not used to register traffic.

Organisation responsible for collecting and maintaining data and systems used
Every second month, the Government Agency for Maintenance and Developing of Inland Waterways prepares a newsletter/bulletin based on e.g. the monthly traffic data and information on the condition of the inland waterways. The newsletter/bulletin provides general information on the condition of the rivers

and statistical records, as well as special issues such as important information for the winter season to inform on e.g. winter ports.

Future plans for the development of systems
There are no specific plans to start collecting traffic data, but the Government Agency for Maintenance and Developing of Inland Waterways intends to collect traffic data in the future.

Conclusion on inland waterway infrastructure management systems
The data on the condition of inland waterways is generally collected regularly, and information such as the cross-sections is computerised.

Other information on condition is collected and assessed for an annual report on the condition of the inland waterways, especially identifying the needs for improvement.

Generally, there is information on the condition of the Danube and Tisa (apart from the section bordering Croatia) in databases and reports, but not in a coordinated way and an in a single system. However, the existing database presenting the cross-sections could probably be the backbone in a future management information system for inland waterways.

The inventory of the inland waterways is kept in books and has not been updated the past 10 years.

Inland waterway traffic data is not collected by the Government Agency for Maintenance and Developing of Inland Waterways, but is received from the Statistics Bureau, based on data from the ports.

7.2 Montenegro

In Montenegro, information on the status of management information systems has been collected for:

- the road sector including its structures
- the rail sector including its structures
- The Port of Bar
- Podgorica and Tivat airport

The information has been collected through interviews with key persons in the Ministry of Transport – Department for road and rail infrastructure, the Montenegro Railways, the Port of Bar, the Airports of Montenegro.

7.2.1 Road and road structure infrastructure management systems

Road infrastructure data
The road network is divided into main arterial and regional roads under the responsibility of the Ministry of Transport, and local roads under the responsibility of municipalities.

The data collection, storage and handling and plans for future systems are described in the following sections for road infrastructure, traffic and structures.

Type of data stored and updating
A reference system exists and is similar to the one in Serbia and to all others in the former Yugoslav republics. The reference system was last updated in 1990. A new, computerised reference system has just started being developed. Presently, the ROUTEN software is in use, before being replaced by HDM4. The consultant companies BCEOM-COWI work on the project and they have finished collecting data.

The road inventory and condition data covers all main and regional networks, but data has not been updated since 1990. All the information from the questionnaire is not included. COWI did some measuring for purposes of the study in progress, so additional and updated data for the main road network exists, but the Ministry of Transport still does not have the information. The database on road inventory is paper-based and data is collected by Montenegro Roads which is a service for the Ministry of Transport.

Montenegro Roads has divided Montenegro into 5 regions, each of them with a team responsible for data collection in the region. Road condition data is also collected by Montenegro Roads. The ministry signs a contract for annual maintenance of the roads with Montenegro Roads, and they have an obligation to send reports about conditions on the road every three months. Usually, however, this is not done.

For purposes of the BCEOM - COWI study for the Ministry of Transport, almost all road condition data from the questionnaire has been collected (COWI did this with the local consultant – Montenegro Roads) in 2002, but the data is not available for the Ministry of Transport, as the project has not been finalised.

Organisation responsible for collecting and maintaining data and systems used
The system is handled by the Ministry of Transport and collection of data is done by Montenegro Roads. The data collected is used only for maintenance and budget planning. An updated, computerised and unique database for road inventory and road condition does not exist.

Future plans for the development of systems
There are plans to develop the system. As mentioned previously, a study for the Ministry of Transport is in progress and carried out by BCEOM–COWI–Montenegro Roads.

Road traffic data
Traffic data exists and is collected from 10 automatic traffic counters and from manual counts.

Type of data stored and updating
Previously, there were 21 automatic traffic counters on the main road network, but now there are only 10 in use, located on the main arterial and regional road network. Manual traffic data collection is done every year by Crnagoraput at the request of the Ministry of Transport.

Montenegro Roads prepares an annual report presenting only AADT, but other parameters could easily be calculated if needed.

Information about axle load exists and measuring is done by Montenegro Roads. There are monthly plans for location of the mobile weighting stations. The axel loads are measured according to the national standards.

Calculation of ESA will probably be done for purposes of the study (BCEOM-COWI). It has not been calculated before.

Traffic data was last updated in 2002, and covers the main arterial and regional road network.

Organisation responsible for collecting and maintaining data and systems used
Montenegro Roads is responsible for collecting and maintaining data. They have a computerised database and prepare an annual report for the Ministry of Transport. The ministry only has the report in paper form, and does not have a computerised version of the traffic data. They use it for analysis and future planning and budgets.

Future plans for the development of systems
There was no mention of plans for developing the system, probably because it is handled by Montenegro Roads.

Road safety data
Road safety data is covered and handled by the police.

Type of data stored and updating
The accident data is collected by the police and who run the accident database. The data are not transferred to the road databases as there is no formal cooperation between the police and the Ministry of Transport.

Organisation responsible for collecting and maintaining data and systems used
The police are responsible for collecting and maintaining accident data. The accident data is not automatically transferred to Montenegro Roads and thus used for black spot identification etc.

Future plans for the development of systems
There is a need for better cooperation with the police.

Structure infrastructure data
Structure inventory data exists and was last updated in 1990. Information covers the main arterial and regional road network.

Type of data stored and updating
All information in the questionnaire is available, but not up-to-date. It was last updated in1990. The structure database is in paper form. Montenegro Roads carries out routine inspections on all structures on the national road network. There are no traffic counts on the structures.

Organisation responsible for collecting and maintaining data and systems used
The system is run by the Ministry of Transportation, and Montenegro Roads is responsible for data collection.

Future plans for the development of systems
There are plans to develop the system.

Conclusion on road and road structure infrastructure management systems
Road inventory and condition data covers the entire main and regional road network, but data has not been updated since1990. All the information mentioned in the questionnaire does not exist. For purposes of the BCEOM - COWI study for the Ministry of Transport, road condition data from the questionnaire has almost been collected (COWI did this with the local consultant – Montenegro Roads) in 2002. But the data is not yet available for the Ministry of Transport, as the project has not been finalised. The system is handled by the Ministry of Transport and collection of data is done by Montenegro Roads. The data collected is used only for maintenance and budget planning. An updated, computerised and unique database for road inventory and its condition does not exist.

Montenegro Roads is responsible for collecting and maintaining traffic data. They have a computerised database and prepare an annual report for the Ministry of Transport, who uses it for analysis, future planning and budgeting.

The road accident database is run by the police and there is no cooperation between Montenegro Roads and the police.

7.2.2 Rail and rail structure infrastructure management systems

Rail infrastructure data

Data collection is carried out on paper and covers the entire rail network, which has a length of approx. 250 km. The database is not computerised.

Type of data stored and updating

A reference system of the entire rail network exists, and is the one which existed in former FR Yugoslavia.

Data collection for rail inventory is carried out according to common regulations, and has all the information from the questionnaire. The data for the rail inventory database is continuously updated, last in 2002. There is no GIS level information system.

Rail condition data is collected from a specialised track recording car borrowed from Serbia and collected once a year. There is also information from stations to sections about any changes on rail network conditions. The visual inspections are on the operational level and are, together with expert estimation, used for assessment of maintenance and improvement needs. The data is collected continuously from the field. The information includes all types mentioned in the questionnaire.

Organisation responsible for collecting and maintaining data and systems used

Montenegro Railways is responsible for collecting and maintaining data. The work is organised like in Serbian Railways; stations, sections and sectors. Data from stations and sections is given to the relevant sector and then to the Management Sector, who uses it for planning purposes, for budgets, improvements and annual reports. The Department for Maintenance is responsible for collecting rail inventory and rail condition data. They send the information to the Traffic Department and the Management Department who use the data to assess needs locally and for global planning, to produce annual plans for budget and improvements. The database is in paper form.

Future plans for the development of systems

There are no computers, so adequate equipment, hardware and software, are needed. A new, computerised information system is necessary.

Rail traffic data

There is updated rail traffic data covering all information from the questionnaire.

Type of data stored and updating

The data on rail traffic is collected daily. People from the sections collect data manually and send it to the Traffic Sector daily, monthly and annually (depending on the type of data). The Traffic Sector prepares an annual report.

Organisation responsible for collecting and maintaining data and systems used
The data is collected at the operational level at the stations and sections. It is used for monitoring, but not as a management system. The system is run at the Traffic Sector and the output is used by the Management Sector and the Traffic Sector.

Future plans for the development of systems
There are plans for a new system.

Structure infrastructure data
Data exists and is updated, but is paper-based.

Type of data stored and updating
There is a list of structures, which is updated. All inspections are defined by regulations and there is a monthly and annual control, as well as once every two years for large rail structures and their condition. All information from the questionnaire is covered by these inspections. The database is in paper form and covers all structures on the national network. There is no information on traffic data or axel load data on the structures.

Organisation responsible for collecting and maintaining data and systems used
The Maintenance and Construction Sector is responsible for collecting the data and uses it themselves, and the Management Sector uses the information for global planning.

Future plans for the development of systems
There is a need for a new information system in the entire organisation, new software and new hardware.

Conclusion on rail and rail structure infrastructure management systems
Data collection for rail inventory, condition and structures is carried out in accordance with common regulations, and all information from the questionnaire is covered. There is not one unique database and information is in paper form. There are no management information or GIS level information systems. There is a need for a new information system in the entire organisation. The system is handled by Montenegro Railways.

7.2.3 Port infrastructure management systems

The Port of Bar is a modern, international business port with rich traditions and high potential. There is a new method of organising work which was implemented to the international standard ISO 9001.

Port infrastructure data
The port infrastructure data mentioned in the questionnaire exists. The information system is computerised and updated daily.

The Port of Bar gained the certificate for system of quality (ISO 9001 – for port transportation services) from the Swiss organisation SGS in 2000.

The port of Bar was the first port in this part of the Mediterranean to obtain the internationally acknowledged certificate for its business activities in accordance with international standards.

Type of data stored and updating
The items mentioned in the questionnaire for breakwaters, piers, etc. and also on size of ships and their capacity are covered. There is a navigation system in the port, which is handled by the Government Agency for Maintenance and Developing of Inland Waterways (Plovput), a government organisation based in Belgrade. The navigation system is financed by the Port of Bar and the Government Agency for Maintenance and Developing of Inland Waterways (Plovput) maintains the navigation system.

The condition data is updated and collected continuously. There are usually daily, 15-days and monthly visual inspections. Every 6 months, inspections are carried out on roof structures. The condition and inventory data covers the entire port.

The information system is computerised. The first computerised system was established in 1992. They had IBM terminals, but it was not a full information system, and it was mostly used by the Financial and Commercial Sector for economic purposes. A completely new information system was introduced in 1999, using the Oracle database, based on Windows 2000. There is also new COMPAQ equipment. A contract was made with the DIGIT enterprise, which developed the software named LUBARIS which is now in use.

For administrative purposes, the port developed their own software ADMIS, which is separate from LUBARIS.

Organisation responsible for collecting and maintaining data and systems used
The Port of Bar consists of 10 sectors. The Development Sector handles all the infrastructure and condition data. On the operational level, each department collects data from the field. They are connected and organised as one system. Output from the database is used by the Development Sector, the Planning Sector, the Maintenance Sector, The General Manager, etc.

Future plans for the development of systems
There are plans to extend the system. More computers are needed, and there are plans to introduce GIS within the next six months.

Port traffic data
The port collects all the traffic data mentioned in the questionnaire. The data is collected continuously, every day. It is also part of the information system.

Type of data stored and updating
All traffic data is collected continuously as part of the new information system. Unit cost data exists and is computerised.

Organisation responsible for collecting and maintaining data and systems used
The Financial and Commercial Sector handles the system for traffic data and unit costs. Information on traffic is collected in the field by the relevant sector.

Future plans for the development of systems
There are plans for further development of the information system.

Conclusion on port infrastructure management system
The condition and inventory data covers the entire port. There is a computerised information system. The first computerised system was established in 1992. A completely new information system was introduced in 1999, using the Oracle database. There is also new COMPAQ equipment. A contract has been made with DIGIT, the company which developed the software named LUBARIS which is in use now. For administrative purposes, the port has developed their own software, ADMIS, which is separate from the LUBARIS software. The whole system is handled by the Port of Bar. There are plans for extending the system. More computers are needed and there are to introduce GIS within the next six months.

7.2.4 Airport infrastructure management systems

Airport infrastructure data
The Airports of Montenegro is an organisation that has just started to work. Airports in Montenegro were covered by JAT and the army. But on 23 April 2003 Montenegro took over the possession of Tivat and Podgorica Airports. This meant that the two airports still did not receive any information from the JAT, and a new system has just been established.

Type of data stored and updating
Two airports will be handled by the Airports of Montenegro – Podgorica and Tivat Airport.

Podgorica Airport was a military airport and all data exists, but some of it is confidential. Tivat Airport was handled by the JAT and they also have all the information from the questionnaire. However, as mentioned, they still did not have the information system. They know that all the data from the questionnaire exists, but they still do not have it.

All information on inventory and the condition of Podgorica Airport was collected by the army, who still have the data. Data was collected by the JAT for Tivat Airport and they also have all the data.

There is information on the classification of airports, runways, taxi lanes, cross sections, etc. as well as lighting. There are no structures (bridges) in the airports.

The navigation system for both airports is handled by the Federal Air Control, and the lighting system is checked by each airport's Technical Department according to special procedures.

Organisation responsible for collecting and maintaining data and systems used
The JAT was responsible for information on Tivat Airport and the army for Podgorica Airport. Now, the new owner of the airports is the Airports of Montenegro, who will be responsible for collecting and maintaining the data in the future.

Future plans for the development of systems
A new system will be established.

Airport traffic data

Type of data stored and updating
The JAT has continuously collected passenger information from each flight, which allows them to prepare statistics as mentioned in the questionnaire. Information on take-offs and landings was collected daily, monthly and annually by the JAT. Almost all information on air traffic from the questionnaire exists. The Airports of Montenegro will collect airport traffic data and are in the process of developing their own new system.

Organisation responsible for collecting and maintaining data and systems used
The Traffic Department of the JAT was responsible for collecting and maintaining the data. The only official data that exists is the data which the JAT prepared. Now and in the future, the Airports of Montenegro will be responsible for airport traffic data.

Future plans for the development of systems
The process of establishing a new system has just started.

Conclusion on airport infrastructure management systems
The Airports of Montenegro is an organisation that has just started to work. Airports in Montenegro were covered by the JAT and the army. On 23 April 2003, Montenegro took over possession of Tivat and Podgorica Airports. A new system is being established.

7.3 Kosovo/UNMIK[6]

In Kosovo, information on the status of management information systems has been collected for:

- the road sector including its structures
- the rail sector including its structures
- Pristina airport

The information has been collected through submission of questionnaires to the Ministry of Transport and Communications of Kosovo which was answered by key persons in the Department of Railways, Civil Aviation and Maritime Transport and in the Directorate of Roads.

7.3.1 Road and road structure infrastructure management systems

The road network in Kosovo which resides under the responsibility of Ministry of Transport and Communications is divided into main and regional roads.

The data collection, storage and handling and plans for future systems are described in the following sections with regard to road infrastructure, traffic and structures.

Road infrastructure data
The collection of information on management information systems in connection with road infrastructure data covers whether:

- the national road network is referenced
- an inventory has been carried out and is updated
- information on the condition of the road network is carried out regularly and is updated
- all this information is stored and used systematically

Information is also collected on unit costs and on who collects stores and uses the data.

Type of data stored and updating
A reference system for the national road network exists and the road inventory and condition data covers all roads.

All relevant parameters for the inventory are collected continuously, e.g.:

- length
- alignment
- longitudinal profile
- cross section
- pavement

[6] Under international administration in line with UNSCR 1244 of 10 June 1999.

- structures (major culverts, bridges and tunnels)
- furniture and land use

and for the condition database, e.g:

- edge damage left and right side (side drains, shoulders, edge step, edge damage)
- carriageway and furniture

There are continuous inspections of road conditions covering all components in the road inventory. A MapInfo programme and a PMS are used and all the information from the questionnaire is generally included in the database.

Unit costs (e.g. km of road constructed and maintained, etc.) are continuously updated but there are no unit prices for benefits.

Organisation responsible for collecting and maintaining data and systems used
The IDR Team and the Directorate of Roads under Ministry of Transport and Communications in Kosovo are the organisations that handle the entire system, including the responsibility for collecting and maintaining the data.

A MapInfo based program exists which partially functions well and is continuously developed. There is lack of a server and the system needs upgrading to connect the regions with headquarter.

Future plans for the development of systems
There are plans to upgrade the system to connect the regions with headquarters.

Road traffic data
Kosovo has a traffic count programme for the national road network and road traffic data is continuously updated. The counting programme is however, only partially followed due to lack of equipment. There are both automatic and manual counts.

Type of data stored and updating
There are classified counts for motorised traffic covering e.g. cars, trucks busses etc. The traffic data has since 2001 been continuously updated on an annual basis. Non-motorised traffic is not part of the traffic counts.

Parameters such as AADT and AADT by direction and lane seasonal, etc are provided as output.

There is information about axel loads on the national road network and these data are updated. There are surveys through weighing and counting of trucks, vans and busses. The national roads are generally covered.

Organisation responsible for collecting and maintaining data and systems used
The Traffic Unit at the Directorate of Roads and the Ministry of Transport and Communications manage and administer the system of traffic data.

The Ministry of Transport and Communications and the Traffic Unit at the Directorate of Roads collect all the data on axle load surveys from the police.

Future plans for the development of systems
No plans were mentioned on development of the system but there is a lack of equipment to run the full traffic counting program thus there is some lack of data to include in the programme to handle traffic data.

Road safety data
The traffic police have since 2001 collected road accident data on almost all the main and regional roads and forwarded these to the Ministry of Transport and Communications.

Type of data stored and updating
The road accidents are identified by road and location. The police collect the road accident data on a monthly basis and the collected data has different parameters, such as the number of accidents, number of fatal and injured, cause of accident, etc.

The information collected by the police is used for further assessment, e.g. for black spot identification.

Organisation responsible for collecting and maintaining data and systems used
The road accident data are collected by the traffic police and forwarded to the Ministry of Transport and Communications. The data covers almost all the main and regional roads.

Future plans for development of the systems
No plans were mentioned on development of the system.

Structure infrastructure data
Information on structure infrastructure exists, and covers most parameters from the questionnaire.

Type of data stored and updating
All typical data from the questionnaire related to structure inventory and condition exists apart from information on the gabions.

The inventory data are updated twice a year while the condition data are updated annually. The unit costs for structures are updated and provide information on m^3 of materials and hourly rates.

Organisation responsible for collecting and maintaining data and systems used
The IDR team established under Technical Assistance of DIWI-consultants financed by GTZ are responsible for data collection and updating the system. The Directorate of Roads and Ministry of Transport and Communication use the output from the structure data bank.

There is a service at the Directorate of Roads providing unit costs to the IDR.

A data bank is in the process of being established but there is no specific bridge management system (BMS).

Future plans for the development of systems
The management information system for structures is in the process of being developed in Kosovo and seems to be functioning.

Conclusion on road and road structure infrastructure management systems
The reference system and inventory is updated in Kosovo. The inventory and the condition data as well as unit costs are continuously updated. Most data are computerised and there is a PMS in Kosovo. The computer system may require upgrading and connections to the regions.

The traffic data is continuously updated for motorised traffic and the traffic police has collected accident data and forwarded these to the Ministry of Transport since 2001. Accident and traffic data may not be fully computerised. The existing traffic counting programme is only partially carried out because of the lack of equipment.

A structure inventory and condition data generally exists and are generally updated continuously but there is no BMS system in Kosovo.

7.3.2 Rail and rail structure infrastructure management systems

The railways in Kosovo fall under the Directory of Kosovo Railways, which is under the UNMIK Board of Railways. There are approximately 450 km of rail lines in Kosovo.

Rail infrastructure data
The collection of information on management information systems for rail infrastructure data covers whether:

- the national rail network is referenced
- an inventory of the rail network has been carried out and is updated
- information on the condition of the rail network is carried out regularly and is updated
- all this information is stored and used systematically

Information is also collected on unit costs and on who collects, stores and uses the data.

Type of data stored and updating
The inventory of the rail network is collected paper-based and then entered in to computers. The inventory was last updated at the end of 2002 and the inventory is updated every year and covers the entire rail network.

The condition of the rail network is continuously updated. The evaluation of data collected at inspections to assess maintenance is done by ordinary way as Kosovo Railways has not got their own equipment for manual record. Kosovo Railways started to use computer at the end of 2001 and the condition data received in hard copies, telephones and radio links are entered in the computer.

The collected inventory is used by the UNMIK, Ministry of Transport and Communication and the railways themselves, and condition data is used by the UNMIK Board of Railways and UNMIK.

There is no register on fault or failure statistics but inspection remarks on irregularities on execution of traffic rules are registered.

There are unit costs for goods/ton-km and for maintenance and construction costs as well as material costs. There are no tariffs for passengers by train as the train is used for minorities and is financed by UNMIK.

Organisation responsible for collecting and maintaining data and systems used
The inventory on rail infrastructure is collected by the maintenance unit of Kosovo railways and the system is managed and administered by the managing staff UNMIK. The information is used by the managing staff of Kosovo Railways, UNMIK and Ministry of Transport and Communication.

There is no special department for collection of condition on the railways. The managing staff of UNMIK in cooperation with their collaborators collect data on railway conditions.

The UNMIK managing staff is running and collecting information on unit costs.

The inventory and information on rail condition and unit costs are first registered on paper and later on computer in word and excel as there is no specific program to register the information in. The system is considered to work at a relatively good level although the procedures on collection of data are a little old fashioned. There is not a specific rail maintenance system.

Future plans for the development of systems
There are plans to extend the existing system and to introduce up-to-date programs both for inventories and condition data.

Rail traffic data
There is generally updated rail traffic data covering the entire rail network in Kosovo.

Type of data stored and updating
There is information on traffic (e.g. frequency, journey times, traffic flow, and train speed) from time tables of activities of trains and graphics of train activities. The information covers number of passengers (but not passenger-km), overall tonnage, ton-km, peak hours for trains, total amount of train per direction on different lines and type of traffic.

The information is collected periodically and annually and covers the entire rail network in Kosovo.

Organisation responsible for collecting and maintaining data and systems used
The collection and organising of traffic data is carried out by UNMIK managing staff.

The system is paper-based as there is no specific programme in the branch. The system functions and the procedures work but they would like to introduce programs dedicated for the purpose.

Future plans for the development of systems
There are plans to extend the system to introduce dedicated programs for railways need. These plans are still waiting to be executed.

Conclusion on rail and rail structure infrastructure management systems
Rail inventory was last updated in 2002 and is updated regularly. The condition data is also updated continuously and unit cost data exist. There is no specific program to register inventory and condition data. The information is collected on paper and later inserted in computers in excel and word.

Traffic data are collected and updated but only collected in paper.

7.3.3 Airport infrastructure management systems

Pristina Airport is ICAO classified as 4E and it has one runway. A detailed master plan was prepared in 2000 where most of the inventory data are from.

There is information on all items in the questionnaire and the entire airport is covered in the inventory and there is condition data for the entire airport, but not in one system.

Airport infrastructure data
The collection of information on management information systems for the airport infrastructure data covers whether:

- an inventory of the airport has been carried out and is updated

- information on the condition of the airport is carried out regularly and is updated
- all this information is stored and used systematically

Information is also collected on unit costs and on who collects, stores and uses the data.

Type of data stored and updating
The inventory includes information on the classification of airports, runways, taxi lanes, cross sections, etc. as well as lighting, navigation and structures (bridges, culverts etc.). The inventory was last updated at the beginning of 2003 as part of an audit. The airport inventory information system is paper-based and is run by the airport administration. The airport would like to have new software to handle the inventory.

The condition data on the airport covers the entire airport including lighting systems, navigation system, landing strips, taxi lanes buildings etc. as mentioned in the questionnaire. The conditions survey is updated and carried out daily. The system is generally functioning but it is paper-based. The condition survey is carried out by the Technical Department and the Infrastructure Department of ATCS.

No information on unit costs is collected.

Organisation responsible for collecting and maintaining data and systems used
The inventory is under the responsibility of the Administration and the Technical Department and the Infrastructure Department of ATCS is responsible for running and collecting condition data.

The information is updated, but both the inventory and the condition data are paper-based.

Future plans for the development of systems
No specific plans to develop the system were mentioned but a need was mentioned for new software.

Airport traffic data

Type of data stored and updating
There is adequate and updated information on airport traffic. This includes information on number of passengers, tonnage of freight, cargo dwell time, average movements, peak hour movements, passenger movements, etc. The information is updated daily.

There is no automatic system to register dwell time for cargo, but a system is being developed.

Organisation responsible for collecting and maintaining data and systems used
The airport traffic data is computerised in the KFOR's military software and is functioning well.

Future plans for the development of systems
No specific plans to develop the system were mentioned.

Conclusion on airport infrastructure management systems
In Kosovo updated inventory of the entire airport exist on paper as part of the Airport Master Plan. Also condition data exist and is updated daily and is paper-based. There are no unit costs.

Traffic data is continuously updated and computerised.

There is no airport management information system and data are mixed computerised and paper-based in separate systems.