OVERVIEW OF ITS DEVELOPMENT IN MALAYSIA

IR. MD. AMIR BIN KASIM
Director
Highway Planning Unit
Ministry of Works Malaysia

1. INTRODUCTION

Increased urbanisation and the rising of economic activities are placing increasing demands on transportation systems leading to significant traffic congestion problems on the roads and highways in this country. Since the continual expansion of the existing transportation infrastructure is socially unacceptable and unsustainable, transportation authorities in Malaysia are looking for Intelligent Transport Systems or ITS to better manage, operate and optimise the operational effectiveness of existing transportation infrastructure.

ITS is the use of advanced technology like electronics, communications, control and information technology for the benefit of more efficient transport systems. Studies have shown that invaluable benefits and advantages could be accrued through the deployment of ITS applications. Among these benefits are:

i. optimise the efficiency of use of highways, hence increasing road capacity;
ii. improve road safety
iii. minimise travel cost and time;
iv. enhance the quality of environment through reduction in carbon dioxide emissions.

Studies in United States and Japan shows that the benefits of the deployment of ITS are as follows:

i. Reduction in air pollution up to 30%;
ii. Reduction in delay up to 20%; and
iii. Reduction in accidents up to 40%

The development of ITS is fairly advanced in developing countries like the United States, Japan and Europe; each with its own development masterplan and coordinating bodies. ITS, like any other technology, has to be properly manage for it to have any use. These coordinating bodies like ITS America, VERTIS and ERTICO get together in forums to map out technology roadmaps so that the scarce resources dedicated to the development of ITS is not wasted.

ITS applications are not new to Malaysia. They were introduced since the mid nineties through a number of projects such as computer controlled traffic signals in the capital city of Kuala Lumpur. Electronic Toll Collection systems are in operations for

privatised roads and the Touch and Go smart card is being used for both toll collection and on public transport. Several expressways around Klang Valley have computerised monitoring and control systems with Variable Message Signs (VMS) and traffic detectors.

However, these systems were installed in an ad hoc manner with little co-ordination among various operators and the usage has been limited to their individual requirements. This has however, led to problems in the areas of inter-operability and compatibility.

Realising the benefit of ITS on alleviating traffic congestion in urban areas, the Government has embarked on a pilot project to ease the traffic congestion in the densely populated Klang Valley. The "Integrated Transport Information System" or ITIS costing some RM 370 million is now at the stage of operation. The system is capable of detecting incidents and traffic congestion; analysing the traffic and calculating travel times. It will finally disseminate or update the information on the VMS (variable message signs) boards, which are strategically installed within the City of Kuala Lumpur and other communication media. The road users will be provided with real-time information on traffic conditions around the city. This would allow the road users to plan their journey and consequently reduce travel cost. In addition, this Advanced Traffic Management System or ATMS will provide an effective means of addressing the urban congestion through both pro-active and reactive strategies thereby ensuring smooth traffic movement.

2. ITS STRATEGIC PLAN FOR MALAYSIA

Realising this, in 1999, the Road Engineering Association of Malaysia or REAM took a pro-active step by formulating an "ITS Strategic Plan" for Malaysia. The formulation of this ITS Strategic Plan was intended to provide a framework for planning and implementation of future ITS systems in Malaysia. It identified the technologies and systems that can provide benefits to the country. The objectives of this strategic plan are:

i. to provide direction for a systematic approach to ITS implementation, including appropriate roles for public and private sectors;
ii. to propose ITS application sectors most relevant to Malaysia;
iii. to provide direction for ITS research and development;
iv. to provide a framework for system integration; and
v. to provide a means for stimulating economic development.

This ITS Strategic Plan recommended four ITS programme initiatives that can be implemented by both the public and private sectors either in collaboration or separately. These are:

2.1 . Demonstration projects of selected ITS user-services

A list of ITS user services that are relevant in the Malaysian context is given in Table 6.1. This has been formulated taking into account proven ITS benefits outside Malaysia, the traffic and transport problems currently facing the country and the applicability of the various ITS systems to improve the situation. A series of carefully structured demonstration projects will serve the following purposes:

- To raise the awareness of government, the public and industry of ITS and the opportunities and benefits that it presents;
- To test and demonstrate various technologies and systems in the Malaysian environment;
- To prepare guidelines for implementation of ITS systems in the future;
- To define a medium and long-term strategy for ITS development, including both implementation in Malaysia and the role that can be played by Malaysian companies for both local systems and in the export market.

ITS Sector	ITS User Services
Advanced Traffic Management System	Urban Traffic Control
	Traffic Surveillance and Monitoring
	Incident Detection
	Parking Guidance Information
Safety Systems	Improved Accident Data Collection
	Intelligent Enforcement
Advanced Public Transport Systems	Public Transport Passenger Information
	Public Transport Operation Management
	Integrated Ticketing
Advanced Driver Information System	Pre-Trip Travel Information
	En-Route Driver Information
	Route Guidance
Electronic payment systems	Electronic Toll Collection
	Electronic car park payment and access control
Commercial vehicle operation systems	Commercial fleet management
	Commercial freight administration
	Commercial vehicle electronic clearance
	Automated roadside safety inspection
Advanced vehicle control and safety system	Longitudinal collision avoidance
	Intersection collision avoidance
	Pre-crash restraint development

Table 2.1: ITS sectors and ITS user services

2.2. Research and development programme

The government's policy of encouraging Research and Development by allocating funding of up to 1% of the gross national product should greatly assist the development of ITS. It is recommended that a portion of that funding be dedicated to ITS to include research to quantify actual benefits of various ITS applications in the Malaysian context and also focus on local development of the core technology.

2.3. Professional development and training

For effective planning and deployment of ITS applications, professionals with proven ITS knowledge and skills are necessary. ITS falls between civil, electrical and computer engineering and hence engineers and transport planners in Malaysia are not well aware of it. There is thus an urgent need to provide professional training and development. Professional institutions like the Institute of Engineers Malaysia, Road Engineering Association Malaysia, The Chartered Institute of Transport Malaysia and The Institution of Transportation and Highways (Malaysia Branch) can work with Universities to provide training courses to familiarise practicing engineers with ITS. Involvement of local engineers and Universities in the planning and implementation of demonstration projects will also be very beneficial. These projects can then become a base for training further engineers in the future. In the longer term, it will be necessary to develop current civil and transport courses to include some elements relating to system engineering and ITS related subjects.

2.4. Outreach programs

As the success of ITS deployment hinges on the perception and acceptance of the community, it is important that public at large, government officials and other relevant parties should be educated. on ITS and what it can offer. Seminars, workshops, forums, newsletters and articles in the mass media are excellent ways to promote the understanding and awareness of ITS. Professional institutions should play a more active and aggressive role in this aspect. In addition, there should be programmes where mutual exchange of information and experience among local and foreign professionals can be carried out. Further collaboration with other ITS organisations world wide should be actively pursued. Funding for secondment of selected professionals to gain experience abroad would also be valuable.

In year 2000, the Government of Malaysia endorsed and adopted this ITS Strategic Plan to serve as a guide towards the development and deployment of ITS applications in Malaysia.

In order to coordinate and monitor the implementation of the ITS in Malaysia, the Government of Malaysia has set up the ITS Council. The Council headed by Minister of Works comprises of high-ranking officials from both public and corporate sectors. The functions of this Council, among others are as follows:

i. to deliberate on ITS deployment policies;
ii. set the direction for ITS research and development; and
iii. formulate implementation strategies.

The Government of Malaysia has also approved a launching grant of RM 8 million to initiate studies leading to the formulation of implementation policies and strategies. Five core areas had been identified as follows:

i. ITS System Architecture for Malaysia;
ii. Traffic Control System for Urban Centres in Malaysia;
iii. Electronic Toll Collection and Management Using ITS;
iv. Expressway Operation and Management Using ITS; and
v. Road Safety for Motorcyclist Using ITS.

3. ITS MASTER PLAN STUDY

ITS applications are an integration of a broad range of advanced technologies and environment. Realising the importance of this integration, Malaysia has embarked on the ITS Master Plan Study in 2003 to develop a comprehensive "roadmap" toward setting the direction and framework for the deployment of ITS applications in Malaysia over the next 10 years. The ITS Master Plan Study highlighted the status of ITS deployment in Malaysia and its current weaknesses related to deployment, such as:

i. institutional weaknesses;
ii. absence of a set of established international ITS standards to be adopted;
iii. urgent needs to develop an ITS System Architecture for Malaysia.

Scope of this study involved five tasks as shown in Table 3.1.

Task	Task Description
1.	**Building up the inventory** - Establish list of stakeholders - Establish existing ITS system
2.	**Requirements Analysis** - Needs Assessment - Develop a Vision for the ITS Master Plan - Identify User Services - Establish Performance Criteria
3.	**Operational Analysis** - Develop Conceptual Operations Plan - Conduct Institutional Analysis - Identify Opportunities

4	**System Architecture** - Identify ITS System Architecture Directions - Identify Enabling Technologies
5.	**Define ITS Deployment Programme** - Identify strategic projects - Develop deployment plan - Develop action plan for on-going evaluation

Table 3.1: Tasks of the ITS Master Plan Study.

The ITS Master Plan Study has proposed some recommendations in order to enhance the deployment of ITS in this country. These recommendations will serve as a comprehensive plan for ITS deployment in this country. The recommendations are as follows:

3.1. Development of ITS System Architecture;

The establishment of the ITS System Architecture will benefit the country when the communication and information backbone derived is capable of enabling ITS programs of all jurisdictions to work together and share information. Systems will be then be more effective when information are shared and are interoperable.

3.2. Adoption of 5.8GHz DSRC

As there is a global acceptance on the use of microwave as dedicated short range communication (DSRC) media with the 5.8GHz (gigahertz) microwave emerging now as the de-facto world standard, the Study has recommended for its adoption for use in Malaysia. The Government has already reserved the recommended waveband for use as the communication media between all roadside subsystems and vehicle subsystems.

3.3. Establishment of Malaysian ITS Bureau

The bureau will act as a central executive agency and the proposed functions of the bureau shall be as follows:

i. coordinate all ITS activities in the country;
ii. act as a national forum for resolving differences in standards and approaches;
iii. develop and implement the National ITS Policy;
iv. set standards for inter-operability and national architecture; and
v. coordinate research and development activities.

3.4. Establishment of National ITS Association

Numerous organisations, both public and private will need to work together to ensure the success of ITS deployment in the country. Towards these ends, developed countries with a matured ITS-based industry have found the

need to have a national ITS association. The National ITS Association, as a non-government organisation will act a bridge to the international ITS fraternity to exchange information of mutual interest, and play a vital role in the area of standards formulation.

The Government has taken a lead in establishing this National ITS Association. The Pro tem Committee comprising those from public and private sector has been established and the application to register this association as ITS Malaysia has been submitted to the Registrar of Societies (ROS) Malaysia and still waiting for approval.

3.5. Designation of National ITS Corridors

The significance of the National ITS Corridor is to have appropriate and cost-effective ITS technologies installed on them and be use to integrate ITS infrastructure. The study proposed this corridor to be implemented in two stages:

Stage 1: Klang Valley, North-South Expressway, Federal Route 1 and municipalities of Penang, Ipoh and Johor Bahru.

Stage 2: Federal Route 2 and 3, inclusive of East Coast Expressway, from Johor Bahru to Kota Bharu and municipalities of Kuching and Kota Kinabalu

3.6. ITS Deployment Plan

For the effective deployment in this country, the study proposes a three-prone deployment programme, which consist of a list of proposed ITS projects, a list of ITS strategic projects and identification of priority areas for enhancing ITS deployment

3.6.1. List of Proposed ITS Projects

The list of proposed ITS project shall form the backbone structure in the development of ITS implementation programme. This programme shall serve as the reference for future overall planning and development of ITS deployment in Malaysia. These ITS projects are under each of nine ITS sectors which are as follows:

i. Advanced Traffic Management Systems;
ii. Safety Systems;
iii. Advanced Public Transport Systems;
iv. Advanced Traveller Information System;
v. Electronic Payment Systems;
vi. Commercial Vehicle Operation Systems;
vii. Advanced Vehicle Control Systems;
viii. Emergency Management Systems; and
ix. Information Warehousing Systems.

3.6.2. List of Strategic Projects

These strategic projects be initiated to cut as a test beds or demonstration projects for future ITS deployment. These projects are essentially real projects on demonstrated. The following ten projects have been identified to serve as strategic projects for deployment in Malaysia.

3.6.2.1. Integrated Transport Information System (ITIS);

ITIS Klang Valley is only being design for implementation along the road within the jurisdiction of DBKL and along the Federal Highway Route II. It needs to be extended to cover the rest of the Klang Valley under the municipalities of Shah Alam, Petaling Jaya, Subang Jaya, Selayang, Kajang and Klang to be effective. The system should be inter-connectable and inter-operable with that of Putrajaya and Cyberjaya. Then it should be extended to other municipalities that warrant the implementation of ITIS such as Penang, Johor Bahru and Ipoh.

3.6.2.2. Electronic Payment Services Interoperability;

Currently, electronic payment services have been confined to electronic toll collection and some forms of common ticketing systems, and parking collection systems.

All smarts cards used for electronic toll collection should be interoperable using the agreed communications media. All existing card readers would have to be adapted to comply to the requirements. This service could then be extended to include electronic fare collection and electronic payments. Ultimately there shall be an integrated electronic payment service supporting all modes of services.

3.6.2.3. Intelligent Enforcement;

Routine enforcement along the roadway could be carried out by intelligent ITS devices installed on gantries, high masts and bridges at strategic locations. Any traffic violations could be captured, summoned and bought to the judiciary. An information warehouse and the relevant infrastructure would be provided by one selected agency. Physical enforcement, which involves individual enforcement agencies or through joint operations could then be conducted continuously electronically.

3.6.2.4. Commercial Vehicle Information System Networks;

Due to the overlapping of responsibilities between the different

agencies, there is a need to develop commercial vehicle information system networks. This system would provide transport records on the stage of affairs amongst these vehicles and their drivers. This is useful for engagement of services in this specific sector.

3.6.2.5. Information Warehouse on Land Transportation;

There is non availability of a common central database on land transportation from which the judiciary, enforcers, administrators and interested private entities could have its accessibility. The information warehouse would be an ideal centre to collect and manage these vital data, which could be disseminated to authorized bodies for efficient and effective enforcement of traffic violators and other administrative purposes.

3.6.2.6. Safety Enhancement to Vehicles;

It shall involve with the installation of the necessary sensors along the roadway to communicate with the safety features installed in vehicles. Drivers will be provided with warning on potential collisions and blind spot. These vehicle could be improved to cater for temporary partial control in collision avoidance siituation and lane holding warning. The necessary ITS infrastructure has to be made available before vehicles could be incorporated with devices for navigation guidance and safety enhancement.

3.6.2.7. Common Ticketing for Public Transport Services;

Common ticketing is the first step towards an integrated ticketing system. 'Touch-N-Go' prepaid cards are only used in certain public transport and need to expand to cover all modes of public transport. Only when it reaches a stage that common ticketing is well accepted and widely used that integrated ticketing could be considered.

3.6.2.8. '511' Phone and Web Service;

This is the tourist information roadmap and guidance systems, whereby tourist, or would-be-tourists could browse through them before deciding where, when and how to go, where to eat, where to stay, etc. By dialing '511' on the phone, wireless providers will give instant access to wide array of transportation information. A state-of-art-speech recognition system allows navigation through the 511 system without pressing a button. This service would be ideal for the state of Penang.

3.6.2.9. Advanced Public Transport Management System;

This system can initially proceed with the development of a centralised schedule monitoring and management system for all modes of transport, with current information on the routes and schedules made available to travellers in the internet, transport terminals, stops, stands and information kiosk. It could have minimal and limited interaction.

The system could then be upgraded to provide integrated multi-modal information with decision support, through off-line analysis/planning and personnel management support. These integrated data for all modes of transport would be made available in one repository.

Finally, the system could be integrated with the traffic control system to enhance real-time schedule adherence capability, and integrated with electronic payment service to make bookings and ticket purchase. Route, time and mode recommendations could than be made to the travelers.

3.6.2.10. Real Time Adaptive Traffic Control System for Selected Municipalities.

This will involve the development of a centralised real-time adaptive traffic control system for selected municipalities for urban traffic control, inclusive of ramp metering, and incident detection and management.

3.6.3. Priority Areas for Enhancement of ITS Deployment

Four programme initiations to be carried out to ensure the sustainability of the national ITS system architecture and the successful deployment of ITS. The four priority areas are:

3.6.3.1. Research and development;

This research is meant to quantify the actual benefits of various ITS applications in the Malaysian context. The following projects are recommended:

i. Development of an Integrated Advanced Traffic Management System (ATMS) and Advanced Traveller Information System (ATIS);
ii. Development of an Advanced Vehicle Control and Safety System (AVLSS);
iii. Feasibility of ITS Technologies at Border Crossing; and

iv. Development of transportation telematics and telemedicine architecture to reduce highway deaths.

It is also recommended that the local R&D of the following core technology fields by the ICT-based industry players be carried out:

i. Data Acquisition Technology;
ii. Data Processing Technology;
iii. Data Communications Technology;
iv. Data Distribution Technology; and
v. Data Control Technology.

3.6.3.2. ITS Outreach Programme;

ITS outreach programme could be spearheaded by the national ITS association to educate the public and stakeholders on ITS. Understanding and awareness of ITS can be promoted through:

i. Mass media;
ii. Forum, seminar, etc.; and
iii. Mutual exchange of technical information.

3.6.3.3. Professional Development and Training;

For effective planning and deployment of ITS applications; it is proven that professionals with ITS knowledge is necessary. The national ITS association could take a leading role together with other professional institutions.The recommended programme are as follows:

i. Industrial training for undergraduates;
ii. Post-graduate programme;
iii. Continuing Professional education; and
iv. Training of ITS for operation and management staff.

3.6.3.4. Market Support and Opportunities.

The market for ITS technologies is already large and it is expected to grow significantly. Given the present maturity of the Malaysian ICT-based industry, there is enormous potential for the development of Malaysian ITS-based industry and to export local ITS products and services, especially to the ASEAN countries.

4. ITS SYSTEM ARCHITECTURE FOR MALAYSIA

Among the recommendations made in the ITS Master Plan Study is the immediate development of ITS system architecture for Malaysia, which shall consolidate into a 'blue-print' for the future ITS deployment to ensure system inter-operability, guided by set of critical ITS standards.

The ITS system architecture will provide related government agencies with the directions in which ITS applications could be deployed uniformly by all the stakeholders independent of technologies. All ITS deployments nationwide could then be integrated with their applications expandable, and their devices and equipment interoperable and interchangeable. The ICT-industry players require the ITS system architecture to be made available to enable the ITS-industry to be launched immediately to produce standardised devices and equipment initially for the country, and later for the ASEAN markets.

The Government has taken a serious effort to implement this recommendation. As a result, a study entitled "The Development of ITS System Architecture for Malaysia Study" has embarked in Jun 2006 as an addendum to the ITS Master Plan Study. This study is expected to be completed in the middle of next year.

4.1. Objectives of the Study

An ITS architecture provides a unified framework for integration to guide the coordinated deployment of ITS programs within the public and the private sectors. It offers a starting point from which stakeholders can work together to achieve compatibility among ITS elements to ensure unified ITS deployment for a given region. The architecture describes interaction among physical components of the transportation systems including travellers, vehicles, roadside devices and control centres. It also describes the information and communication system requirements, how data should be shared and used, and the standards required to facilitate information sharing. Overall, the architecture defines the functionality of ITS components and the information flows among ITS elements to achieve total system goals.

The objectives of the study are:

i. To define, design and develop an ITS architecture and supporting standards to promote, unify and ensure inter-operability in the deployment of ITS across modes throughout Malaysia and within the ASEAN countries;

ii. To recognize that the architecture is of critical importance and its design should

ensure that:

- ITS products and services are seamlessly integrated and inter-operable in providing services to the travelling public and the transportation industry;
- it provides the communication and information backbone that supports and unites the key ITS technologies enabling them to work together and communicate with each other; and
- it identifies the unifying standards needed to support inter-operability across technologies, modes and jurisdictions;

iii. To recognize that standards are an important part of this process that will stimulate and guide industry's product development decisions and user's procurement plans. Furthermore, any ITS projects carried out using government funds will, in the future, be required to conform to the national architecture and applicable standards.

In developing the ITS system architecture for Malaysia, the following broader objectives for the development and deployment of ITS must be taken into consideration:

i. Improve the safety of Malaysia's land transportation system;

ii. Increase the operational efficiency and capacity of the land transportation system;

iii. Reduce energy and environmental costs associated with traffic congestion;

iv. Enhance present and future productivity;

v. Enhance personal mobility, convenience and comfort of the land transportation system;

vi. Ensure compatibility and inter-operability of ITS systems across all modes of transportation within Malaysia as well as among ASEAN countries and at the international level;

vii. Create opportunities for Malaysian ITS companies in the world market place; and

viii. In general, create an environment in which the development and deployment of ITS can flourish in Malaysia.

4.2. Scope of the Study.

The major scope of the study in developing the ITS system architecture are listed below:

4.2.1. Formulation of Design Framework

The design framework for the ITS system architecture for Malaysia should first focus on satisfying the needs of Malaysia ITS based on findings from the ITS Master Plan Study. This is then followed by a search of standard technologies that will support these functions. However, international success stories and local considerations form excellent guidelines for the formulation of the design framework.

4.2.2. Development of Logical Architecture Framework

The logical architecture defines what has to be done to support the ITS services. This is the analysis part of the so-called 'Structured Analysis and Design' techniques used in software development. The framework from the ITS System Architecture establishes the different process specifications, data flows, data stores and terminators that define the architecture boundaries.

4.2.3. Development of Physical Architecture Framework

This involves the identification of the physical representation of the important ITS interfaces and major system components. This task takes the processes identified in the logical architecture and assigns them to subsystems. The data flows are grouped together into architectural flows that connect the subsystems and terminators into overall structure.

4.2.4. Development of Deployment Packages Framework

Deployment packages are usually presented by pieces of the physical architecture that are deployable. Therefore, the objective of this task is to develop the various deployment packages based on the physical architecture derived.

4.2.5. Establishment of Critical ITS Standards

In order to achieve compatibility and inter-operability between regions and internationally, it is essential to adopt protocol standards for the delivery of functions and information as identified in the logical and physical architecture. Deployment of inter-operable systems is not possible without the adoption of open ITS standards.

4.2.6. Formulation of Maintenance Strategy for the ITS Architecture of Malaysia

In order for the ITS system architecture for Malaysia to be as beneficial and accessible as possible, one must remain vigilant on its maintenance. The main

objective of this task is to formulate on going effort to ensure the established ITS System Architecture is kept current as compared to ITS system architectures in other countries, and also effective.

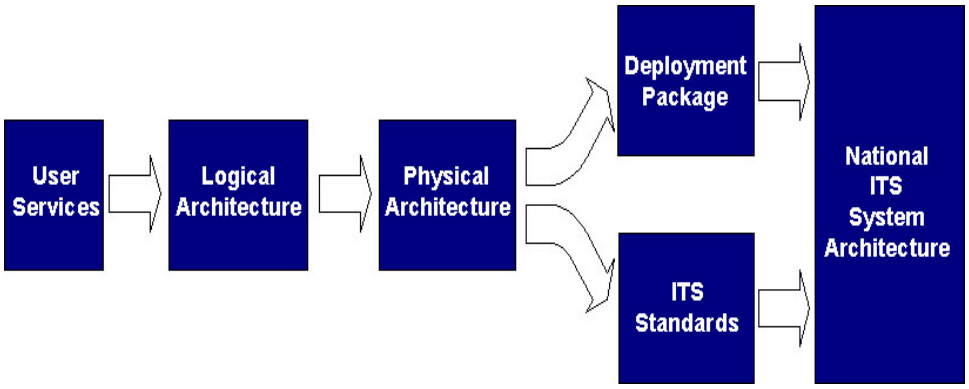

Figure 4.1: Establishing ITS System Architecture for Malaysia

Figure 4.1 illustrated the planning process when establishing a national ITS system architecture that are system interoperable.

Besides defining the functionality of ITS components, the ITS system architecture will also detail the information flows among ITS elements. With the assistance of a standard planning tool, which is normally applied in the development of national ITS system architecture and customised to suit the specific requirements in Malaysia; the functionality, the information flows as well as the ITS components and elements can easily be selected from a set of professional-prepared and pre-defined choices. If everyone is selecting from these pre-defined choices without exception, organizations can be sure that their ITS programmes are compatible and inter-operable in providing services to the travelling public and the transportation industry.

The ITS system architecture developed generates the greatest benefits when communication and information backbone derived is capable of enabling ITS programmes of all jurisdictions to work together and share information. Systems are more effective when they can share information; and because systems are inter-operable, cost for the system maintenance is usually lower. Therefore, having a correct ITS system architecture will increase operation effectiveness and efficiency. Figure 4.2 shows the typical ITS system architecture.

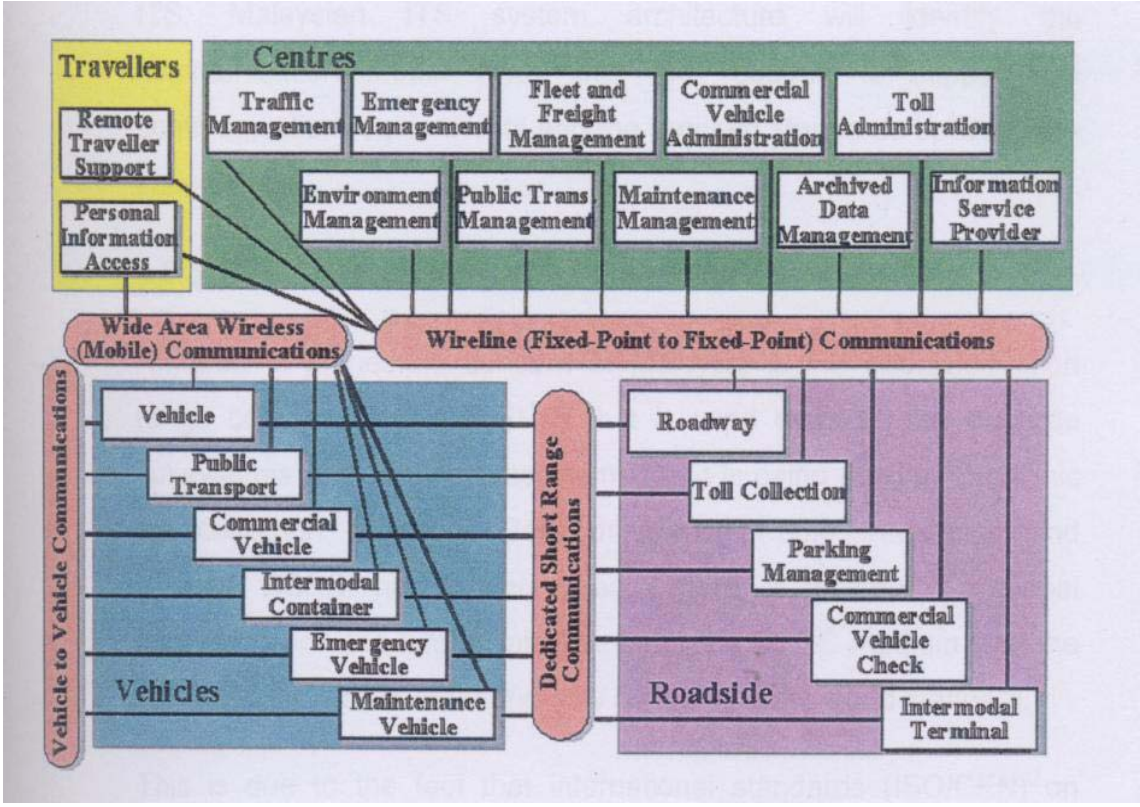

Figure 4.2: Typical ITS system architecture

5. CONCLUSION

The ITS industry in Malaysia is heading in the right direction and is on the right track. With a comprehensive plan, in the near future, conventional traffic management system will be slowly phasing itself out and a new era of ITS technology will emerge. Though ITS may not be able to solve all the transportation problems of today, this technology has great potential and will have a significant impact on the global economy. Malaysia is keen and is committed to harvest the benefits of ITS technology and is gearing itself to be in the main stream to contribute significantly towards further enhancing the quality of life and the environment we live.