ITS DEPLOYMENT STRATEGY BASED ON PILOT PROJECT IN DEVELOPING COUNTRIES: KARAJ-TEHRAN CORRIDOR, AN IRANIAN EXAMPLE

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ABSTRACT

This paper presents an ITS pilot project in a developing country, Iran, as a way to foster to the development of ITS national strategic plan.

The pilot project concerns a high trafficked road corridor, linking the capital Tehran to the largest city in the suburb: Karaj. This corridor was selected among others, by the end of 2002 as a good candidate, due in particular to the variety of problems encountered [1]

In order to launch the pilot project a co-operation was set up in 2004 between EGIS, France and Metra Consulting Engineers Co, Iran and several ITS experts were sent to Iran for two missions in June and July 2004.

The mission consisted of detailed on-site visits, interviews of the different stakeholders (Police, transport operators, Municipalities, authorities, etc) and the organisation of two ITS workshops for consolidation of the project content. This paper details the results of the study and the design of the pilot projects taking into account the national ITS strategy plan.

KEYWORDS

ITS: Intelligent Transport System, ITS Strategy, National Strategic Plan, Deployment strategy, developing country, Iran

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INTRODUCTION

The earliest ITS project in Iran went in operation in 1992 for traffic management in Greater Tehran. Later, Isfahan, Tabriz and Mashad began to use ITS solutions in 1996, 2000 and 2002, respectively. ITS based services are provided by Traffic Management Centres, advisory radio, speed enforcement cameras, traffic lights violation cameras, CCTVs and Variable Message Signs. The scope of these projects falls within the boundaries of urban ITS. Therefore, in 2002, Iran's Ministry of Roads and Transportation (MRT) decided to deploy ITS solutions across the national road network. To identify strategic moves, a national ITS strategic plan was required. First, ITS evolution process in pioneering countries was studied and for the reasons discussed in [1], MRT launched a pilot ITS project to study and implement the solutions for a sub-network of appropriate size which will be elaborated in this paper. The aim was to create synergy amongst key players to support the national planning process and speed up ITS deployment as the substitute of traditional solutions.

As part of the outcomes, in 2005, ITS Iran Society was established; the first ITS book in Farsi [2] and the monthly ITS bulletin was published by Metra for distribution within MRT, municipalities and vehicle manufacturing industries throughout the country. Internet site www.itsiran.ir was launched to consolidate ITS society. Iran was then to establish an ITS leadership entity for coordinating the activities of various organisations, and for fostering numerous activities relating to ITS standards, national architecture, etc. which have been emphasized in [5].

This paper focuses on the showcase project conducted jointly by Egis and Metra. This section continues with the introduction of the transportation problems in Tehran-Karaj corridor and potential benefits expected from ITS use. Then, there is a discussion on the study including methodology, preliminary and detailed recommendations which are followed by future steps to be taken.

THE SITE

Karaj is linked to Tehran with a freeway and two expressways constituting **a transport corridor**. This corridor is experiencing many difficulties, with high level of accidents and daily congestion.

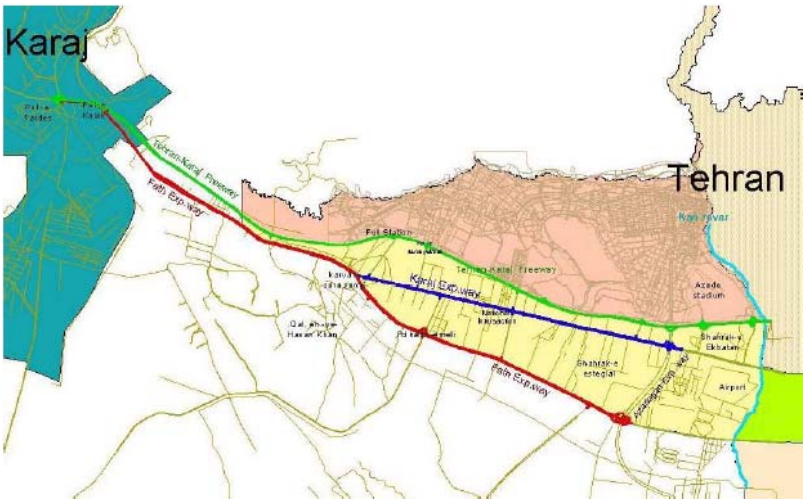

Illustration 1: Map of the corridor

In order to **improve the traffic situation**, the **Iranian Ministry of Road and Transportation** (MRT) decided to implement an **ITS pilot project** on this corridor that will serve two objectives:

- improvement of the traffic conditions on the corridor
- acquire knowledge about ITS solutions for future ITS deployment in Iran.

Due to the complexity of the network and the level of difficulties encountered, this pilot project represented a challenge.

The main problems that were identified on the Tehran – Karaj corridor are:

- **safety**: the latest figures available reveal more than 1000 accidents on the freeway with about 100 fatalities per year, which are far more than the usual standards on this type of road
- **congestion**: recurring congestions on the freeway, close to Tehran and Karaj (no detailed figures available but measured and observed levels of service during peak hours at E or F[2] on many sections, meaning blocked traffic)
- **mixed characteristics of the road**: not really urban, not really rural with bad infrastructure conditions: pavement, entries/exit design, marking, signalling, safety equipment…
- **a complex road and traffic operation organisation** due to the multiplicity of stakeholders that have to co-operate.

[2] According to HCM standards

For alleviating these problems, it was proposed to implement strategies that combine different type of actions, using or not using ITS techniques, mainly:

- encourage shift of modes from road traffic to public transport, requiring improvement of metro service and better user information (develop Park & Ride solutions thanks to ITS)
- tackle safety problems and enforce bad drivers' behaviour thanks to automated enforcement, but also communicate and announce new services
- start by data collection (Cameras, Automatic Incident Detection and Traffic Management Centre) in order to acquire better knowledge of the traffic and road situation and adjust the suitable actions
- develop a Pavement management system
- develop information exchanges among all parties, including the public

The **expected benefits** of these strategies were:

- a drastic decrease in accidents (could be rapidly divided by 3 with the implementation of automated enforcement)
- much less congestion: the shift of 20% of users from the road to the metro during peak periods (objective that can be easily reached) may divide the congestion volume by 4.
- Better user satisfaction that will certainly influence positively the driving behaviour
- And last but not least, offer to decision makers a show-case for future national ITS deployment.

OVERVIEW OF THE STUDY

The study included the following methodology, based on system approach and using as well the recommendations developed in the ITS handbook [3] and the PIARC network operation handbook [4].

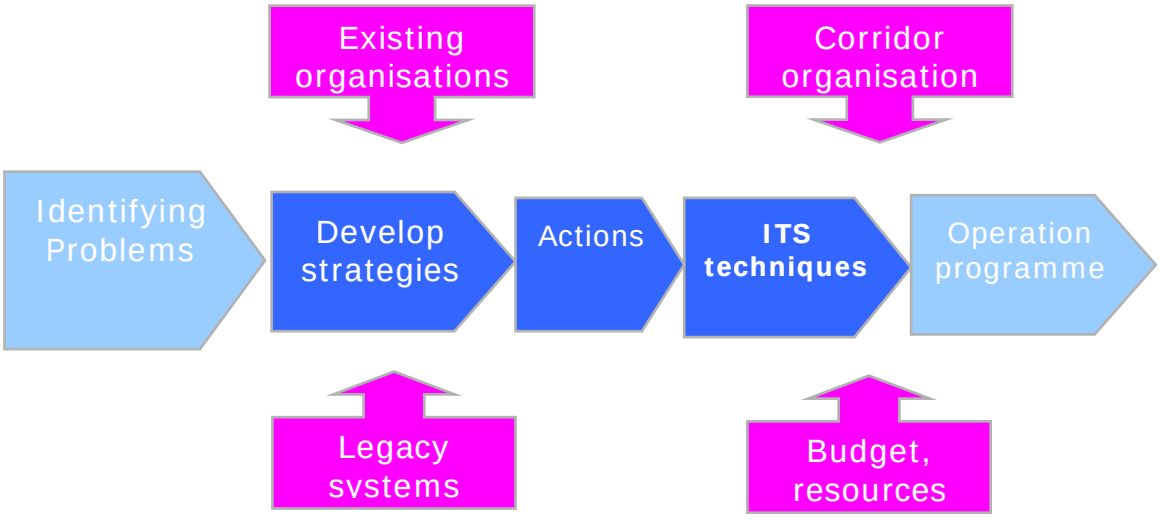

Illustration 2: Methodology

Preliminary recommendations

First investigations on the site revealed that before developing technology, preliminary basic measures should be implemented; in order to maximise the expected benefits during the next steps. In addition, it was made clear that a data collection system should be implemented in the early steps in order to:

- **better know the traffic situation** and then decide on the most appropriate solutions
- **be able to evaluate** with better accuracy the benefits of the ITS solutions and serve as a reference for other projects in Iran.

Other recommendations were to :

- install as soon as possible a Traffic Management Centre in charge of the motorway and parallel highways, connected with the urban traffic control centres of Tehran and Karaj.
- Set up in the first steps, co-operation agreements between all stakeholders
- Improve the infrastructure design (pavement, marking, interchange, ..) in order to make ITS solutions more efficient
- Consider a suitable extension of the corridor in order to better integrate the traffic patterns
- Consider the re-installation of a modern toll system (with Electronic Fee Collection) on the motorway (the toll system was abandoned recently due to the high costs of operation in comparison to the collected amount)
- Adopt a multimodal approach, from the beginning by considering the potential transfer of the traffic on the metro line linking Tehran and Karaj
- Give priority to public transport , by the creation of a reserved lane for buses, taxis, …

All these recommendations are detailed and constitute the main components of the project

THE ITS PROJECT

The design of the ITS project has been established and includes the following aspects:

Information collection

Speed cameras and CCTV for enforcing traffic rules.
Digital speed cameras are already in operation on the motorway but are not connected remotely to a Police centre, so that frequent interventions are necessary on the spot to download the photos. In order to alleviate this difficulty it is recommended to connect the digital cameras to a process centre. But speeding is not the only problem and other types of bad driving behaviour need to be enforced. In particular illegal stopping on parts of the motorway for taking on-board or off-board passengers are very frequent: implementation of CCTV cameras, coupled with incident detection will allow identifying vehicles stopping illegally. (a similar system is already in operation inside the city of Tehran for enforcing illegal parking)

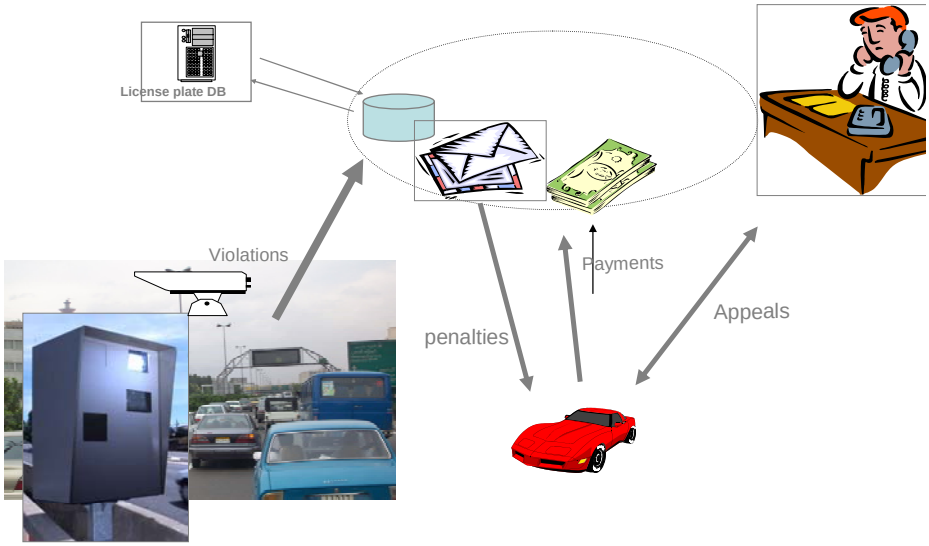

Illustration 3: Automated enforcement architecture

CCTV and Automatic Incident Detection
Due to the necessary improvement of the infrastructure design and the pavement, it was made clear that installing classical inductive loops may raise difficulties. Therefore, the choice of CCTV cameras and automatic incident detection based on image processing based AID was considered as a good option.

Weather stations
The Tehran region is facing adverse weather conditions during winter period. Snow, black-ice, fog may appear during several days per year and generate accidents as drivers are not used to such bad conditions. Implementation of weather stations and integration of meteorological data from other sources will allow warning users before departure and during trip (see section on actions below)

Emergency call box or dedicated number for GSM (dedicated number: 110)
Currently, only few emergency call boxes are implemented: extension is necessary in order to provide users with this service on regular intervals. In addition, considering the availability of GSM equipment, it is recommended to generalise and publicise the emergency short number 110.

Patrolling vehicles
Due to the current weakness of the data collection system, it seems that a first step is to reinforce patrol vehicles: today, only the Police are in charge of regular patrols on the motorway. It was then recommended to reinforce this scheme by creating dedicated patrols for road and traffic management.

Interfaces with other partners: TMCs, weather forecast services …

Considering the location of the corridor and its connection to other road networks, developing interfaces for exchanging information and co-operate on traffic management strategies appeared to be the first priority. For that reason, the study was undertaken on a step by step approach involving discussions and workshop with the concerned actors.

Actions on the traffic and/or user information:

VMSs and electronic panels

Two types of signs will be implemented: VMS with text and pictograms which allow displaying traffic information, rerouting strategies, etc. and electronic panels dedicated to warn users on critical spots and situations.

Vehicles for intervention and signing

The use of patrol and intervention vehicles has been recognised as a good solution on a network, where problems are not yet well known, particularly in terms of location: mobile units allow to implement very quickly a flexible and reactive solution. These mobiles units need to be equipped with communication and location facilities.

Intelligent stops areas

As already indicated, one major safety problem is the illegal stopping on the motorway for embarking or disembarking passengers. Instead on prohibiting this behaviour, that in fact contributes to the transport facilities of the corridor, it appeared more advantageous to canalise the process by installing what we have called intelligent stop areas:

- passengers waiting for a lift will be invited to wait on dedicated parking spaces (protected from the main traffic)
- traffic signs with flashing lights installed upstream will allow to warn drivers that passengers are waiting.

Illustration 4: Intelligent Stop Area

Ramp metering

In order to preserve the traffic flow on the motorway, it has been recommended to implement ramp metering on 7 locations (close to Karaj or Tehran). But no detailed study has been made yet on the strategies to be deployed, due to the lack of coherent and detailed traffic data.

Adaptive or intelligent traffic light

One particularity of the Corridor is that the main alternative roads, partly parallel to the motorway are equipped with traffic lights that are managed by Tehran municipality, but not equipped with adaptative traffic lights. One of the priorities is to implement these features and establish connection with the urban traffic control centres that are relevant: Tehran or Karaj.

Interfaces to other partners
As already mentioned, these interfaces are crucial for the project: they have first to be built for the Tehran traffic control centres and later on for the Karaj control centre when it is in operation.

Interfaces to information service providers
One other important aspect of the recommendation for this corridor is driver and more generally traveller information. All available communication channels such as Internet, radio, TV may be used. Depending on the organisational aspects, these channels maybe used directly by the authorities in charge of the transport operations or better in co-operation with all relevant media.

Information Process and transmission

Taking into consideration all different ITS applications, it has been proposed to implement from the beginning a Traffic Management centre. The TMC should include the necessary resources for undertaking the following tasks:

- On-line (traffic management)
- Off-line (maintenance and analysis)

And fulfil 3 types of strategies :

- strategies under r**egular operation**: traffic watch, information on hazardous spots, on road-works, access control, driver information, routine maintenance …
- **anticipation** strategies: pre-warning, preventive action in case of forecast event, demand management, preventive information, planning of maintenance activities…
- **incident management** strategies: protection of users, warning, emergency response, diversions, access control, lane control, winter maintenance….

The Traffic Management Centre should also integrate facilities such as :

- Logbook
- GIS database
- Synoptic map
- Communication facilities

All these equipment will be able to communicate through a powerful communication network to be installed as soon as possible on the corridor.

FURTHER STEPS AND CONCLUSION

Further steps of the project have been described in a work programme. Different scenarios have been proposed for project implementation, including public private partnership. One important aspect of the project is the organisational aspects. Due to the number of stakeholders involved, and the number of projects in development in the area, that could influence the course of the project, it was proposed to create thematic working groups for accompanying the project management structure during the deployment phase.

Another aspect is that the Karaj – Tehran pilot project should serve to devise the future organisation of the traffic management at the different levels: local, province, national. It is therefore necessary to see how the TMC should be integrated in the future context. The following diagram (illustration 5) depicts one of the scenarios where the TMC is at the same time in charge of the freeway and of the corridor (regional level).

This scenario may serve as a basis for discussion with the partners and will be adjusted, once the project is defined more precisely.

Last but not the least, one important actor of the project is the final user:

- Co-operation is also needed with the users and can be developed through new ITS services
- Safety is a critical point, that requires change in driver's behaviour, and the key for changing drivers' behaviour stands certainly in a good balance between the offer of new services and enforcement of the rules: "the stick and carrot policy".

….. technology cannot solve all problems….

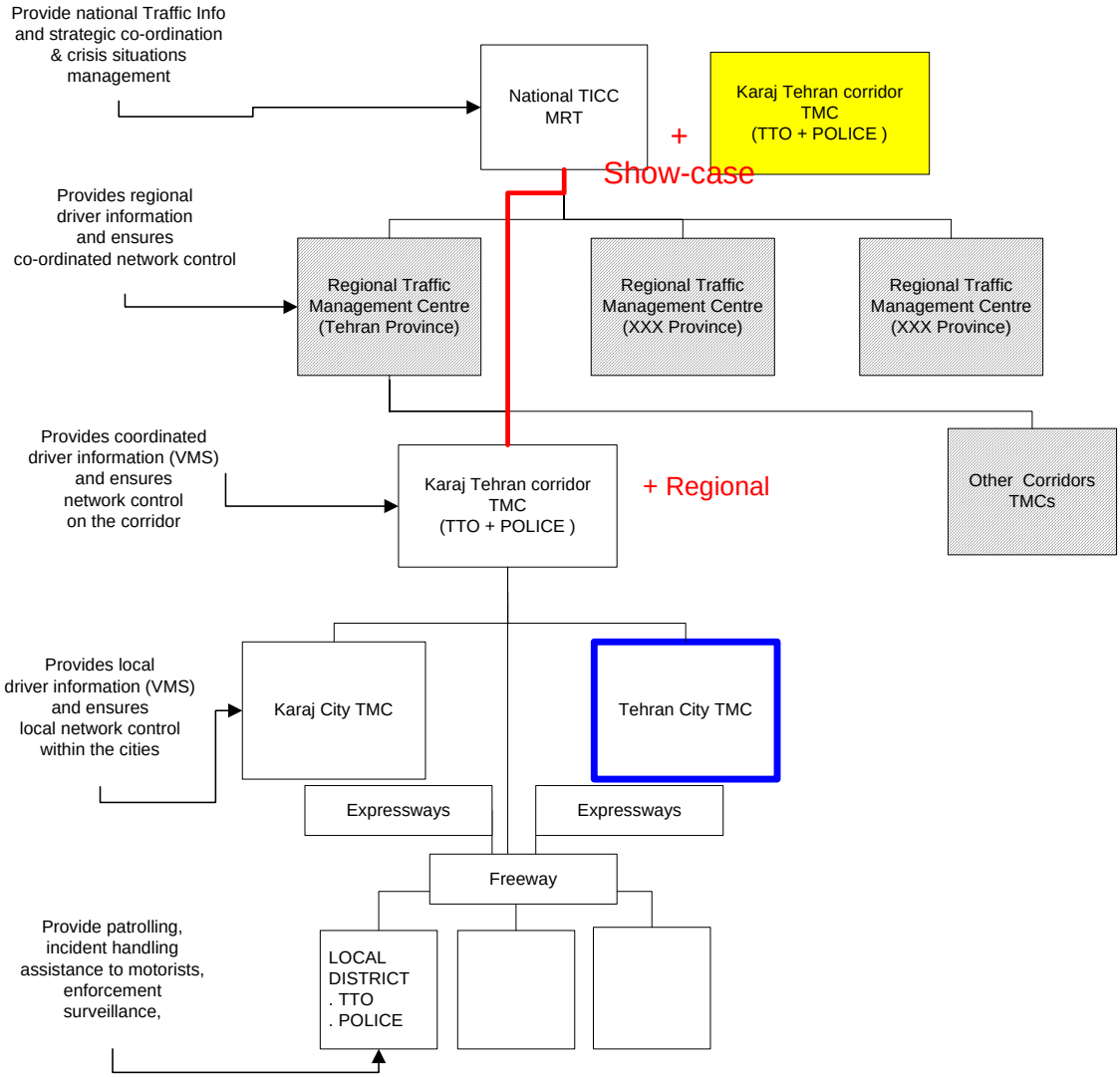

Illustration 5: organisation scheme

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