Integrated management of Malaysian road network operations through ITS Initiatives: issues, potentials and challenges

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Abstract

During the last twenty five years, rapid urbanization and industrialization have resulted considerable growth of Malaysian highway network. Apart from few specialized industrial zones, most of the industrial zones are established in close proximity of the urban areas in order to ensure the smooth supply of manpower especially for the dominating manufacturing sectors. This phenomenon resulted in a number of large regional units of transport demand base involving high private motorized trips and truck dependent freight trips. The growth of car and truck trips especially in the regions including sea ports is putting tremendous pressure on the capacity of these regions's road network which cannot be subdued by only physical extension of the network which often proved to be costly also. As a result, a number of such regions e.g. Klang Valley, Penang and Johor Baru are experiencing the problems of congestion, accidents and air pollution on their highway network. In many developed countries integrated intelligent transport system (ITS) initiatives applied to these sorts of regional bases have been claimed to be successful in alleviating those problems in a cost-effective manner. This paper will investigate the issues related to such integrated application of ITS initiatives in Malaysia on a regional basis with particular focus on Klang Valley region. Starting from the basic ITS functionality, the paper will identify the potential focus areas such as data gathering, data communication among and across jurisdictions, System flexibility, smart use of alternative routes, public-private collaboration and integration of public-private agencies in terms of regional ITS operational needs. Examples of best practices in the similar ITS applications around the Globe will be cited in a benefit-cost perspective for creating a Malaysian motivation in the right direction. Where possible the relevant challenges in implementing those initiatives in Malaysia will also be highlighted in the paper.

Keywords : Network operation, Agency collaboration and Regional ITS operation

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Background

Malaysia has had favorable rapid economic growth for almost three decades now. This induced rapid urbanization and industrialization with relatively higher concentration of activities in larger cities and their conurbations. Apart from few specialized industrial zones, most of the industrial zones are established in close proximity of the urban areas in order to ensure the smooth supply of manpower especially for the dominating manufacturing sectors. This phenomenon resulted in a number of large regional units of transport demand base involving high private motorized trips and truck dependent freight trips. Number of car and freight vehicle registration has experienced a compounded growth rate of over 9% during the period of 1986-2003. The growth of car and truck trips especially in the regions including sea ports is putting tremendous pressure on the capacity of these regions's road network which cannot be subdued by only physical extension of the network which often proved to be costly also. As a result, a number of such regions e.g. Klang Valley including North and West ports, Penang including Penang port and Johor Bahru including PTP and Johor ports are experiencing the problems of congestion, accidents and air pollution on their highway network. In each such region, traffic flows between/among all the corners/zones despite the existence of various administrative districts, local majlis/city boundary, free vs tolled roads, different highway operators, different traffic management setups, etc within the regional boundary. In other words, motorists perceive the whole regional highway network as a system to cater to their travel demand. Whereas entities in the regional transport system as mentioned above are not naturally emerged into an integrated system. Therefore, integrated management of regional highway network with the aid of intelligent transport system (ITS) tools need to address these issues during the planning stage of such regional ITS system. This study will focus on the issues, potentials and challenges of such integrated ITS aided highway network operation in the region of Klang Valley.

Overview of Klang Valley Highway Transport

Kuala Lumpur, capital of Malaysia, is the largest city and most prominent financial and business center in the country. The city of Kuala Lumpur is part of the Kuala Lumpur and its conurbation (KLC), which covers approximately 4,000 square kilometers. Within the KLC is the Klang Valley Region, the original urban planning unit that covers 2,843 square kilometers. Klang Valley is an area in central Selangor, Malaysia comprising Kuala Lumpur and its surroundings and suburbs. Properly, it encompasses the whole Federal Territory of Kuala Lumpur and the districts of Gombak, Klang, Petaling and Sepang of Selangor (Figure 1). The conurbation has a total population of over 4 million as of 2004, and is the heartland of Malaysia's industry and commerce. In the most recent census, the population in the Klang Valley has expanded to 5.2 million (World Gazetteer, 2003). Over the past two decades, Klang Valley has undergone a period of unprecedented economic growth that has significantly affected travel demand in the metropolitan region of KLC (Table 1). Car ownership and car trips have gone up quite rapidly. Also many industrial especially manufacturing estates have evolved all-around KLC with densely packed industrial units which have contributed significant increase in freight traffic. The presence of two ports ie North and west port, and the air cargo centre ie MasKargo in this region and a generally sprawling residential and commercial development have resulted a truly regional transport demand (both car and freight) base. In an attempt to cater to this increasing demand a number of highway/expressway have been constructed totaling over 300 km in length during the last two decades and a few more highways are under development or planning stage even now (Figure 2). It is understood that such highway expansion needs huge investment and as such cannot be taken as a natural means of catering to increasing demand. One alternative to this is increasing the highway capacity by efficiency improvement and better management of traffic operation and demand. Intelligent transport system (ITS) has emerged as a means to implement such initiatives for efficient operation and better traffic management. As regional ITS architecture sits on whatever planned transport system, regional network operation aided by ITS, is dependent on regional transport planning and ITS architecture. As such regional highway network operation with ITS touches a number of cross-cutting issues and in the process presents number of challenges to overcome. Such issues, challenges and potentials of integrated highway network operation in Klang valley with ITS will be explored in the following paragraphs.

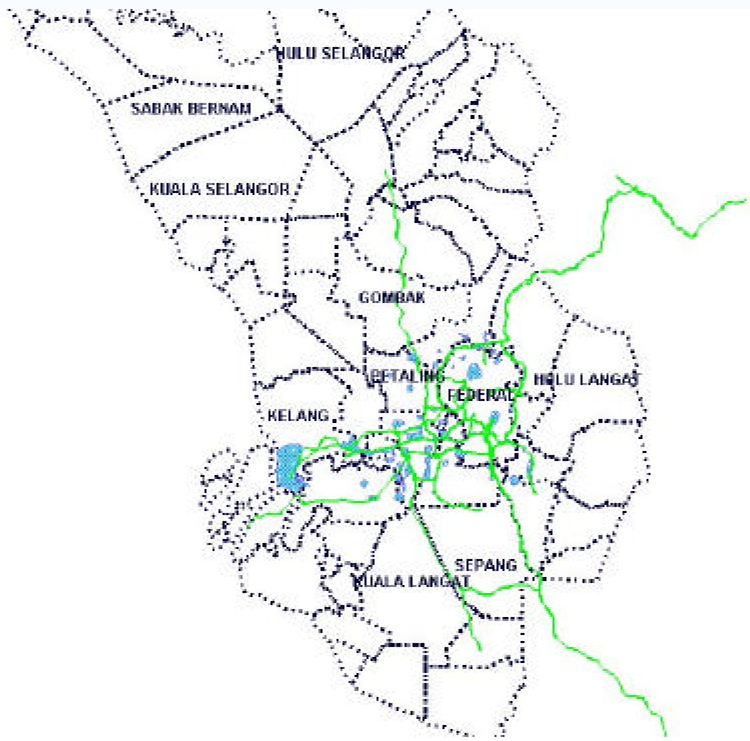
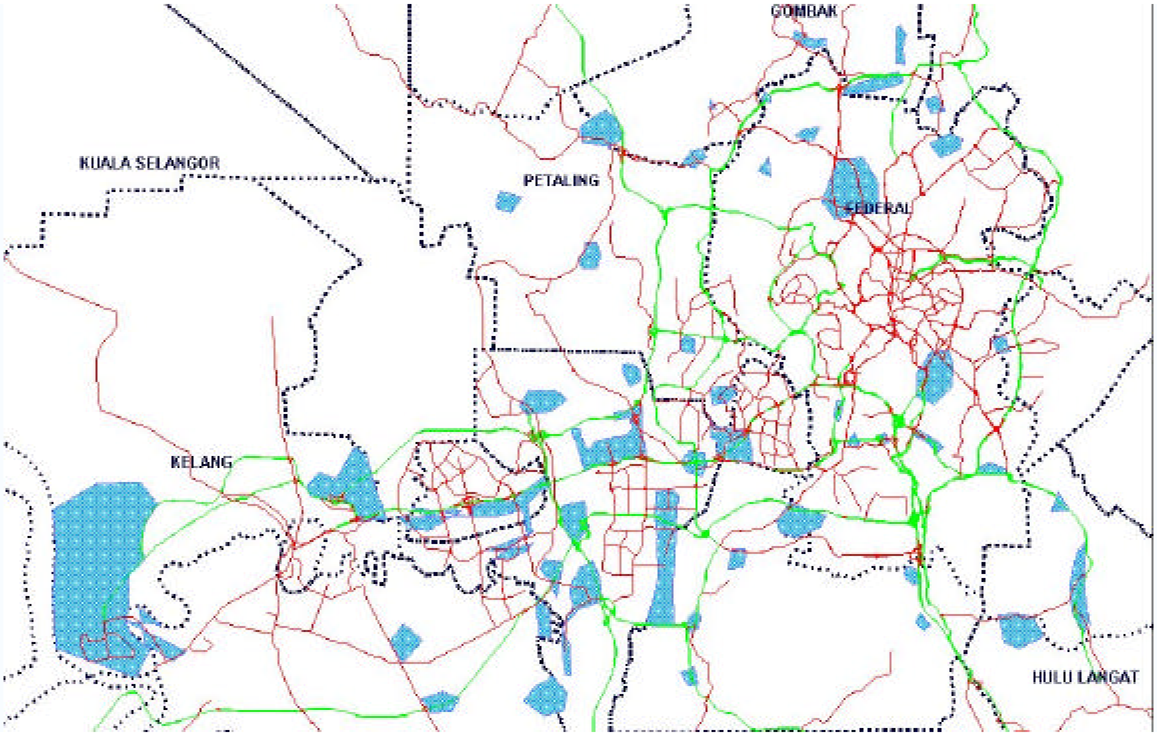


Figure 1 Klang Valley and its highway network

Table 1 Overview of Transport Indicators

Residential Density	
Kuala Lumpur City (2000) Metropolitan Area (2000)	5,800 persons per sq. km 1,100 persons per sq. km
Personal Trip Rate	
Average daily trips per capita (Klang Valley) (1997)	2.4
Motorization Rate	
Private vehicles per 1000 (2000)	300 (autos) 173 (motorcycles)
Mode Shares	
Share of Motorized Trips (2003)	Public Transport 14% Private Transport 86%
Klang Valley Expressways	Shah Alam Expressway (SAE/KESAS: 34.5 km) E5 North-South Expressway Central Link NSECL/ELITE: 43.5 km) E6 Cheras - Kajang Expressway (CKE/Grand Saga) E7 Sungai Besi Expressway (SBE/BESRAYA) E9 New Pantai Expressway (NPE: 19.6 km) E10 Damansara-Puchong Expressway (LDP) E 11 Ampang-Kuala Lumpur Elevated Expressway (AKLEE: 15 km) E12 Duta-Ulu Klang Expressway (DUKE: 18 km- Proposed) (U/D) E16 Kajang Dispersal Link Expressway (SILK) E18 KL-KLIA Dedicated Expressway (U/C) E20 Sprint Expressway (26.5 km) E23 Assam Jawa-Templer Park Highway (LATAR: Proposed (U/D) E25 South Klang Valley Expressway (SKVE: Under progress) E26 Lebuhraya Timur-Barat/Salak Expressway (East-West Link) E27 New North Klang Straits Bypass (Shahpadu) E30 Guthrie Corridor Expressway (GCE: 25km) E35 Stormwater Management and Road Tunnel (SMART:3 km), (U/C)

Note: U/D means under development; U/C means under construction



Industrial estates

Figure 2 Industrial estate and Highway network development in Klang Valley

Regional Transport of Klang Valley

Malaysia Highway Authority (MHA), a division of Ministry of Works, Malaysia is responsible for planning, regulation and monitoring of highway network. But operation is fragmented into a number of operators including MHA and Kula Lumpur City Hall (DBKL). There are a number of existing transportation-related organizations in KV region, involving several ministries, 5 districts, and about a dozen of municipalities. The largest municipality, DBKL, has about only 20% of the region's population, indicating that population, power, wealth, authority, and transportation resources are spread over a large number of actors. The conurbation encompasses an area of over 2800 square km, a geographic scale that does not correspond to the scale of any existing governmental entity in this part of the country (e.g., city, county, or state). Recently, a new city has also incorporated in the region ie Petailing Jaya, adding new jurisdictions, opinions, and interests to the transportation system. Also imminent growth of existing municipalities and formation of new municipalities are very much on the card. Although planning and financing the regional transport projects involve Economic Planning Unit (EPU) of prime minister's department at the field operation level presence of only two public agencies can be observed ie. MHA and DBKL. Other stakeholders involved in regional transport scenario are the private road operators. However, a regional institution with a vision for the overall regional transport strategies through broad, region-wide ITS implementation is clearly missing for KV situation.

Existing ITS in Klang Valley Region

The Regional ITS Architecture and Integration Strategies identify future ITS deployment and linkages, but also recognize that there is an existing inventory of ITS infrastructure and institutional linkages. Existing ITS setup in klang Valley is summarized below:

Highway management: Malaysia Highway Authority (MHA) has just started to operate a national traffic management centre (TMC) as a hub to about 12 different highway control centres all-around peninsular Malaysia. It is connected to and receives information from about 155 vehicle detection stations, over 200 cameras for closed-circuit television, and 80 variable message signs (VMS). It can also extract data, video and voice information from the remote highway control centres. It is planned that traffic information will be collected, stored and processed before being disseminated to the public via the VMS, Web portal, SMS and MMS for the latest traffic conditions and travel advice.

Highway Communication centers (CC): Individual highway Communication centers such as PLUS and LDP/SPRINT CC collect and disseminate traffic flow related information collected through emergency telephone, CCTV and VMS boards. However, CC centre activities are focused only on individual highway safety, operation and emergence management.

Arterial Management: For management of arterial network in Kuala Lumpur Intelligent Transport Information System (ITIS) was commissioned recently with its TMC located in Technology Park, Bukit Jalil. It is planned for the management of a wide spectrum of CCTVs, Vehicle detectors, VMS boards, probe vehicles equipped with GPS units, emergency and incident management.

Other much talked about technologies to be developed/ in operation are transit fare coordination, transit traveler information, transit signal priority, and electronic toll collection through smart cards such as smart tag, Touch-n-Go.

Towards Integrated Network Operation with ITS

Despite an array of transportation management tools, integrated network management has not naturally emerged in KV. Collaboration between planning and operations communities and integration of travel management tools could help shift travel demands between facilities and modes, thus reducing delays and increasing reliability and predictability of travel. Unused corridor capacity often exists on parallel routes, on the non-peak direction on freeways and arteries. Shifts in travel demand to unused capacity can be accomplished by delivering real time travel data through in-vehicle devices, VMS signs, as well as through various traffic management strategies, including adaptive traffic signal and ramp metering systems. This initiative builds on many individual tools already developed. Network/corridor management can be achieved through collaboration and coordination between the operations and planning communities and through integration of the services that these agencies provide. In partnership with State, local and private agencies, this initiative needs to:

- Pull together ongoing, nearly completed, and planned work into a proactive network/corridor management focus
- Identify and close knowledge gaps between/among agencies
- Design and implement a major model deployment and other technology transfer activities that will give the transportation community the information and tools it needs to make improvements in network/corridor management

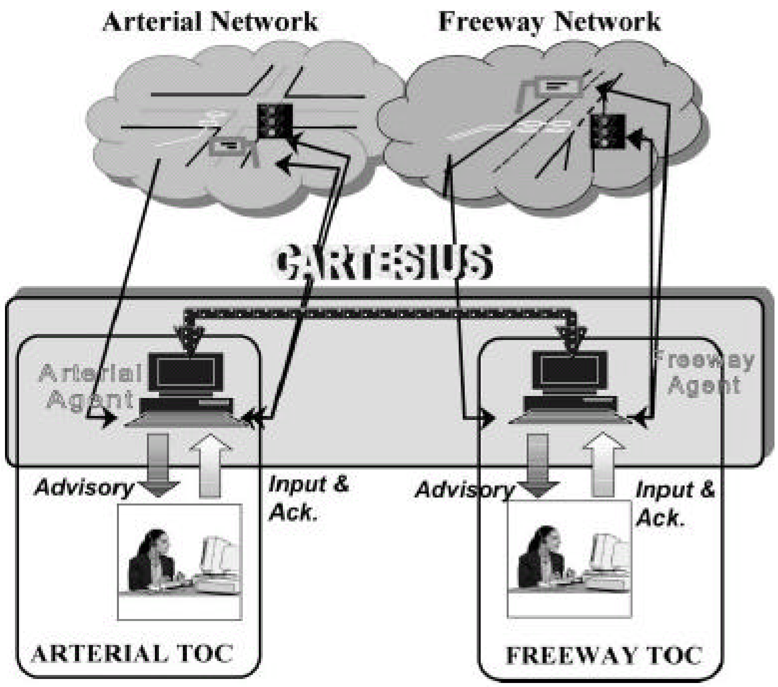
As above, in KV, several agencies share the administration of the transport infrastructure, through a distributed network of Traffic Management Centers (TMCs) responsible for the management and control of their facilities. Even if the ultimate goal of these agencies is, in general, the efficient management of the road network in KV, different agencies have different policies and objectives that may generate conflicting interests and hence operations. Also, the spatial and administrative organization of such agencies often results in a localized distribution of data and information and on the presence of multiple decision-making entities that pursue different goals and adopt different criteria to achieve those goals. In presence of the different demand and performance characteristics of interacting subsystems, such as freeways and arterials, it may require interdependent control decision-making processes (Logi and Ritchie 2002). In order to increase the effectiveness of real-time response to congestion and guarantee sufficient adherence to integrated network operation, a cooperative effort is required, that satisfies all involved parties. Such effort must respect the various levels of authority, guarantee privileged control of data, and in general reflect the inherent distribution of the decision-making process. Yet, it must attempt to exploit the agencies' willingness to cooperate and unify their problem-solving capabilities towards potentially conflict-free, coordinated operation.

The development of data sharing and communication networks among the agencies participating, provides all involved parties with shared data access to global information. Although such approaches normally result in better-informed decision-making, they are not intended to explicitly facilitate coordination and conflict resolution and do not preserve dedicated access and control of the local data among the participating agencies. Often an area wide network operation analysis may need data from MHA, KL ITIS and any other private operators. Although modeling algorithm can yield a set of suitable operation solutions globally and also locally for MHA or KL ITIS, implementation of one of those solutions need further collaboration and sometimes agreement between or among the agencies. For example, an optimum network under a certain situation might result controlled access/exit to/from a privately run tolled road which the private agency may not agree to; dispersion of traffic to alternative routes may need data sharing and agreement between/among agencies, etc.

For example, Bangkok has a number of transportation organisations, both privately and publicly run, which are responsible for the various aspects of transportation. These range from freeway management, through area traffic control, to bus operations and in-car trip planning. Various monitoring and control systems have been developed over time and implemented in isolation to meet the specific needs of each operator. Several websites also exist to assist the public in looking at services offered by each agency. However, there was found to be no way of obtaining useful information about the networks as a whole and making truly informed decisions on travel within the city. A recently undertaken project therefore concentrates on provision of a central data warehouse which combines centralisation of transport information with provision of information to the public on travel alternatives and to the police and other emergency services to aid effective and timely response.

While full scale data communication and analysis/decision-making collaboration may need costly institutional and capacity setup it may sometimes create complexity and confusion during dynamic real time collaboration. A simpler but effective collaboration framework was suggested by Logi and Ritchie (2002) named CARTESIUS architecture which aims to place itself somewhere in between the above-mentioned approaches, in the attempt to develop a bridge between them (Figure 3). This is achieved by providing the means for limited but effective data and information exchange, and offering mechanisms for dynamic cooperation through coordination and conflict resolution.

The distributed architecture in CARTESIUS is composed of two interacting, real-time problem solving agents that communicate with each other through a fast TCP/IP-based real-time protocol. As shown in Figure 3 the two agents are decision-support systems for a TOC operator: the freeway agent supports incident management operations for a freeway subnetwork and interacts with a human operator at the TOC of a freeway management agency. The arterial agent supports operations for the adjacent arterial network, and interacts with an operator at the local city TOC. Each module continuously receives real-time measurements from traffic detectors and a description of the current status of the control devices (signals, ramp meters, and variable message signs, VMS) under the jurisdiction of the corresponding agency. After receiving notification of the occurrence of congestion from an external incident detection algorithm, the two modules provide the operators with a set of possible control responses. These are network-wide control plans composed of suitable control settings aimed at reducing the impact of congestion. The agents provide an explanation of the reasons why each strategy and plan are proposed and an estimation of the benefits that their implementation is expected to provide. Through a distributed graphical user interface the operators are provided with a dialog facility that allows them to agree on the selection of a global solution. Once a control solution is chosen, the agents transmit the corresponding control settings to the devices under the jurisdiction of the two agencies.



Source: Logi and Ritchie (2002)

Figure 3 CARTESIUS architecture for multi-agent integration within urban ITS

In moving towards integrated network operation with ITS in KV Region, organizations must: commonly identify technologies that they may deliver benefits to their transportation service; Plan for adoption of those technologies through acquisition of human, financial, and capital resources; Invest in those technologies; and Manage and maintain those technologies. In presence of an integrated operation platform significant benefits can be achieved from the ITS aided Adaptive system-wide ramp metering, Adaptive arterial traffic signal control, Emergency/Incident management, Traffic diversion based on traveler response to VMS information and automated speed enforcement.

Adaptive system-wide ramp metering

Ramp metering has emerged as a useful highway control measure to ensure efficient highway operations. Ramp meters regulate the entering traffic to the highway to avoid flow breakdowns and ensure smooth flow (Hasan et al 2002). Ramp meters also help break the ‘‘platoon’’ of entering vehicles, giving rise to efficient merging. It has been found to improve highway capacity utilization, reduce extent and duration of recurrent congestion, reduce the occurrence of non-recurrent congestion, reduce average travel times, and increase throughput (Papageorgiou et al., 1997). Most of the freeway in and around Klang Valley may be benefited with higher capacity efficiency if ramp metering is implemented especially during peak hours. For example, being well known for its congestion during peak period the Federal highway in the Petailing Jaya corridor may be a good candidate for exploring the ramp metering potential with a number of closely spaced on-ramps (Figure 4). But it is required to know the impacts on the ramp traffic on different arterials such as Jalan Kerinchi, Universiti, Grasing, Utara, Timur, Kelang lama, etc. Also such initiative needs to be evaluated in a simulation environment before field installation.

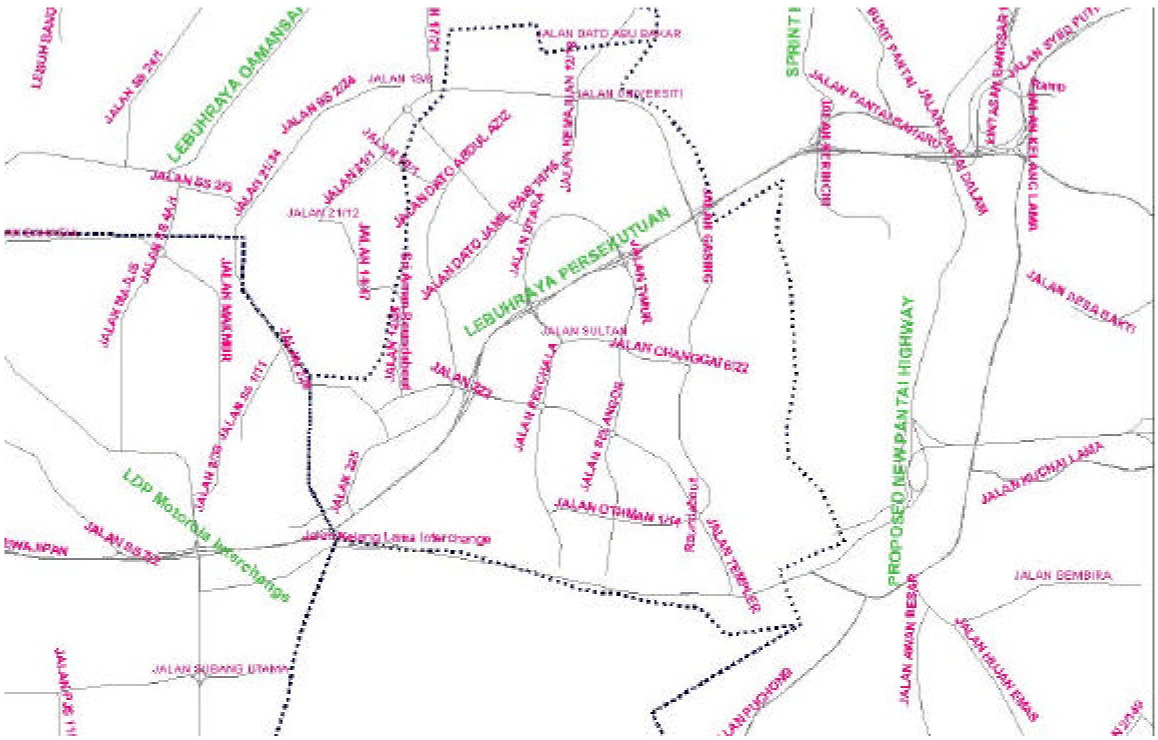


Figure 4 Federal highway and adjoining arterials in PJ corridor

An evaluation study (Hasan et al 2002) on Boston network showed that the total actual travel time savings with high demand, no downstream bottleneck and 62.5% queue override (suspend metering beyond certain length of queue on ramp) are 10.8% and 9.8% for ALINEA and FLOW algorithms respectively. ALINEA is a representative of local control algorithms and FLOW is a representative of the heuristic coordinated algorithms covering system as well as local constraints.

For ITS of Salt Lake city, US, the benefits of ramp metering were simulated using field data from a representative site. The site was selected because it had a ramp traffic volume similar to the average ramp volume for the region. Using peak freeway traffic volumes and current metering rates from this site, a simulation was run for various metering cycle lengths. The analysis found a decrease in mainline (freeway) delay with an increase in ramp metering cycle length. For a peak-hour mainline traffic volume of 8,350 vehicles/hour and no metering, the average mainline delay was 151.2 seconds/vehicle. The greatest delay reduction, 125.3 vehicle-hours over a period of one hour, was found with an eight second metering cycle and an average mainline delay of 97.2 seconds/vehicle. Ramp metering consists of sensors and traffic signals at freeway entrances to control the number and frequency of vehicles entering the freeway. The cost of 24 freeway ramp meters as part of the ATMS in Salt Lake city was USD5.75mill. The capital cost of ramp metering is the full cost to implement, including the design, equipment, and installation.

Adaptive arterial traffic signal control

Adaptive-signal-control (ASC) with or without bus priority can significantly increase average travel speeds and decrease total traffic delay. In addition, the average and variance of bus delays may be decreased while having little effect on other traffic. This potential should be given due consideration for Klang Valley situation as Bus fleet suffers from travel time reliability crisis in KV being mostly operated in mix with other traffic. Although most of the traffic signals in DBKL area are using a SCAT based ASC system but rest of KV is yet to be facilitated with such system. Also full scale functionality of such system including bus priority is yet to be implemented.

In Tucson, AZ, traffic activity was modeled and the potential benefits of deploying an adaptive signal control system in conjunction with transit signal priority was evaluated (Pitu et al 2001). The objective of the system was to accommodate buses while minimizing impacts on other traffic. Overall, the system decreased delay for travelers on main streets by 18.5% (as measured in person-minutes of delay) while decreasing delay for travelers on cross-streets by 28.4%.

To improve air quality, the City of Syracuse installed a computerized signal timing system, optimized signal timing plans, and evaluated the impacts of the system on a network of 145 intersections. The study (Harris 2003) focused on five main arterials and system performance was analyzed at 37 representative intersections. The Synchro™ software package was used to model the performance of the system before and after optimized signal timing plans were implemented. The before data were collected in 1998, and consist of signal timing data and traffic counts for three time periods (AM, Mid-day, PM). Field travel time data were collected both before and after implementation to confirm the travel time estimates made by the simulation model accurately represented actual travel times.

The network simulation was designed to optimize signal timings. Once the optimized configuration was determined, the signal timings were implemented at field controllers. To account for real-world conditions not accurately represented in the model, staff calculated field adjustments to the traffic signal timing plans by driving the arterials at different time periods. These final adjustments, implemented in early 2000, were once again entered into the Synchro™ package and the simulation tool was run for the thirty-seven intersections to evaluate system performance measures.

The study observed improvements in most system performance measures for the entire network:

- Vehicular delay 14-19% reduction,
- Total stops 11-16% reduction,
- Average fuel consumption 7-14% reduction,
- Average vehicle emissions 9-13% reduction,
- Vehicle speed 7-17% increase, and
- Travel time 0-35% reduction.

The cost of the computerized signal system was $8,316,307 for a network of 145 traffic signals.

Emergency/Incident management

A major source of traffic delay in many large urban freeway systems is non-recurring congestion caused by incidents such as accidents, disabled vehicles, spilled loads, temporary maintenance and construction activities, and other special or unusual events, that disrupt the normal flow of traffic. For example, estimates of the proportion of urban freeway delay in the U.S. attributable to non-recurring congestion range up to about 60% and this proportion is believed to be increasing (Ritchie and Cheu 1993). Regional incident management can reduce average incident duration on the highway network**.** Successful detection of incidents in their early stages is vital for formulating effective response strategies. These may involve real-time control of traffic entering and on the freeway, provision of real-time traveler information, and timely dispatch of emergency services and incident removal crews.

In Salt Lake Valley, Utah, Incident Management Teams (IMT) responds to thousands of highway incidents each year (Perrin et al 2004). As a result of increased staff and coverage area, local IMT responses increased from approximately 2,500 incident responses in 2000 to over 5,000 incident responses in 2002. An analysis of traffic data collected over a five year period (1999-2003) showed that the average incident duration on three major interstates decreased by approximately 20 minutes in areas covered by the teams. Assistance had positive impacts on the full range of incidents, including minor incidents that did not involve a lane closure, and more extensive incidents that closed all three lanes. These reductions in incident duration ranged from 12 to 36%, with the most significant reduction for incidents closing two lanes of traffic, where responders contributed to a 37 minute (36%) reduction in incident duration. System capital cost for IMT was 0.6 million for 120 miles of freeway network and annual operating cost was 0.4 million.

The Maryland CHART (Coordinated Highways Action Response Team) incident management program covers roughly 450 miles of freeway and major arterials around Baltimore, Annapolis, Frederick, and Washington, DC (Petrov, A., et al 2002). At the time of evaluation, the system included a statewide operations center (SOC) and three satellite traffic operations centers (TOC) to monitor traffic conditions, provide traveler information, and manage incidents.

In order to assess the contribution of CHART in terms of reduced incident clearance time, average incident duration was tracked over two years (1999, 2000) for both incidents where CHART provided a response, and those to which CHART was unable to respond. A total of 62,878 incident reports were collected, and the data indicated average incident durations when CHART responded were 51 minutes shorter in 1999, and 44 minutes shorter in 2000. To estimate the impacts of CHART on delay, a mathematical model was constructed to represent a number of freeway segments having similar geometry and peak-hour volumes in the area. The model generated data that indicated the CHART system saved about 47.6 million vehicle hours of delay in 1999 and 2000. Based on this data, the author estimated the incident management system saved several hundred million dollars in terms of time saved, reduced fuel consumption, and fewer environmentally harmful emissions.

Traffic diversion based on traveler response to VMS information

Alternative route information can help balance heavy traffic loads and improve commute times. For example, maintaining an alternative route plan for PJ corridor (Figure 5) involving Federal highway (Route 1), New Pantai Highway (Route 2), SPRINT highway (Route 3) and Adjoining arterial (Route 4) a dynamic collaboration arrangement is needed among MHA, DBKL and Pantai private operator. While Federal highway is highly congested there may be light traffic on Pantai or SPRINT highway due to toll charge on those roads. Also there may be light traffic on adjoining arterial roads due to no information to the drivers. A number of other highway corridors in KV region may be benefited from similar traffic diversion schemes.

As part of the European TABASCO (Telematics Applications in Bavaria, Scotland, and Others) project, traffic-responsive urban control (TUC) strategies were developed (Christina et al 2000) and applied to the M-8 corridor in Glasgow, Scotland. Adaptive signal control systems, highway ramp metering, and dynamic message signs (DMS) were integrated using real-time traffic data to balance network traffic loads during peak periods of congestion.

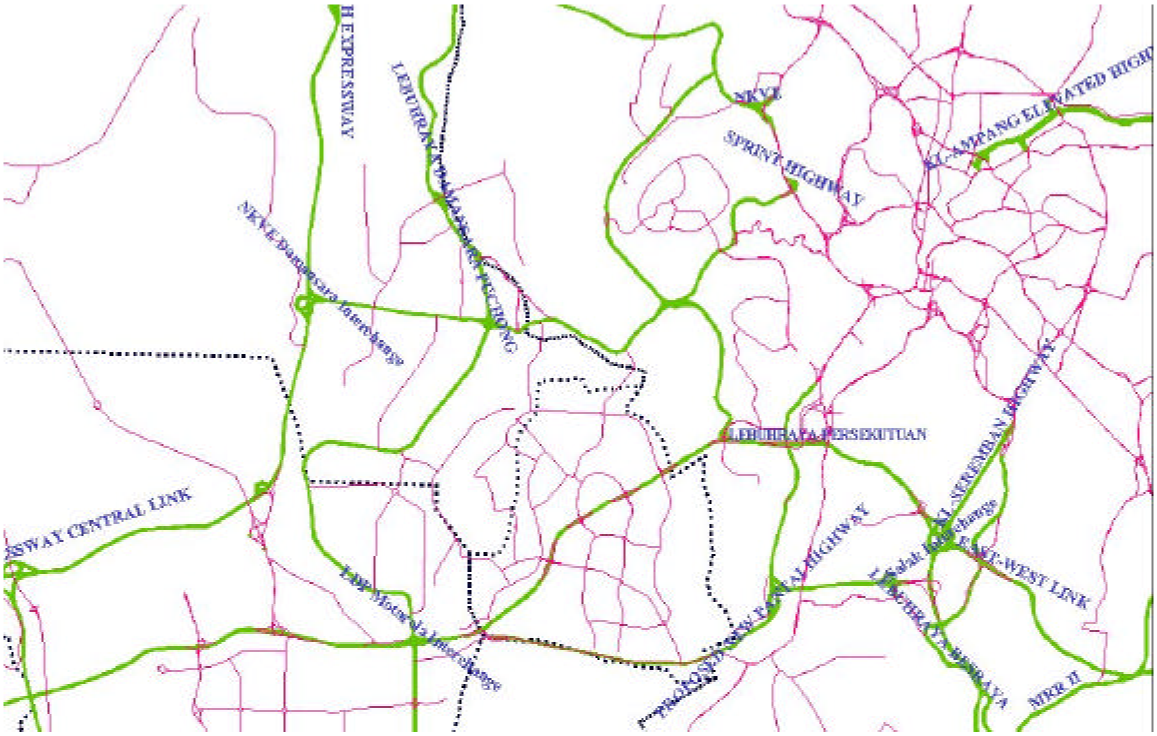


Figure 5 Alternative routes in PJ corridor

Traffic detectors were deployed to evaluate baseline conditions and measure system impacts. The test area included 3.5 km of freeway, 27 signalized intersections on adjacent arterials (seven in the TUC system), two freeway entrances (one with a ramp meter) and three dynamic messages signs.

Traffic volume and journey times were measured on arterial and freeway segments during several afternoon peak periods between February and March 1998. Driver response to the management strategies led to a 23% increase in traffic load and a 1% increase in travel times on alternate routes, while the system also helped avoid the development of oversaturated conditions (gridlock). Overall, the combined total travel time experienced by all travelers in the study area, on both freeways and arterials, decreased by 13%.

Greater benefits can be achieved through integrating freeway and alternate route operations as seen from San Antonio's experience (Texas, US) with integration of freeway and arterial management systems (USDOT 2001). The project integrated the new arterial management system along the corridor's arterial road with pre-existing freeway management system on a 5.4 mile section of I-10 and I-410. The arterial management system would consist of 10 loop stations, three camera systems, nine dynamic message signs, and a new arterial operations work station. Applying an integrated strategy is substantially more effective at reducing delay than any of the various components of the system acting in isolation. Specifically, the impacts of the integrated Medical Center Corridor on traveler delay are nearly 25 percent greater than those affected by separate incident management strategy.

Automated speed enforcement

Motorway Traffic Management can utilize a system of loop detectors and video cameras to measure traffic volumes and speeds, for classifying vehicles, and for incident detection. Information is provided to motorist through a series of variable message signs. Lane control and variable speed limits are used to control traffic flow. Detectors identify vehicles exceeding the speed limit while cameras mounted on overhead freeway signs photograph the license plate.

Such traffic management system of detection, lane control, variable message signs, and variable speed limits is used in the Lundby tunnel, Gotherberg, Sweden (Samuel et al 1999). Similar systems have provided a variety of documented benefits. In Amsterdam, the system reportedly reduced the “overall accident rate” by 23%, reduced the “serious accident rate” by 35%, and reduced the “secondary accident rate” by 46%. In Germany, the accident rate fell by 20% in areas where variable speed limit signs and lane control signals were used to warn drivers of congested conditions on the A5 autobahn between Bad Homburg and Frankfurt/West. On a comparable section of autobahn without control, accidents increased by 10% in the same time period. The Germans estimated that the payback in savings from the reductions in accidents would equal the cost of the system within two to three years after deployment.

According to England officials, automated enforcement is important in maintaining compliance with variable speed limits. The system has shown a very high compliance rate with speed limits, an increase in capacity by 5% to 10%, and a 25% to 30% decrease in rear-end accidents on the approaches to queues on the freeway.

In year 2001, the Malaysian government adopted a new national road safety target of 4 road accident deaths per 10,000 vehicles by year 2010. A study by Radin et al (2005) suggested that a minimum 2.18% reduction of accident death per annum is required to achieve the national target in year 2010. In the light of above experiences, ITS assisted speed enforcement and lane control on the highway can help achieving such accident reduction target.

Conclusions

ITS aided integrated road network operation needs institutional and operation level collaboration among stakeholders. In Klang valley, there is lacking in such collaboration among public and private agencies. While individual agency aims at its own objectives and goals, there is no regional supervisory body to look after the transport related societal goal. As optimum highway network operation often involves cross-agency and cross-jurisdiction issues requiring seamless communication, it is required to develop a common platform for multi-agencies collaboration. While full-scale data communication might involve huge investment and complex restructuring equally effective operation may be achieved through formation of knowledgeable agents interfacing the agencies. Under the integrated operational setup, a number of ITS assisted network operation measures may be undertaken for efficient operation of Klang valley highway network. ITS assisted coordinated ramp metering, adaptive signal control, emergency/incident management, area-wide traffic diversion and automated speed enforcement have huge potential for higher capacity, reduced congestion and improved safety of Klang Valley highway network.

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