The benefits of National Intelligent Transportation Management Centre (NITMC) establishment in Malaysia

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The benefits of National Intelligent Transportation Management Centre (NITMC) establishment in Malaysia

Nurul Saffrena Musa, Noor Mazlan Muhammad Noor and Jamilah Mohd Marjan

Highway Planning Unit, Ministry of Works, Kuala Lumpur, Malaysia

E-mail: saffrena@kkr.gov.my

Abstract. Malaysia has been embracing Intelligent Transportation System (ITS) technology and has started the effort by establishing a few traffic management centres (TMC) which are operated by different government agencies for transportation data collection. For examples, Kuala Lumpur City Hall (DBKL) has been operating Integrated Transport Information System (ITIS) where traffic data is collected in Kuala Lumpur and Klang Valley area.~~,~~ In addition, Malaysian Highway Authority (MHA) has TMCs at all tolled highways to collect and manage traffic data and Land Public Transport Land Public Transport Agency (APAD) is in charge for public transport management including bus and light rail train. Due to the operation and maintenance of these centres are maintained by multiple agencies separately, transportation data from them are not coordinated and integrated. Therefore, the in-silo working culture causes difficulty in data collection and analysis for historical data record, real-time information and future prediction. In conclusion, National Intelligent Transport Management Centre (NITMC) is important as the centre that will coordinate, integrate, collect, analyse and disseminate these data from multiple agencies from government and private agencies. The data analysed in NITMC is expected to benefit all relevant stakeholders including the public by providing up-to-date and reliable data to them.

1. Introduction

Malaysia has a nationwide road network includes Peninsular, Sabah, Sarawak and Federal Territory of Labuan. In general, road in Malaysia is categorized into two categories which are Federal and State Road. Both of these roads are developed and maintained by Federal and State Government respectively. On the other hand, the number of vehicle has gradually increased over past few years. This increment affect the need to increase the road capacity too. Currently, Level of Service (LOS) is used as a basic indicator to show the condition of the traffic flow at specific road. LOS A until LOS C is very much preferable as the traffic can move without long delay. Nevertheless, once the traffic flow reach LOS D to LOS F, the traffic is halted and highly congested. Table 1 below shows the further detailed description of each LOS [1].

One of the ways to mitigate congestion problem is centralization of all Intelligent Transport System (ITS) centres nationwide. Currently, in Malaysia, there are a few ITS which are operated and maintained by several agencies. For example, Kuala Lumpur City Hall (DBKL) has established Integrated Transport Information System (ITIS) where traffic data in Kuala Lumpur and Klang Valley is channelled for monitoring and supervising purposes. Meanwhile, Malaysian Highway Authority (MHA) which is under Malaysian Ministry of Works (MOW) has traffic management centre (TMC) at all tolled highways to collect and manage traffic data and Land Public Transport Agency (APAD) which is under Ministry of Transportation (MOT) is in charge for public transport management including bus and light rail train.

Table 1: Type of LOS and Description [1]

Type of LOS	Description
A	Free flow with individual users virtually unaffected by the presence of other vehicles in the traffic stream. This is a condition of free flow with low volume and high speed of vehicle travel on the highways
B	Stable traffic flow with a high degree of freedom to select speed and operating condition but with some influence from the other users.
C	Restricted flow that remains stable but with significant interaction with others in the traffic stream. The general level of comfort and convenience decline noticeably at this level. Speed and manoeuvrability are closely controlled by the higher volume. Most of the drivers' freedom to select their own speed, change lane or pass are restricted.
D	High density flow in which speed and freedom to manoeuvre are severely restricted meanwhile comfort and convenience have decline. This level of service represents unstable flow with operating speed being maintained, though considerably affected by changes in operating condition.
E	Unstable flow at or near capacity levels with poor level of comfort and convenience. This level represents operation at lower operating speed with volume at or near the capacity of the highways. Flow is unstable and stoppage may occur for a momentary duration.
F	Forced traffic flow in which the amount of traffic approaching a point exceeds the amount that can be served. LOS F is characterized by poor time travel with low comfort, convenience and increase accident exposure. This condition describes a forced flow operation at low speed where volume has reached the capacity level. Speed is reduced substantially and stoppage may occur for short or long periods of time because of the downstream traffic condition.

2. Government Agencies and Their Roles in Transportation

Generally, at an urban area such as Kuala Lumpur, traffic congestion is a common problem especially during peak hour. Most roads in Kuala Lumpur are surrounded by buildings and houses and this condition restricts the capability for the road expansion. Based on traffic count data obtained from Road Traffic Volume Malaysia 2016 (RTVM 2016) [2], Kuala Lumpur has recorded LOS F at several major road as tabulated in Table 2 [2]. The data was collected at the road connecting between Kuala Lumpur to adjacent state. According to new vehicle registration record by Malaysian Road Transportation Department (JPJ) as shown in Figure 1, there is an increase in amount of new car and motorcycle registered from year 1986 to 2016 with total of motor vehicle from 4,439,949 units to 27,163,120 units respectively [2]. This shows amount of new vehicle grows by seven times in urban areas in 30 years. However, the infrastructure capacity does not increase in parallel with the traffic growth due to space limitation and financial constraint.

Table 2: Traffic Count Data in Kuala Lumpur

Census Station Number	Road Location	Level of Service (LOS)
WR101	Kuala Lumpur – Kuala Selangor (Jalan Kepong)	E
WR102	Kuala Lumpur – Ipoh	F
WR103	Kuala Lumpur – Ipoh	F
WR107	New Klang Valley Expressway(NKVE) – Middle Ring Road 2 (MRR2)	F

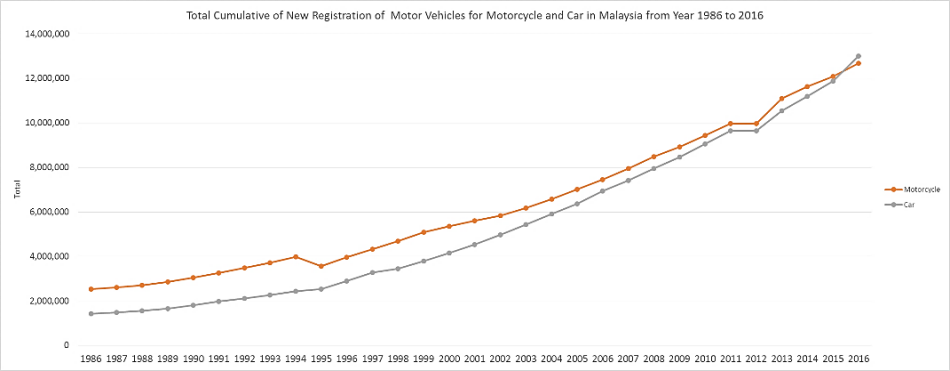

Figure 1. Total Cumulative of New Registration of Motor Vehicles (Motorcyle and Car) from Year 1986 to 2016 [2]

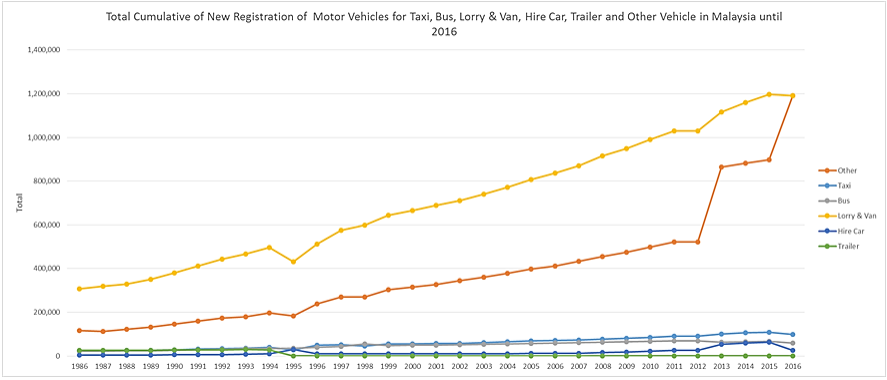

Figure 2. Total Cumulative of New Registration of Motor Vehicles from Year 1986 to 2016 (Taxi, Bus, Lorry and Van) [2]

APAD is in charge for public transportation including bus, train, light rail and also taxi services. APAD plays a major role in providing the public with comfortable and practical public transportation infrastructure with intra-city and inter-city connectivity. The commuter can reach destination without the need to drive private vehicle via public transportation and thus reduce the number of private vehicles on the road. Therefore, one of the ways to encourage people to use the infrastructure is to provide them with reliable journey planner. The journey planner can provide real-time and accurate routes option, bus and train schedule and also estimated fare. Mobile application is much more

preferred as it is accessible by most commuters. With these information, the commuters will likely to opt for public transportation in their everyday routine.

Besides that, the first-and-last-mile of public transportation and connectivity between different public transportation modes are important to encourage the public to use them in daily basis. The distance between the stations and residential areas must be close enough for walking distance. If the location between both areas are far, sufficient parking space and hailing services need to be provided for commuters. Public transportation also contributes to greener environment since it will reduce private vehicle on the road.

On the other hand, DBKL has established a centre named ITIS. ITIS is responsible to monitor the traffic condition on Kuala Lumpur and certain Klang Valley area. The total length of the road under DBKL jurisdiction is approximately 1,539.46 km [3]. ITIS has installed an amount of 250 surveillance cameras for traffic monitoring and key junctions [4]. The information obtained by ITIS is beneficial for other government agencies such as Malaysian Public Works Department (JKR) for highway planning and APAD for bus and taxi route planning.

On the other hand, all tolled highways in Malaysia is operated by highway concessionaires under MHA. The total of tolled highway length is 1,988.21km in Peninsular Malaysia [3]. Since year of 2017, all tolled highways implement electronic toll collection (ETC) and eliminate cash payment as to reduce bottleneck traffic at toll plazas. These toll payments are collected and recorded by authorized highway concessionaires. The implementation of ETC in all tolled highways have improve the traffic flow especially highways within the urban city. Besides the successful of ETC implementation, MHA also install surveillance cameras and Variable Message Signs (VMS) to share the real-time information to the road user if there is any construction, accident or slow traffic ahead. VMS will show traffic information and advice about alternate route available. These valuable information stored by MHA has not been utilized up to its maximum potential. For example, the recorded data in previous years can be used to predict traffic growth in a few years ahead.

All of these agencies play a major role in managing and controlling transportation in Malaysia. Integration of transportation data between these agencies and NITMC is seen as one step forward towards transportation improvement urban cities and create a better lifestyle for the public in general.

3. The Data Management in NITMC

3.1 Data Sources

One of the main objective of NITMC's establishment is to coordinate multiple agencies, collect, analyse and disseminate transportation data among them. The set of data can be utilized to generate a new set of data which is useful for the government and public. In order to succeed, communication between existing control centres under these agencies under the same platform which is NITMC. Besides that, NITMC need to provide a common platform that is ready to integrate, compile and analyse the collected data. Table 3 below is the type of data needed for NITMC from several parties.

On the other side, crowdsourcing is another source of transportation data that can be channelled to NITMC. Crowdsourcing means the source of information is obtained the public through internet. The public can provide data to NITMC by reporting the information such as accident, vehicle stopped at roadside and potholes. Smartphone is one of the efficient and fast way for crowdsourcing since smartphones are equipped with Global Navigation Satellite System (GNSS) and mobile internet. GNSS and mobile internet are needed to enable reports to be sent with location and time of incidents. In addition, pictures on site can also be attached with the report. One of the famous mobile application is Waze. Waze recently added a new feature which the public can send report on potholes. Besides that, Waze can also be used to report on traffic condition, accidents and police on duty ahead of the road. NITMC can collect and utilize data from Waze.

Table 3: Data from government agencies

AGENCY	TYPE OF DATA
Ministry of Works	Road length, traffic count, infrastructure inventory
Ministry of Transportation & Land Public Transport Agency (APAD)	Private and commercial vehicle registration, road transport enforcement and Public transportation data
Malaysian Highway Authority	Traffic count, electronic tolling collection, infrastructure inventory
Local authority	Infrastructure inventory, surveillance camera, enforcement

In addition, industrial player can also play their part to contribute for NITMC success by providing data of fleet tracking to back-end system in NITMC. The data is important for NITMC for data collection and analysis in order to manage the route and schedule of fleet for congestion and accidents control especially during peak hour.
All of these data sources for NITMC can be stored at data warehouse and open limited access to private sector and public.

3.2 Communication Tools Between Vehicles, Roadside Infrastructure and NITMC

Internet of Thing (IOT) devices such as Radio Frequency Identification (RFID) can be a communication tool for data sharing between vehicles, roadside infrastructure and NITMC. For example, RFID tag is unique to each vehicle in terms of its serial number. For example, if one owner has two cars, then there is two RFID with different serial number for both cars.

RFID tag serial number will connect with RFID reader at the road and respond to back-end system to view stored data such as vehicle ownership, vehicle's plate number, backend payment system, road tax and also summon record.

Currently, MHA is working on the implementation of Multi-Lane-Free-Flow (MLFF) by using RFID. The implementation of MLFF will be conducted in several phases. Back in earlier days, all toll plazas only accept cash as a toll payment and yet to implement electronic tolling collection (ETC). ETC is a use of prepaid magnetic card called Touch N' Go (TNG) and as an option, there is an infrared device called Smart Tag (STAG) which hold the prepaid magnetic card that can help the user to pass through the toll plaza without need to stop and touch the card reader. Lanes for TNG and STAG user are separated at toll plaza to ensure smooth traffic flow at STAG lane. Since March 1997, the first ETC was implemented at Jalan Pahang Toll Plaza and a year later, ETC implementation was extended to toll plazas along North-South Expressway (PLUS) route. In year 2017, all tolled-highways replace cash payment method with ETC [6].

In addition, MHA continues to move forward in ETC improvement with MLFF implementation at all tolled-highways. The first phase towards MLFF is to create RFID – TNG lane with barrier and STAG – TNG lane with barrier. Initially, RFID tags was distributed to exempted vehicles for introduction and testing purposes. These exempted vehicles can pass through both lane. Exempted vehicles consists of emergency vehicles,

Later, the next phase is designation of RFID special lane with barrier. This special RFID lane is for vehicles installed with RFID tags only. After the RFID is ready to launch technically and legally, RFID tags will be distributed to all types of vehicle and become compulsory for each vehicle to have

RFID tag. The RFID tag will be distributed in stages due to large amount of vehicles in Malaysia. Then, the third phase is open Single-Lane-Free-Flow (SLFF) without barrier if the legal framework is ready. Legal framework is important as to ensure all highway users pay for the toll or driving any vehicle without RFID tags. Lastly, by early year 2020, MLFF is expected to fully be operated at all tolled-highways. Toll plazas will be replaced with RFID reader and camera speed at gantry.

On the other hand, RFID tags function and benefits are not limited to tolled-highways only. Normal roads can also utilize the advantages of RFID. Roadside infrastructure will be equipped with RFID reader for traffic count purposes, speeding meter sensors, pedestrian crossing sensors and so on. In addition, these abilities are beneficial for journey planning as they can determine current traffic flow condition and spread the information to on-the-road vehicles as to avoid congested area. Therefore, communication between Vehicle-to-Infrastructure (V2I), Vehicle-to-Vehicle (V2V) and Vehicle-to-Centre (V2C) which is NITMC are crucial to fully utilized of the data.

4. The Outputs of NITMC

The NITMC's outputs are as below:

a) The real-time traffic data can be retrieved on the spot. The real-time data can be used for journey planning. If the real-time data collected is sufficient, journey planner can be created for public use. Journey planner may designed to give the user a single mode or multimodal transportation options.

b) Control the accuracy of traffic information spread to the public. Road users can send report to NITMC. If there are multiple similar reports received, the information sent may be identified as true and information verification can be done through CCTV.

c) Increase traffic management efficiency. Currently, traffic is monitored through CCTV and is directly connected to TMC at tolled highways and ITIS for Klang Valley area. The video feed from the CCTV is important as to determine the traffic condition and identify any occurrences happened on the road that could be the root cause of the traffic congestion at that time. Next, VMS play an important role to inform the road user about accidents or any events that affect the road so the road user can opt for other route to reach their destination.

d) The NITMC establishment can help to strengthen the enforcement related to road and transport. For example, RFID tag can store data related to vehicle ownership, road tax and link to bank accounts for toll payment. The stored data can help the enforcers to track any law violators through detection from RFID reader installed at predetermine locations. NITMC will collect data from RFID tag detector and alert the relevant authority for their further action.

e) Historical transportation data can be stored and utilized for data forecasting. RFID tag can also be used for traffic count and the data can be classified in accordance to the vehicle classes. The traffic count data can be collected all year round and stored for forecasting traffic trend.

f) Nationwide common platform for data-sharing among government agencies, private sector and also public. All parties are encouraged to share data so the data collected by NITMC has wider range of data sources.

5. Conclusion

In a nutshell, NITMC is considered as the best alternative to improve traffic and transport management in Malaysia. This will eliminate working in-silo culture in government agencies and narrow the gap among government, private and public community. In the end, all parties from government, private and also public will gain benefits from collaboration and cooperate in making NITMC a successful data centre.

6. References

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