The Social Sciences 6 (1): 24-33, 2011
ISSN: 1818-5800

An Overview of Urban Transport in Malaysia

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Abstract: Economic development and prosperity of countries depend on cities. The urbanization and urban cities gets life from the transportation sector. Malaysian urban transportation has developed in a rapid pace but still needs to meet certain demands of the growing economy and population. This study aims to focus on some of those issues like rise in private vehicle ownerships, motorcycle related concerns, traffic congestion, demand of more public transport, parking, road safety and air pollution. All or some of these factors are dependent on each other. So, rectifying one by one will alleviate the major concerns of traffic congestion and other environmental hazards. When each of these factors is addressed the effective contribution can make successful urban development.

Key words: Urban transportation, roads, car, motorcycle, parking, Malaysia

INTRODUCTION

Urban cities in developing countries have several factors that creates problem to sustainable transport system. The population growth, high income and rapid growth of cities and urbanization has led increase in travel demand. The service of transport sector has always not been up to the mark in developing countries. Most transport facilities fail due to lack of proper planning and design. Besides, the pedestrians and non-motorized vehicle users are less considered when planning urban transport system that creates mixture of traffic in the roads and further complications. Malaysian economy is developing so fast that most of the people afford to have private vehicles and hence the vehicle population has also boomed. Extremely congested roads with all types of vehicles and passengers, traveling at different speed are the present situation of Malaysian roads. This is further worsened by lack of public transport facilities and parking space. Air pollution and other environmental hazards are also yet another concern. This study aims to examine the current status of Malaysian transport sector.

URBAN TRANSPORTATION AND MALAYSIA

Urban economy and development is well dependent and influenced by transportation (Hill, 1965). Owing to the interdependency of various other factors like industries, livelihood of growing population and the environment that affects the socio-economic status, cautiously planned and incorporated transport facilities are very much necessary for the urban world. Malaysian economy is growing rapidly at the present time. The private vehicle number is rising in an escalating manner. Like most of the other British colonized countries, Malaysia also had its urbanization process started by the colonialism.

The basic infrastructures for almost everything were created at this time (Guan, 2001). After the Malaysian independence in the 1957, the pace of urbanization was rather tedious. This took a swifter pace after the 1970. The rapid urbanization and motorization seen in Malaysia at present is mainly due to the expanding economy since 1987 (Morikawa *et al*., 2001). There was an increase of 50.7% in the proportion of urban population in Malaysia from 1991-2000 (Ho, 2008).

As per the global competitiveness index, Malaysia is under the stage 2 and ranks 21st in the global competitiveness index and is in the middle stage of development. The road infrastructure ranks 17th among the world countries (Porter and Schwab, 2008). From 1986-2005, the 20% of development expenditure was distributed in transport sector by the Malaysian government (CPPS, 2008). The capital city of Kuala Lumpur has the maximum rate and the urban development and globalization of Kuala Lumpur has been studied by Bunnell *et al*. (2002). The urbanization and motororization was prominent especially in the Klang Valley (Bunnell *et al*., 2002). The most important feature about the urban development in Malaysia is the urban population itself (Fig. 1). The highway infrastructure is also outstanding. It contains federal roads, state roads and roads (Bughrara, 2008). There are also Light Rail Transit (LRT), commuters and monorails to serve transport needs for the moving population (Schwarcz, 2003). However, traffic congestion,

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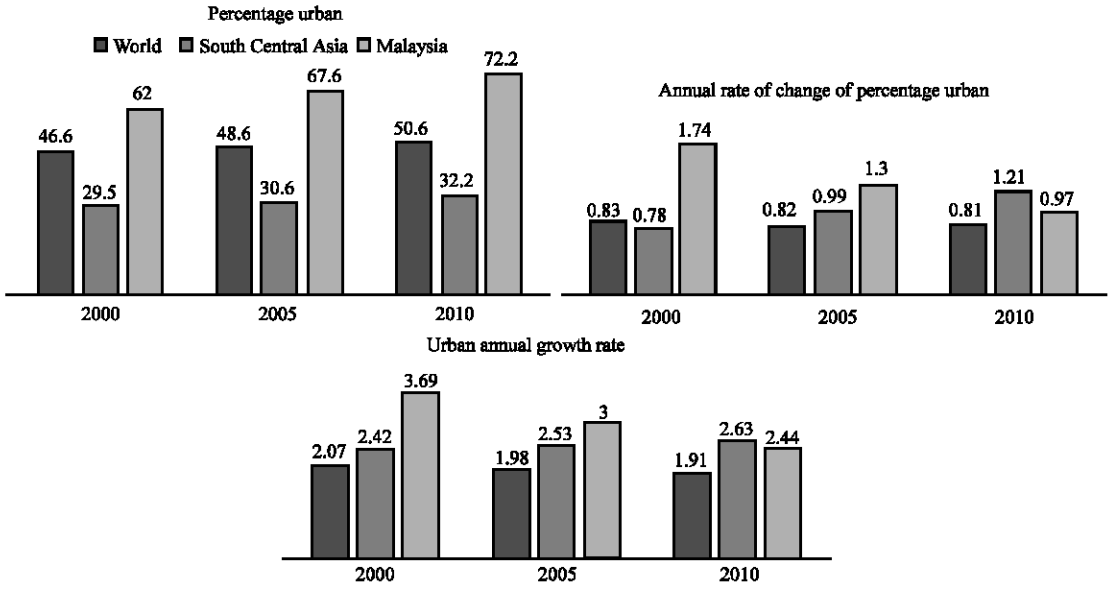

Fig. 1: Graphs showing urban development in Malaysia in the years 2000, 2005 and 2010 (World Bank, 2008)

traffic accidents, limited parking space, environmental pollution all remains concern. In the study of Morikawa *et al*. (2001), they have stated that population aged 45 and above mostly prefer car or public paratransit transportation rather than bus service.

URBAN POPULATION IN MALAYSIA

Urban population growth determines the progress of transport sector in the concerned region (East Asia and Pacific Region, 2006). The bigger the city or its growth, thus is the growth of transport infrastructure. Moreover, the income growth makes people prone to travel much more (Bhat, 1998).

In the developing nations, employment is more concentrated on cities and towns. Both in developed and developing countries, traffic congestion is a major problem in many urban regions (Dissanayake and Morikawa, 2002). Traffic congestion occurs when the road supply does not meet the demand. It is a barrier for the free movement and business in the urban regions.

The population in Malaysia has a steady increase as observed from Fig. 2 and 3. The urban population of Malaysia is about 49.9% as per the World Bank statistics by 2008. About 78% of the urban population has improved sanitation facilities and 132 persons per 1000 people have access to car (World Bank, 2008). According to National Physical Plan Malaysia, in 2020, the urban population percentage will reach to 68.2% that is about 18.8 million people. But as evident from Fig. 2, by

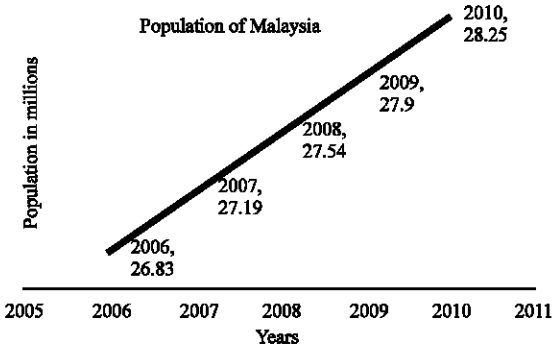

Fig. 2: Population of Malaysia between 2005 and 2010 (Department of Statistics, 2010)

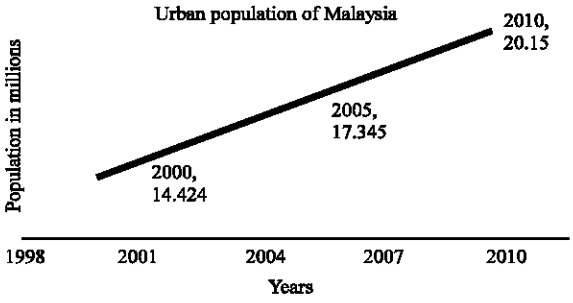

Fig. 3: Urban population of Malaysia between 2000 and 2010 (World Bank, 2008)

2010 itself, the population crossed 20 million. This suggests that the urban population will increase far more than the estimate. Peninsular Malaysia is more urbanized than Sabah and Sarawak, both consisting <50% of urban

population. More than 78% of the urban population have access to basic needs and have well-planned infrastructures including roads (Ho, 2008).

TRANSPORT SYSTEM

The public transport system in Malaysia is very poor and hence, the private transport flourished that about 24% increase was observed in private transport usage between the years 1985-2005 (Lynn and Boyle, 2008). The concerns of pedestrians, bicycle users and bus users are less considered in Malaysia. The available public transport system including buses, trains and cabs are provided by the government. The public transportation facility is modern but lacks service quality. Even in the capital city Kuala Lumpur, the buses arrive late. One of the studies on modeling of transport behavior in Kulala Lumpur suggests the need of efficient public transport system to attract car owners (Nurdden *et al*., 2007a). Nothing different is not the case with trains (Zakaria *et al*., 2010). The rail public transport system introduced in 1980s could not reduce the popularity of private vehicles. Among most of the Asian countries, it is Malaysia that has low rate of public transport usage. The increase in car ownership has created the road network insufficient at the present scenario.

Constructing roads to meet the demand is not so easy especially in Kuala Lumpur (Morikawa *et al*., 2001). Besides the factors like travel time and travel cost, distance from home to public transport and distance from home to work are the contributing factors that influence the modal shift from car to public transport in Malaysia (Nurdden *et al*., 2007b).

Most people prefer cars because of the degree of freedom, accessibility, passion for car and driving, comfort or at times, negative perception on public transport (Steg, 2005; Beirao and Cabral, 2007). Furthermore, use of public transport may put them in between traffic and thus waste their time (Beirao and Cabral, 2007). We found in two different case studies on choice of modal shift conducted in Malaysia that travel time and travel costs are the characteristics that favor car ownership (Kamba *et al*., 2007; Nurdden *et al*., 2008). Urban cities like Kuala Lumpur, Penang, Johor Bahru, Kuching and Kota have an increased car population rate. More than 35% of the nation's oil consumption is by transportation sector (Kari and Rasiah, 2008). As far the nations own automotive company is concerned, the first automotive company, Proton was started in 1981. The other national car, Perodua was established in 1993. In 1998, the percentage of the national cars sold was 90%. Non-motorized transport has been constrained in cities like Kuala Lumpur (Replogle, 1991). Generally, non-motorized transport means to walk or use bicycles (Ryley, 2006). Normally as the country develops, less will be the non-motorized transport users. In Malaysia, the people are less concerned or unaware of the impacts of motorized transport and hence non-motorized transport is not so, common means for travel.

Table 1: Increase in Motorcycle registration from 2005-2009

Years	Motorcycles registered
2005	422255
2006	448751
2007	484598
2008	543122
2009	441545

MIRSR (2010)

Just like the car numbers, motorcycles increased in Malaysia and are among first place in the world to have extremely large number of motorcycles in the cities. Motorcycle is also popular in Malaysia (Table 1) and is more prone to fatalities and causalities (Ooi *et al*., 2005). Motorcycle users are more vulnerable to fatalities and injuries (Beck *et al*., 2007; Adams and Hillman, 2001). When the country develops, the number of motorcycles gradually reduces. However in Malaysia, motorcycles is not only a mode of transportation but are used more for leisure activities (Alt and Mansor, 2006). The motorcycles in Malaysia are under 250 cc and are very expensive (Vien *et al*., 2006). In Malaysia, the motorcycles are allowed in highways whereas in some other countries, it is not so. However, safety measures like compulsory wearing of helmet and exclusive motorcycle lane are prevalent in Malaysia (Hsu *et al*., 2003). More than half of total traffic fatalities are death related to motorcycle accidents (Kulanthayan *et al*., 2000; Rahman *et al*., 2007). A study conducted in January 2005 alone revealed that 68.8% of the road traffic accidents involved motorcycle riders (Moe, 2008). Motorcycle users tend to violate traffic rules like riding along wrong side, not caring for the traffic signals, not wearing helmets, etc. (Rahman *et al*., 2007).

ROAD AND RAIL SYSTEMS

The country has >80% paved roads. However the neighboring country, Singapore has 100% paved roads (World Bank, 2008). Among the Asian cities, only the Klang Valley has high level of expressway length per person (68 m/1000 people) having spatial density those in North American cities and is as good as those in some of the European cities (Barter *et al*., 2003).

The Malaysian Highway Authority (MHA) otherwise called as Lembaga Lebuhraya Malaysia (LLM) is a government agency established in 1980 under the Laws of Malaysia Act 231. Initially, this was setup to build the

Table 2: Various highways in Malaysia and related details

Highway	Length (km)	Date built	Concession
Penang bridge (E36)	13.50	01-Jun-1982	Penang Bridge Sdn. Bhd. Bhd..
North South expressway (E1 and E2)	823.00	15-May-1986	North South Expressway Project Limited
Seremban-Port Dickson (E29)	22.70	09-Aug-1993	Plus Expressways Berhad
The Malaysian Highway Route-Singapore (E3)	4.70	31-Aug-1994	Linkedua (M) Sdn. Bhd. Bhd.. (LINKEDUA) (Linkedua)
Lebuharya Shah Alam (E5)	34.50	31-Jan-1993	Konsortium Expressway Shah Alam Selangor Sdn. Bhd. (KESAS SDN BHD)
Kuala Lumpur-Karak Highway (E8)	60.00	03-Oct-1994	MTD Prime Sdn. Bhd.
Kajang SILK Highway (E18)	37.00	20-Dec-1995	Ring-Kajang Highway System Sdn. Bhd. (SILK) Bhd. (SILK)
Lebuhraya Cheras-Kajang (E7)	11.70	09-Jan-1995	States Grand Saga Sdn. Bhd. Bhd..
Lebuhraya Butterworth-Kulim (E15)	17.00	01-Dec-1994	Konsortiun Lebuhraya Butterworth-Kulim Sdn Bhd. (KLBK SDN BHD)
Lebuhraya Damansara-Puchong (E11)	40.00	26-Apr-1996	Transkota Circle Holdings. (LITRAK) (LITRAK)
Shortcut Highway New North Klang Staits (E30)	17.50	01-Jun-1996	Shapadu Expressway Sdn. Bhd. Bhd..
Ampang Elevated Highway (E12)	7.90	19-Dec-1996	City Crossing Project Sdn. Bhd..
Sungai Besi Expressway (E9)	16.70	14-Feb-1997	Besraya (M) Sdn. Bhd. Bhd..
Butterworth Outer Ring Road (E17)	12.10	27-Apr-1997	Butterworth Outer Ring Road (Penang) Sdn. Bhd.
Lebuhraya KL Traffic Dispersal Scheme-West (E23)	26.00	02-May-1997	Western KL Traffic Dispersal System Sdn. Bhd. Bhd.. (SPRINT) (SPRINT)
East-West Highway relationship (E37)	17.00	13-Jun-2001	Metramac Corporation Sdn. Bhd.
Guthrie Corridor Expressway (E35)	25.00	18-Jul-2000	PROLINTAS Expressway Sdn. Bhd. Bhd..
New Pantai Expressway (E10)	19.60	01-Jan-1999	New Pantai Expressway Sdn Bhd. Bhd..
Senai-Desaru Expressway (SDE) E22	77.00	18-Jul-2005	Senai-Desaru Expressway Berhad
KL-Tutrajaya Highway (E20)	26.00	06-Dec-2004	Maju Expressway (MEX) Sdn Bhd. Bhd..
SMART Tunnel (E38)	3.00	02-Jun-2004	Stormwater Management Companies and Tunnel Sdn Bhd. Bhd..
North South Expressway (Open)	500.00	15-Jun-2001	North South Expressway Bhd Project. (PLUS) (PLUS)
East-West Highway relationship (E37)	17.00	13-Jun-2001	Metramac Corpotation Sdn. Bhd.
East Coast Expressway (Phase 1) (E8)	169.00	30-Aug-2000	MTD Prime Sdn. Bhd. Bhd..
Kajang Seremban Highway	44.30	18-Jul-2005	Lebuhraya Kajang-Seremban Sdn. Bhd. Bhd..
South Klang valley Expressway (SKVE)	51.00	29-Aug-2006	SKVE Holding Sdn. Bhd. Bhd..
Lebuhraya Kemuning-Shah Alam (Tournament)	14.70	27-Nov-2006	Project Track Shah Alam Sdn. Bhd. Bhd..
Lebuhraya Kajang-Seremban (E21) Lebuhraya Kajang-Seremban (Ez21)	44.30	01-Jan-2007	Lebuhraya Kajang-Seremban Sdn. Bhd. Bhd..
Lebuhraya Kajang-Seremban (soon) ~2B and Package 3 Package	18.28	04-Jan-2007	Lebuhraya Kajang-Seremban Sdn. Bhd. Bhd..
Kuala Lumpur-Kuala Selangor (KLKS)	31.00	28-Oct-2008	KL-Kuala Selangor Expressway Bhd.

Malaysian Highway Authority (2010)

North-South Expressway but now it monitors and implements the design, construction, operation and maintenance of highways and expressways in Malaysia (LLM, 2010; Wikipedia, 2010). Table 2 shows the highways in Malaysia. At present, there are three highways under construction: East Coast Expressway (phase 2), 79 km; Johor Bahru Eastern Dispersal Link (EDL), 8.1 km and Linking Project Kinrara Interchange North of the Shah Alam Expressway to Old Klang Road, 0.50 km.

The history of rail based transit system began in 1995 in Kuala Lumpur with the introduction of Keretapi Tanah Melayu Berhad's (KTMB) Komuter. This serves Rawang in the north, Seremban in the South, Sentul in the east and Port Klang in the west (Bachok *et al*., 2004). Star LRT and Putra LRT also started in the 1990s which are operated by private sector (Bunnell *et al*., 2002). The Putra LRT system is propelled by a linear induction motor and is automated driving with no driver. It is linked with other transport systems and is facilitated with bus stops and interchanges. In addition to these the Kuala Lumpur has monorail system of 8.6 km built over an elevated track (Bunnell *et al*., 2002).

PARKING

The number of newly registered vehicles has increased immensely in Malaysia (Table 3). In 2009, alone around 536905 vehicles were registered in Malaysia of which 486342 were passenger cars. Within June 2010 itself, the total number of vehicle registration figured 301077. From 2005, the number of new cars began to rise at kept almost a steady pace until 2009. This will certainly continue in the following years. Parking is a basic need for transportation. It is a common problem in almost all cities in the world. As the number of vehicles increase, the need for parking facilities too proportionately increases. Especially in a country like Malaysia, the space is very limited in shopping malls (Ahmed *et al*., 2007). Parking is really a headache to the parking patrons with cost and frustration (Idris *et al*., 2009). Parking management and policies are very much important to avoid traffic congestion, traffic accidents, pollution and unwanted fuel use. Increased car ownership, changes in traffic arrangements and densification of land creates a diminished supply of parking facility (Prabuwono and Idris, 2008).

Table 3: Summary of new passenger and commercial vehicles registered in Malaysia for the year 1980 to the June 2010

Years	Passenger cars	Commtercial vehicles	4×4 vehicles	Total vehicles
1980	80,420	16,842	-	97,262
1985	63,857	26,742	4,400	94,999
1990	106,454	51,420	7,987	165,861
1995	224,991	47,235	13,566	258,792
2000	282,103	33,732	27,338	343,173
2005	416,692	97,820	37,804	552,316
2006	366,738	90,471	33,559	490,768
2007	442,885	44,291	-	487,176
2008	497,459	50,656	-	584,115
2009	486,342	50,563	-	536,905
YTD June 2010	271,873	29,204	-	301,077

MAA (2010)

It is the building and shop owners who have parking as their chief concern especially during peak shopping periods and weekends (Prabuwono and Idris, 2008). The customers dislike moving in search of parking space and trekking from one mall to another (Ahmed *et al*., 2007). In 2005, Malaysian Highway Authority, Malaysian Public Works Department and Ministry of Transport in Malaysia together set up a traffic management system called as Integrated Transport Information System (ITIS). This system was set up to monitor traffic, accident, construction and other situations that occur on the roads and highways in Kuala Lumpur and Klang Valley. This system consists of 2 main components as Advance Traffic Management System (ATMS) and Advance Travellers Information System (ATIS). All of these uses technology to provide better transport services (Wikipedia, 2010).

There are also systems or technologies that could deliver information about availability and location of parking space. The use of Intelligent Parking Systems (IPS) can provide better information on parking availability. It also reduces parking time and frustration due to congestion (Teodorovic and Lucic, 2006). In addition, it can also congestion, illegal parking and air pollution (Vianna *et al*., 2004; Barth and Todd, 2002).

Some of the problems that parking customers face is the lack of knowledge of parking space location, operating hours and cost of parking and most prominently, the availability of parking upon their arrival (Andre, 1991). The parking of a car correlates to lot of other factors like user behavior, space utilization, design of parking zone, safety and security etc. (Litman, 2006). The common type of parking system seen in Malaysia is shared-parking turn-time system (Iman and Hamid, 2006). This type of parking creates less supply when compared to demand. However, they have proved in their study that there are zones where additional parking space could be provided and meet the demand. The smart parking system was initially started in Europe, United States, United Kingdom and Japan (Chinrungrueng *et al*., 2007). This type of parking system is ideal for both parking operators and patrons in addition to environmental conservation (Chinrungrueng *et al*., 2007). This helps the parking operators to plan for the future policies and developments with the gathered parking information. This prevents the excess travel by vehicles and thus less air contamination. The patrons on the other hand are benefited by the safer, efficient, minimal time parking facility in addition to avoiding traffic congestion and illegal parking. They are able to point out the vacant parking lots (Chinrungrueng *et al*., 2007).

Touch'n Go cards in Malaysia are used for parking payments and payment for bus and trains. The Touch'n Go cards were initially intended to be used in toll booths in Malaysian Highways (Ramasamy *et al*., 2006). Touch'n Go was launched in 1997 at Metramac Highway and PLUS Expressways. It is a pre-paid e-payment card and has the credit that is the only Electronic Toll Collection (ETC) operator in Malaysian highways (Touchngo, 2010). The service provider of Touch'n Go, Touch'n Go Sdn Bhdis also provides a device called Smart TAG which is an on-board unit that to allows the Touch'n Go card user to pay toll with drive-through convenience. This device enables the detection of the installed vehicle within a span of 40 milli sec and 4 times speeder than cash lane (Touchngo, 2010).

ROAD SAFETY

Road safety is a major issue in urban transportation throughout the world (Soderlund and Zwi, 1995). The road traffic injury is labeled as the 9th leading cause of disability in the world (Langley and Brenner, 2004). Owing to the rapid motorization and urbanization, the rate of road fatalities is rising at a faster pace. The working population and children are the majority of the victims of road traffic collisions (Nantulya and Reich, 2002). The growth in urban population, industrialization, motorization, economic development all contributes to the road accident rate in cities. As far as Malaysia is concerned, all these factors have increased over time since independence. The Malaysian government has also set up Malaysian Institute of Road Safety (MIROS) in the year 2007 to carry out research and development on road safety. They design the road safety standards, audits and database for safe vehicles etc. (CPPS, 2008).

In Malaysia, there was an increase in road fatalities over time. The fatal accident crossing 6,000 numbers in 2009 which was <5,500 until 2002 (Table 4). Even though, there is a decreasing trend in the road fatalities over the 7 years, the reasons for the existing fatalities

Table 4: Road fatality statistics of Malaysia (type of injury)

Parameters	Years 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Accident injury type										
Fatal accident	5,440	5,230	5,378	5,634	5,674	5,604	5,711	5,672	5,952	6,218
Serious injury	8,067	6,942	6,696	7,163	7,444	7,600	7,375	7,384	7,020	6,978
Minor injury	28,778	30,684	30,259	31,357	33,413	25,928	15,596	13,979	12,893	12,072
Total accident injury	42,285	42,856	42,333	44,154	46,531	39,132	28,682	27,035	25,865	25,268
Total accidnet without injury	208,144	222,319	237,378	254,499	280,283	289,136	312,550	336,284	347,182	371,926
Total accident	250,429	265,175	279,711	298,653	326,814	328,268	341,232	363,319	373,047	397,194
Injury type										
Fatal	6,035	5,854	5,891	6,286	6,228	6,188	6,287	6,282	6,527	6,745
Serious injury	9,790	8,689	8,425	9,040	9,229	9,397	9,254	9,273	8,866	8,849
Minor injury	34,375	35,974	35,236	37,415	38,631	31,429	19,884	18,444	16,901	15,823
Total injury	50,200	50,517	49,552	52,741	54,088	47,014	35,425	33,999	32,294	31,417

Malaysia Road Safty Department (2010)

Table 5: Fatality report: mode of vehicle

Road user	2002 (%)	2008 (%)	2009 (%)
Motorcycle	58.21	59.72	60.30
Car	17.37	20.45	20.83
Pedestrian	11.03	9.16	8.73
Bicycle	4.43	3.11	3.32
Van	2.65	1.47	1.35
Bus	0.76	0.75	0.46
Lorry	1.26	1.62	1.16

MIRSR (2010)

Table 6: Road fatality statistics of Malaysia in relation vehicle and population

Years	Every 10,000 vehicle	Every 100,000 population
2002	4.88	25.3
2003	4.90	25.1
2004	4.15	24.3
2005	4.21	23.7
2006	3.98	23.6
2007	3.74	23.1
2008	3.70	23.5
2009	3.55	23.8

MIRSR (2010)

are to be addressed (Mustafa, 2005). Among all road traffic fatalities, it is the motorcycle crashes that are more fatal above all others. In the year 2000, there was a total of 79,816 crashes involving motorcycles which is almost 3 times the number of crashes occurred in 1990 and 3,000 individuals lost their lives in the crashes (CPPS, 2008). In 2002, the percentage of death due to motorcycle was 58.21% but by 2009, it has reached about 60.3% (Table 5). The second largest cause of traffic fatalities is cars that accounts to about 20.83% in 2009.

The least numbers are shown by bus which may be attributed to the low rate of bus service in the country. Many motorcyclists do not follow traffic signals and are red light runners (Porter and England, 2000) and about 6% of motorcycle accidents in Malaysia has occurred at traffic signal site (Law *et al*., 2003). Most of the motorcycle accidents are found to be with other vehicles (Yen *et al*., 1999). This is similar to the findings of Whitaker (1980). The traffic density is very high that it is also a contributor of road traffic accidents.

The year wise account for the traffic injuries for every 10,000 vehicle and 100,000 population can be shown in Table 6. Other factor for accidents is festive seasons which make the road filled with vehicles and 5% of road fatalities occurred at festive seasons (Mustafa, 2005). There have been actions from government to reduce the incidence of accident. As part of this, RM 200 million was allocated in 9th Malaysia Plan for improvement of roads to reduce the accident rate at 5 dangerous spots (The Economic Planning Unit, 2006).

URBAN AIR POLLUTION

Urban air pollution has both short term and long term ill effects on human health and increases mortality rate (Beelen *et al*., 2008; Brunekreef and Holgate, 2002). Motrocycle are larger contributors to air pollution in Malaysia. The hydrocarbon, lead and nitrogen oxide etc., causes severe health problems. Diseases like asthma, chronic lung diseases and neurological defects etc., occurs due to this air pollution (Kampa and Castanas, 2008). The brisk increase of CO_2 emission from the large number of vehicles on road is real concern for policy makers and the scientific community is much worried on the resultant global warming. About 1% increase in the population increases 1.42% of CO_2 emissions on average (Shi, 2003). Reducing the green house gases is a challenging task for a developing country like Malaysia.

The rise in income level and private vehicles creates more CO_2 emissions. In the year 2000 itself, the per capita CO_2 emission of Malaysia is 5.4 metric ton which is more than the global average (3.9 metric ton per capita) and Asian average (2.2 metric ton per capita) (World Resource Institute, 2007). The data from World Resource Institute (Table 7) shows that the CO_2 emission is increasing in Malaysia. The Co_2 emission in Malaysia can be reduced by reducing the motor vehicle numbers, reducing the travel distance by motor vehicles making proper land use planning etc. (Ho and Fong, 2007).

Table 7: Total CO_2 emissions (million metric ton of CO_2)

Places	2000	2003
World	23,832.70	25,575.99
Asia (excluding middle east)	7,272.53	8,477.90
Malaysia	116.19	140.95

World Resource Institute (2007)

CONCLUSION

Even though, congestion cannot be eradicated completely, transport policy makers should implement strategies to enable cost effective management of congestion without giving much burden on urban travelers. Especially in the festive seasons and holidays, special services should be provided to alleviate traffic congestion; for example, providing predictable travel times.

They should also consider proper land use pattern together with sufficient public transport facilities accessible to more people and locations. Parking management can also support the traffic congestion. Implementing smart technologies could diminish the travel time and cost.

For example, we designed a smart traffic controller system and experimented it for a year in busiest junctions in Malaysia which had a positive outcome of reducing the total vehicle queuing time up to 30% than the other traffic controller systems (Purnomo *et al*., 2009).

Public transport enables mobility of bulk of people than individuals using private vehicles like car. Improving public transportation means is a fundamental traffic management strategy which Malaysia needs to follow from other developing countries.

Actions should be taken to promote the shift of private transportation to public transportation. The current situation of public transport can be addressed by improving accessibility, ease and comfort of traveling. In addition, it should enhance reliability, safety and security. Promoting the public transportation can reduce the oil and gas use by transportation sector. Public transportation factices when improved can automatically reduce the car ownerships at least to a small extend. Deliberate and strict policies should be brought into reduce the car ownership which otherwise will make the car ownership a great concern that will be impossible to be addressed in the future.

Existing infrastructure should be modified or new infrastructures should be constructed taking into consideration the motorcycle users which are the maximum travelers and the pedestrians. Growing population of vehicles in roads causes serious consequences of road fatalities.

Especially in Malaysia, the large population of motorcycle is the sole contributor of severe road fatalities and has always been on top for several years. The heavy traffic mixture with poor road management and infrastructures should be carefully planned and addressed. Road safety issues must be addressed by implementing better policies like enforcement of child restraint seats and seat belts for all passengers. Malaysian people should be made aware of air pollution and its hazards to reduce air pollution. The large number of vehicle, particularly motorcycles, traffic congestion and lack of parking space adds to the air pollution.

A shift towards public transportation can reduce the emission of CO_2. Energy efficient technologies should be introduced and adopted by automobile industry as major energy consumption of Malaysia is done by the transport sector.

A well organized and planned strategy can dwindle the travel distance and congestion in addition to less fuel consumption.

Finally, there is need to organize and plan various factors mentioned above involved in development and improvement of urban transportation sector in Malaysia. It is crucial for Malaysia to resolve all the mentioned problems and make transportation in Malaysian cities better.

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