Vehicle Composition in Indonesia and Malaysia

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Abstract: Increasing congestion in Indonesia in recent years is mainly caused by unsatisfactory public transport provision and uncontrolled developments. Traveler have to decide their route with the shortest time avoiding congestion and using motorcycles. In this sense, it might change vehicle composition. It was indicated previous studies in multilane highways. Therefore, traffic compositions in multilane highways can not represent overall vehicle composition of the cities and the use of vehicle registration data was considered to be better. Knowledge on vehicle composition can be utilized to change unclasiffied traffic count data into predicted classified traffic count data as in Indonesian mixed traffic, traffic flow should be converted from vehicles/ hour into passanger car units/ hour. By conducting present research, suggested values of vehicle composition in Indonesian Highway Capacity Manual (1997) can be corrected. Malaysian cities were different from Indonesian cities. It would be beneficial to conduct vehicle compositions international comparison.

Keywords: Vehicle Composition, Indonesian Cities, Malaysian Cities

1. INTRODUCTION

Increasing congestion in Indonesia cities in recent years is mainly caused by lack of satisfactory public transport provision and uncontrolled cities developments, e.g. in the case of Jakarta the development of Bodetabek creates substantial commuter traffic (Figure 1). As the public felt that no serious effort has been carried out by the government to provide satisfactory public transport, they tried to find their own solution by owning and using motorcycles (Figures 2 and 3). Motorcycle can be easily purchased by very attractive installment even without substantial downpayment, so its affordable for almost everybody. Motorcycle is also believed as the best solution to shorten daily travel time. As in general it can be deducted that growths of motorcycle ownerships ini Indonesian cities and regencies are higher than the growth of other vehicle types, the vehicle composition in Indonesian cities and regencies might be already changed. This was indicated in Putranto and Setyarini (2011) which based on traffic distribution accross multilane highways in 5 cities in Indonesia (Bandung, Surabaya, Mataram, Medan and Makassar). However, traffic compositions in multilane highways can not represent overall vehicle composition of the cities so the use of vehicle registration data might be better.

In order to control the growth of motorcycle in Indonesia the government have already had some policies. This can be seen in Table 1.

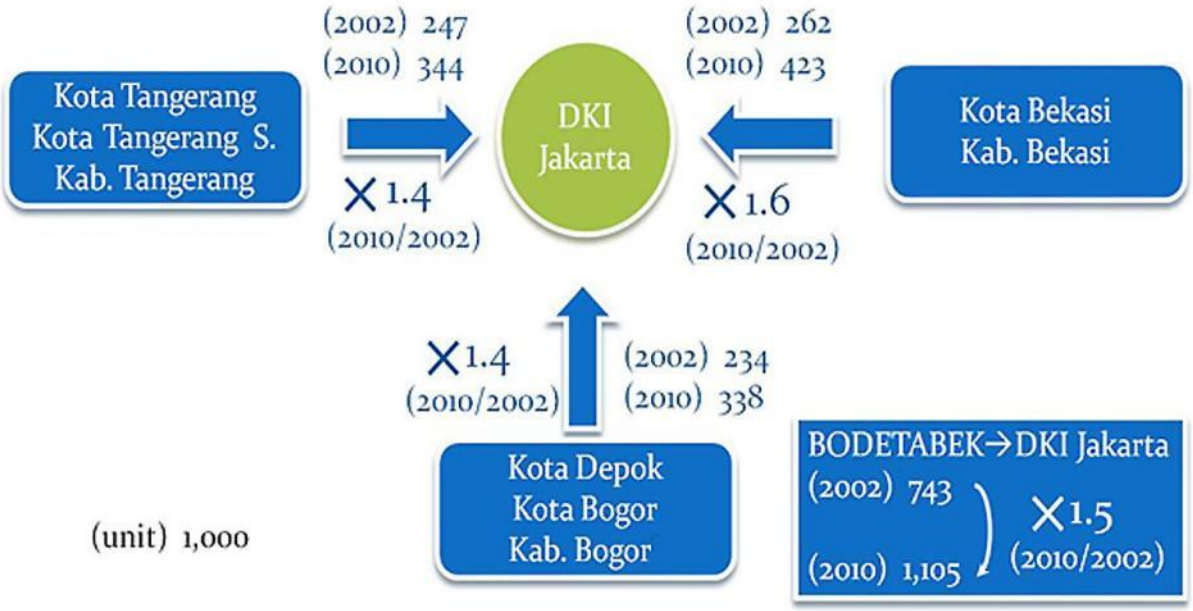

Figure 1. High Commuter Trip to CBD (Source: JUTPI)

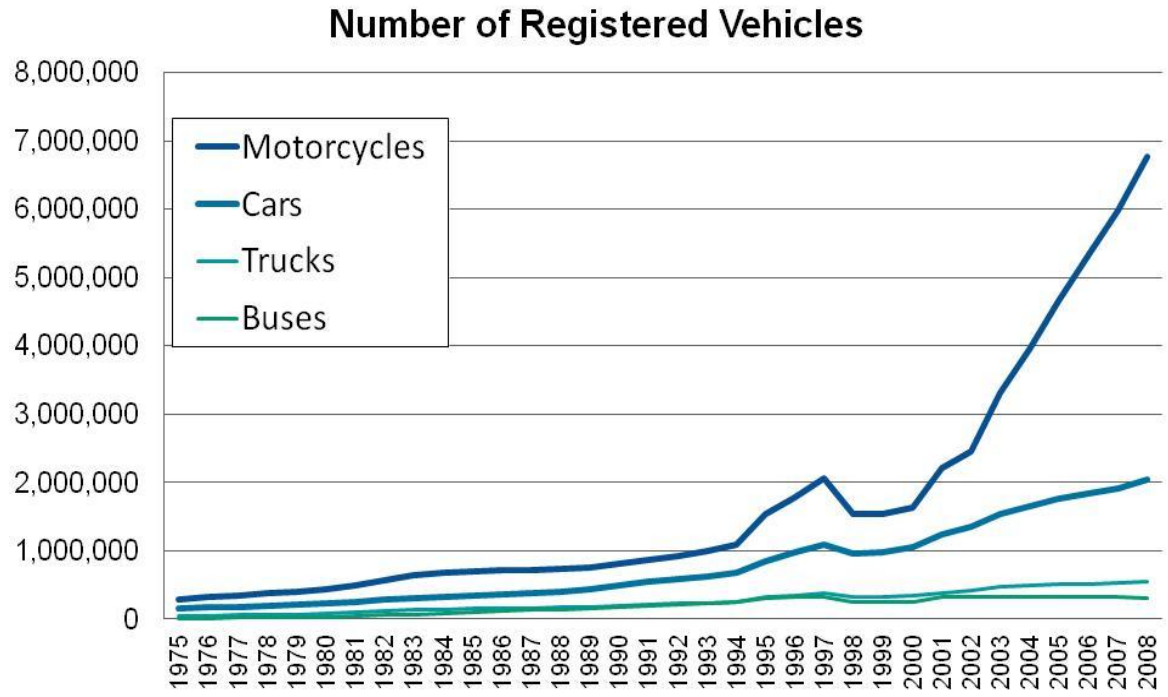

Figure 2. High Motor Vehicle Demand (Source: Indonesian National Police)

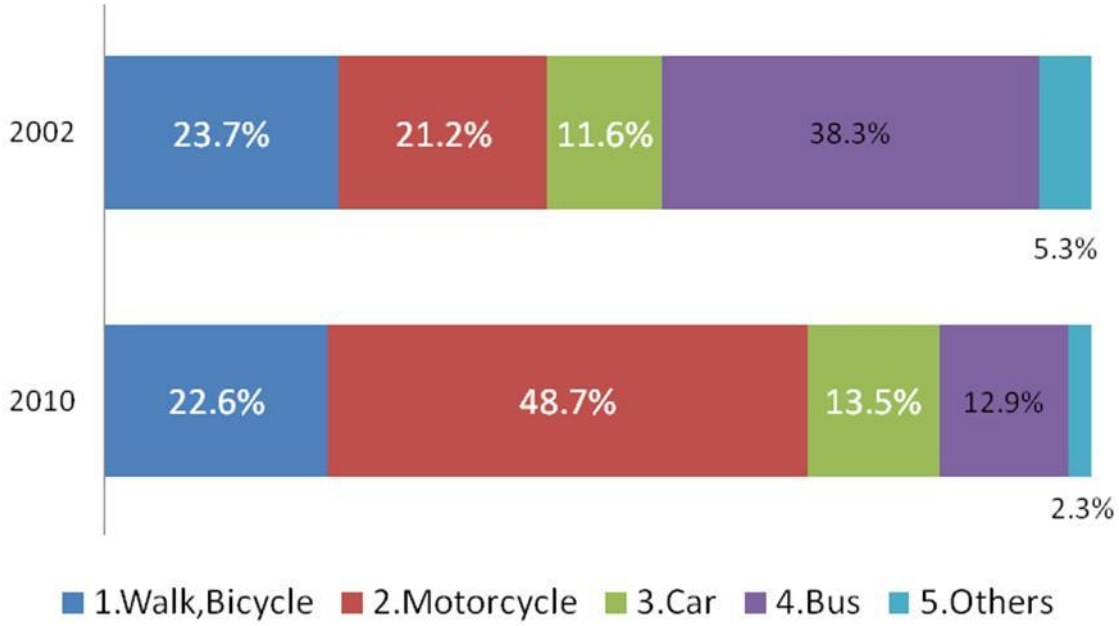

Figure 3. High Proportion of Motorcycle (Source: JUTPI)

Table 1. Indonesian Policy on Motorcycle Growth Management (Putranto et al, 2011)

Instrument	Description
Transportation system	Development of mass rapid transit
Safety	Vehicle test, the use of standardized helmet, safety education, law enforcement
Fiscal	Increase ownership tax, increase fuel price, road pricing, increase parking fee
Environment	Implementation of emission and air quality standard, sustainable engine and fuel technology,
Traffic management	Motorcycle lane, zero motorcycle parking and motorcycle use in certain areas, speed limit
Suporting policy	Accident information system, vehicle registration and driving license sytem, police officers skills development

2. OBJECTIVE AND URGENCY

The objective of this research is to examine the change on vehicle composition in Indonesian Cities and Malaysian Cities based on traffic count and registered vehicles. Knowledge on vehicle composition can be utilized to change unclasiffied traffic count data into predicted classified traffic count data. Classifed traffic count data in Indonesia is quite important as in mixed traffic situation the traffic flow should be converted from vehicles per hour into passanger car units per hour.

Malaysian cities were different from Indonesian cities in terms of public transport availability, level of city development control and level of motorcycles use control. At the moment Malaysia also in the preparation to update Malaysian Highway Capacity Manual. It would be beneficial for researchers from both country to conduct international comparison on vehicle compositions in both countries.

By conducting this present research, suggested values of vehicle composition in Indonesian Highway Capacity Manual (1997) which was grouped by range of city size in terms of number of population can be possibly corrected. The updated Malaysian Capacity Manual might also get benefit from this research.

3. PREVIOUS STUDIES

IHCM (1997) provide reference values for traffic composition based on city size in terms of number of population (Table 2). Data from 17 cities in Indonesia were collected. It was found that in smaller cities, percentage of motorcycle in the general traffic was tend to be higher whislt in larger cities the opposite was true.

Table 2. Reference value of vehicle composition in IHCM (1997)

Number of Population (in Million)	Vehicle Composition (%) by Vehicle Type		
	Light Vehicle	Heavy Vehicle	Motorcycle
<0,1	45	10	45
0,1-0,5	45	10	45
0,5-1,0	53	9	38
1,0-3,0	60	8	32
>3,0	69	7	24

Putranto and Tantama (2009) conducted 24 hours traffic count in Bandung, Surabaya and Mataram. In each city, 2 four lanes-two ways divided roads (4/2 D) and 2 six lanes-two ways divided (6/2 D) road were observed in a normal working day. Unfortunately, Mataram had no six lanes-two ways road found to be eligible for observation. Statistical tests showed that percentage of motorcycle in each city was significantly higher than reference value in Table 2, whilst percentage of light vehicle and percentage of heavy vehicle in each city were significantly lower than reference values in Table 2. In IHCM (1997) Bandung and Surabaya are in the same group of city size. However, statistical tests showed that percentages of motorcycle in Bandung and Surabaya were significantly different and percentages of light vehicle in Bandung and Surabaya were significanly different. This finding indicates that grouping cities with similar vehicle composition could not rely on the city size. Similar results (Putranto and Setyarini,2011a) also found for Medan and Makassar. From other publication by Putranto and Setyarini (2011b) there will be also available vehicle composition on multilane highways in Palembang and Denpasar.

According to Putranto, Grant-Muller, Montgomery (2007), in a non-car owning household, the higher the number of household members, the higher the number of motorcycles. Study also found at a city occupied by many universities, the higher the number of students (number of household members aged >16 years old) the higher the number of motorcycles. The higher the wealth level the lower the number of motorcycles.

Putranto (2004) found that the number of motorcycles produced was usually similar to the number sold domestically. Some production was exported. The percentage of exported motorcycles reached a peak (16%) in 1998 due to low domestic market absorption. Normally, exported motorcycles account for fewer than 10% of total production.

Tuan and Shimizu (2005) found in Hanoi, Vietnam, that increases in number of workers or students, motorcycle price, income, and previous transactions significantly influence current motorcycle ownership decisions. Sufficient high taxes imposed on motorcycle users could be effective in controlling the ownership.

4. METHODOLOGY

Several cities which have been observed for the purpose of lane distribution study, i.e. Bandung, Surabaya, Mataram, Medan, Makassar, Denpasar and Palembang. Vehicle composition in multilane highways and the lane distribution data were collected. Police vehicle registration data would be chosen as a reference due to in-accurate data on vehicle composition. An adjustment factor from partial data to overall data could then be calculated. This adjusment factor (equation 1) can be used to predict overall vehicle composition in particular area, if only traffic count in multilane highways available and access to police vehicle registration data can not be gained. Similarly such adjusment factor will be produced for Malaysian cities.

$$Adjusment\ Factor = \frac{Vehicle\ Registration\ Data}{Survey\ Data} \quad (1)$$

5. ANALYSIS

In the original plan the international comparison between Indonesia and Malaysia was city based. However city based data was available for both traffic count and vehicle registration only in Indonesia. In Malaysia, traffic count was accumulation of city based data in a state but vehicle registration was state based. Therefore in Malaysia there will be no direct comparison between vehicle composition from traffic count data and from vehicle registration data. In Indonesian case, traffic count was based data collected by the first author in previous research and therefore the road specification was predetermined (4 lanes-2 ways divided and 6 lanes-2 ways divided) and road widths were measured. In Malaysia traffic count data was from Road Traffic Volume Malaysia (RTVM) 2009, a database software published by Highway Planning Unit, Ministry of Works Malaysia covering highways without road specification. However the road specification is assumed to be similar with Indonesian road specification. Table 3 shows the comparison of vehicle composition based on 24 hour traffic count and based on vehicle registration in Indonesia while Table 4 shows similar for Malaysian case and Table 5 shows the summary of the ratio for Indonesian case and Malaysian case.

Table 5 shows proportion of registered motorcycles can be predicted by 24 hours traffic count in multilane highways with only slight underestimate error (18% in 4/2D and 30% in 6/2D) for Indonesia case. The proportion of registered of light vehicles was overestimated by the survey and the proportion of heavy vehicle was highly underestimated by the survey. The latest might be due to limited operation hours of heavy vehicles in the surveyed highways.

The prediction of proportion of registered vehicles using traffic count data was not suitable for Malaysia case. This is due to very high proportion of registered motorcycles in Malaysia but mainly operated in local roads which were not observed in the traffic count database**.**

5. CONCLUSIONS AND RECOMMENDATION

In this research, it can be concluded that in Indonesian case, proportion of registered motorcycles can be predicted by 24 hours traffic count in multilane highways with only slight underestimate error. The proportion of registered of light vehicles was overestimated by the survey and the proportion of heavy vehicle was highly underestimated by the survey while in Malaysia, prediction of proportion of registered vehicles using traffic count data was not

suitable since we used only the data from Road Traffic Volume Malaysia (RTVM) 2009. Therefore, it is recommended to trace more comprehensive vehicle registration data base in both countries.

Table 3. Comparison between Vehicle Composition based on 24 Hours Traffic Count and Vehicle Composition based on Vehicle Registration Data in Indonesian Cities

City	Based on 24 hours traffic count					Based on Vehicle Registration				Registration/Survey		
	Road Name	Lane Configuration	LV	HV	MC	Data Year	LV	HV	MC	LV	HV	MC
Bandung	Ahmad Yani	4/2 D	28.1	1.0	70.9	2009	22.5	6.3	71.2	0.80	6.30	1.00
	Supratman	4/2 D	32.8	1.0	66.2					0.69	6.30	1.08
	Laswi	6/2 D	42.6	0.8	56.6					0.53	7.88	1.26
	Terusan Pasteur	6/2 D	42.8	1.5	55.7					0.53	4.20	1.28
Surabaya	Genteng Kali	4/2 D	30.3	0.4	69.3	2009	9.0	4.8	86.2	0.30	12.00	1.24
	Jemur Andayani	4/2 D	22.8	1.4	75.7					0.39	3.43	1.14
	Ahmad Yani	6/2 D	27.3	1.1	71.5					0.33	4.36	1.21
	Jemur Sari	6/2 D	28.4	1.7	70.0					0.32	2.82	1.23
Mataram	Ahmad Yani	4/2 D	20.9	5.1	73.9	2008	27.1	23.0	49.9	1.30	4.51	0.68
	Sriwijaya	4/2 D	19.3	0.7	80.0					1.40	32.86	0.62
Medan	N. Surbakti	4/2 D	33.6	4.4	62.0	2007	15.6	7.0	77.4	0.46	1.59	1.25
	A.H. Nasution	4/2 D	44.4	3.8	51.8					0.35	1.84	1.49
	Sisingamangaraja	6/2 D	40.3	5.6	43.1					0.39	1.25	1.80
	Gatot Subroto	6/2 D	30.4	0.4	68.8					0.51	17.50	1.13
Makassar	Perintis Kemerdekaan	4/2 D	28.0	1.1	70.9	2009	16.6	2.8	80.6	0.59	2.55	1.14
	Sam Ratulangi	4/2 D	39.8	0.4	59.8					0.42	7.00	1.35
	Pettarani	6/2 D	31.9	1.5	66.6					0.52	1.87	1.21
	Pengayoman	6/2 D	29.6	0.9	69.5					0.56	3.11	1.16
Palembang	Alamsyah Prawiranegara	4/2 D	31.7	26.0	42.3	2010	16.1	3.1	80.8	0.51	0.12	1.91
	Basuki Rahmat	4/2 D	32.4	5.2	62.4					0.50	0.60	1.29
	Gubernur H.A.Bastari	6/2 D	25.5	1.8	72.7					0.63	1.72	1.11
	LetJen Harun	6/2 D	33.4	16.5	50.1					0.48	0.19	1.61
Denpasar	Bypass Ngurah Rai	4/2 D	21.7	2.1	76.2	2010	18.1	2.0	79.9	0.83	0.96	1.05
	Sunset Road	4/2 D	31.4	3.1	65.4					0.58	0.65	1.22
	Puputan Renon (DS)	6/2 D	35.8	2.3	61.9					0.51	0.89	1.29
	Puputan Renon	6/2 D	35.7	2.4	61.9					0.51	0.85	1.29

Table 4. Comparison between Vehicle Composition based on 16 Hours Traffic Count and Vehicle Composition based on Vehicle Registration Data in Malaysian States

States	Based on 2009 16 Hours Survey			Based on 2009 Vehicle Registration			Registration/Survey		
	LV	HV	MC	LV	HV	MC	LV	HV	MC
Perlis	68.9	5.3	25.8	23.0	1.4	75.6	0.33	0.26	2.93
Kedah	60.1	7.8	32.0	28.3	2.2	69.5	0.47	0.28	2.17
P.Pinang	62.4	6.3	31.3	43.6	1.9	54.5	0.70	0.30	1.74
Perak	63.9	12.3	23.8	35.9	2.4	61.7	0.56	0.20	2.59
Selangor	75.5	8.8	15.7	49.2	3.7	47.1	0.65	0.43	3.00
Wilayah Persekutuan	78.3	5.4	16.4	67.4	2.2	30.4	0.86	0.40	1.86
Negeri Sembilan	73.5	10.4	16.1	38.8	3.3	57.9	0.53	0.32	3.60
Melaka	68.4	6.2	25.5	42.3	1.9	55.8	0.62	0.31	2.19
Johor	69.9	10.0	20.1	44.7	2.9	52.4	0.64	0.29	2.60
Pahang	71.6	12.1	16.3	40.8	2.9	56.3	0.57	0.24	3.46
Terengganu	68.5	11.4	20.1	36.6	2.6	60.7	0.53	0.23	3.02
Kelantan	69.7	6.8	23.6	37.9	2.1	60.0	0.54	0.32	2.54
Sabah	71.9	23.1	5.0	69.2	6.9	23.9	0.96	0.30	4.82
Sarawak	68.3	14.9	16.9	51.7	3.1	45.2	0.76	0.21	2.68

Table 5. Summary of Ratio between Percentage of Each Type of Registered Vehicles and Percentage of Each Type of Vehicles Counted in Traffic in Indonesian Cities and Malaysian States

Vehicle Type	Indonesian Cities						Malaysian States		
	4/2 D			6/2 D					
	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Light Vehicle	0.30	0.65	1.40	0.32	0.48	0.63	0.33	0.62	0.96
Heavy Vehicle	0.12	5.76	32.86	0.19	3.89	17.50	0.20	0.29	0.43
Motorcycle	0.62	1.18	1.91	1.11	1.30	1.80	1.74	2.80	4.82

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