

TRAFFIC CONGESTION IN MANDALAY CITY

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Abstract

Traffic congestion is a condition on road networks that occurs as the increases, and is a characterized by slower speeds, longer trip times and increased vehicles queuing. Traffic congestion is caused when a volume of traffic generated demand for space greater than the available road capacity. In Mandalay City, there are totally 28 numbers of traffic lights but some are not in properly working condition. Only about 10 are the busiest. To study the traffic congestion in Mandalay City, there are many indicators such as traffic intensity, traffic density and the speed of vehicles. Therefore, it is necessary to measure the incoming flow and outgoing flow of the vehicles which pass through the traffic lights.

Key words: traffic congestion, Mandalay City, vehicles, traffic light, saloon, motorcycles, cargo truck, passenger truck.

Introduction

Cities and traffic have developed since the earliest large human settlement. The same forces that draw inhabitants to large urban areas also lead to in tolerable levels of traffic congestion on urban street and thorough fares. The study area is founded in 1859 by King Mindon during Myanmar Last Dynasty. After annexation by the British Government, the Mandalay City has been started developing with urban characters and infrastructures. During Second World War, the British Forces and its alliance forces bombed there, so that some infrastructures were destroyed. After gaining Independence, the Parliament Government has renovated all the characters of the City. Since that time, the government of Myanmar and the authorities from Mandalay City Development Committee also put effort to develop the facilities for City dwellers. Mandalay City lies in the heart of Myanmar and it is the third capital of the country. It lies in the Central Basin with natural boundary of the Ayeyarwady River in the west. Therefore, the city is accessible from any direction of the country various modes of transportation. Hence, it has become the commercial centre of the entire county not only for inter- and intra- local trade but also for the international one. Along with the development of the city, the total population has also increased day by day. Moreover, the growth of economy of the inhabitants in the city leads to use more number of vehicles in or around the city. Apart from that, more leisure time can be spend by the City people, as a result moving here and there by the residents has become one of the major causes for traffic congestion in Mandalay City.

Aim and Objectives

The main aim of the paper is focused on that whether there is traffic congestion in Mandalay City and it's environ or not. To meet (acquire) the main aim of the paper, it is necessary. To understand how many types and number of vehicles are used by the City dwellers. To know the spatial distribution pattern of transportation routes in the City. To account the number and location of traffic lights which are able to control or to manage the traffic flow in/or Mandalay City and around the City. To provide the alternative ways for reducing traffic congestion. To know when and where the motor vehicles are congested the ways mostly.

Study Area

Mandalay City lies between North Latitudes (21° 53') and (22° 02'), and East Longitudes (96° 04') and (96° 09'). It is located on the flat plain which is formed by the river terraces of the Ayeyarwady. It has an average elevation of 250 feet above sea level except Mandalay Hill (776 ft) [Map (1)]. Recently, Mandalay City is composed of 5 townships with (86) wards. In 2012, about 1.2 million people resided in the City. Being located in dry zone of Central Myanmar, it usually experiences hot summer, scanty but double maximum rainfall, cool and dry winter in a year. As the study area is full of urban characters, there is also the urban vegetation cover. The total number of vehicles according to their types which were registered by the Department of Road Transport Administration within Mandalay Municipal Area up to end of 2012 are shown in the following table.

Sl. No.	Types of Vehicle	Number of Vehicle
1	Private-owned	408358
2	Cargo Truck (small)	3641
3	Cargo Truck (big)	5915
4	Passenger Truck	1407
5	Others	563
6	Two-wheelers	478323
7	Tri-Shaw	10972
8	<i>Htawlargy</i>	5912
9	Machines	33

Source: Department of Road Transport Administration, Mandalay Region (2012)

Data Collection and Method

Yatanapon Shwe Myo Daw Gyi (ancient name of Mandalay City) started forming as a square shape along with the pattern of Moat and Palace at the regime of King Mindon. Yearly increase of population mainly by immigration becomes the major cause to expand the city as a result; the present shape of city is in rectangular. Moreover, Mandalay City is a focus of trade and transportation routes. Its location also favours to arrive at the city from other big towns and even from border area. Therefore, the number of vehicles which incoming to / outgoing from the city are especially collected at 6 gates (i.e. entrances of the city). But, there is a great drawback that this study could not cover the intra-urban moving of traffic flow.

Besides, due to less time and number of researcher, this project has lack of data collection for certain part of time of a day (i.e. 6:00 p.m. to next day 6:00 am). It was assumed that most vehicles have been traveling during the day time. Actually, the data collection was made on the particular day which is not the fast-day with 2 hours time interval from 6:00 a.m. to 6:00 p.m. When collections the number of vehicles which those types of vehicles are also classified as follows:

Passenger truck (including public busses). Cargo truck. Private owned vehicles (Saloon and pick-up). Others (*Htawlargy*, government and organization owned, ambulance, ambulance, motor tri-Shaw). Motorcycles

Due to flat lowland topography, the people not only from the city itself but also from nearby areas can move around the city, by using (bicycles and motorcycles). Counting on those two-wheelers is the greatest difficult for the researchers, so that such two-wheelers without fuel engine are omitted in this paper. The main roads which serve for inter- and intra- city

transportation are shown in map (2). Moreover, the locations of the traffic lights and the selected places of data collection are also integrated on the same map. The traffic intensity for each way entrance is calculated by using the method from "Wikipedia". The formula is as follow:

Traffic intensity = number of vehicles / unit of time

According to the ratings, the intensity is classified into six classes (i.e. from "A to F"). Their descriptions are:

Class (vehicle/lane/hour)	Description	Intensity
A	Traffic flow at or above posted speed limit under	700
B	Slightly congested	700-1100
C	Ability to pass or change lanes constrained	1100-1550
D	Speeds somewhat reduced (urban peak period)	1550-1850
E	Flow becomes irregular, speeds vary and rarely reached posted limit.	1850-2000
F	Flow is forced with frequent drops in speed to nearly zero	unstable

The researchers are neither motorists nor travelers, so that to collect the data for speed of vehicle, road length unit, etc. are not possible. Therefore, only the traffic intensity index is applied to examine the congestion rate of selected places. Up to December 2012, the Department of Road Transport Administration, Mandalay City had registered totally 547,604 numbers of vehicles by nine categories. Out of which total number of motor cycles were 478,323. It is also attracted that whether the number of vehicles which are only registered for the city are moving or not. For considering the traffics which are from out of municipal area, the selected places are arranged at 6 places of two at eastern, one at southern, two at western and one at northern entrances of Mandalay City.

Out of six, the eastern one is the most accessible and mostly used not only by the city dwellers but also by the outsiders. Therefore, two different sites for the eastern entrance are observed separately. Although there are at least four places to enter the city from the east site, the entrance of 30th main road was renovated while surveying. And, for the entrance of Theikpan Road, the observation was made along with that of southern entrance (junction of Theikpan Road and Yangon-Mandalay Highway). The western entrance was chosen at the junctions of 86th main road and Kandawgyi Circular Road and Sagaing –Mandalay Road and Kandawgyi Circular Road. It was due to the consideration of vehicles from the western part of Ayeyarwady River (Chin State, Sagaing Region, Tamu Border Area). For the last entrance, the northern gate, the junction of Mandalay-Mogok Road and the City Circular Road was selected (Map- 2).

Discussion on Traffic Intensity Rate

From the specific days of data collection, the traffic intensity for east sample place could be calculated and the results are shown in the following table.

According to the table, for both incoming and outgoing to/ from Mandalay City, the traffic intensity rate was the highest at the junction of Theikpan Road and Yangon-Mandalay

Highway. It is mainly due to many reasons. They are that: It is more accessible since earlier days. It is the main entrance from Yangon (former capital) and Nay Pyi Taw (recent capital).

After expansion of Mandalay City, new residential areas have been extended towards the southern and southeastern portions of the city. The Highway Bus Station, wholesales centres have been opened in the south of the city.

Traffic Intensity Rate for Mandalay City (from 6:00 a.m. to 6:00 p.m.)

Sr. No.	Sample Places (Sites)	Traffic Intensity Rate	
		Incoming	Outgoing
1	Junction of 35th & 62nd Streets	1,402.75	1,324.33
2	Junction of 19th & 66th Streets	638.16	645.66
3	Theikpan Road & Yangon-Mandalay Highway	3,972.33	3,935.25
4	Sagaing-Mandalay Road & Kandawgyi Circular Road	1,042.58	906.75
5	86th street & Kandawgyi Circular Road	378.00	472.5
6	Mandalay-Mogok Road & City Circular Road	552.83	539.75

Source: Calculated by the researchers based on surveyed data

The second highest intensity is noticed at the junction of 35th & 62nd Streets. It is also main entrance from the eastern part of the country to the city especially from Northern Shan State and Pyin Oo Lwin, which is famous hill resort station of the country. Therefore, the people used to move by passing this junction. Moreover, allocating of Yetaguntaung Golf Course, Yemontaung Residential Area also attracts many people to settle around the City who have to pass this point.

It is followed by the site of the junction at Sagaing-Mandalay Road and Kandawgyi Circular Road. At this point, the site of 86th Street and Kandawgyi Circular Road can also be considered together. Because, both are located as western entrance the city. This gate mainly used by the vehicles which come from/go to Monywa, Pakokku and Sagaing: western parts of the Ayeyarwady River. After completing Yatanabon Bridge on Ayeyarwady River, it is more convenient to connect east and west of the Ayeyarwady.

The minimum intensity of traffic is found in the northern entrance, i.e., the junction of Mandalay-Mogok Road and City Circular Road. Actually, the road to Mogok, Thabeikyin, Madaya is tarred road, but its width is narrow and is not yet upgraded as highway. Therefore, the number of vehicles which pass through this point is rather less than that of other sites.

Traffic Congestion Rate According to the Sample Places

As mentioned above, six places are selected to observe and collect to primary data for investigating the traffic flow of Mandalay City. The traffic intensity rates for those sites are shown in tables and figures. Table (1.a & 1.b) and Figure 1 indicated that the total number of vehicles (including motor cycle) which pass through the junction of 35th & 62nd streets. It can be noted that total number of motorcycle have been found as the highest both for incoming and outgoing to/from the city. The second highest number is saloon cars and the least number is the others. Moreover, the greatest number of motorcycle moved during its peak hours of 8:00 a.m. to 10:00 a.m. for incoming to the city, whereas its outgoing way was

highest during 10:00 a.m. to 12:00 noon. It may be due to drop the students or to go for shopping and coming back from the schools or markets, respectively. Again, it has been raised up at the time of about 4:00 p.m. for both ways. That may be also due to the journeys of going back home from the works or schools or offices. The moving trend of saloon explained that both incoming and outgoing ways were highest during the hour of 10:00 a.m. and 12:00 noon.

The same patterns of vehicles moving are also observed in Figure 2. It is shown the sample site of junction at 19th & 66th streets. In this figure, it can be noticed that the outgoing motorcycle from the City has been remarkably higher than that of incoming to the City. This site is an entrance of Mandalay City from Patheingyi Town, which is about 5 miles away. Therefore, total incoming motor cycles during 8:00 a.m. and 10:00 a.m., might have gone back to home since from 2:00 p.m. up to 6:00 p.m. At this point also, the second highest vehicles are saloon both for incoming and outgoing way. It is no doubt that the least number of moving vehicles was others. (Table 2.a & 2.b)

At the sample place of Theikpan Road & 78th Road (Yangon-Mandalay Highway) junction, both incoming and outgoing numbers of cycles are the highest during 8:00 a.m. to 10:00 a.m. Then, it dropped again up to 2:00 p.m. and it started rising up again since 4:00 p.m. to 6:00 p.m. (Figure-3, Table 3.a & 3.b). It is followed by the number of saloon and the least number is that of others.

At the junction of Kandawgyi Circular Road and Sagaing-Mandalay Road, only the number of motorcycle led as the highest vehicles which passed through this point both for incoming and outgoing ways. But the number of passenger truck was also high along with the number of saloon. All the passenger cars going to Sagaing, Pakokku and Monywa have to pass this point so that is number has become noticeable. As shown in Figure-4, Table 4.a & 4.b, the peak hours of incoming vehicles were during 8:00 a.m. and 10:00 a.m. and that of going back are after 4:00 p.m.

As another western entrance, the junction of Kandawgyi Circular Road and 86th street also showed the same pattern of vehicles moving to/from the City. Whereas, the incoming motorcycle has been started going down since 10:00 a.m. up to evening 6:00 p.m. It is reversed that the outgoing motorcycle from the City has been increased since 2:00 p.m. up to 6:00 p.m. In the Figure-5 and Table 5.a & 5.b, comparatively less in number of other vehicles (saloon, cargo truck, passenger truck and others) have been found at this point.

The junction of City Circular Road and Mandalay-Mogok Road represents as the northern entrance of the City. Here also, total number of motorcycles influenced passing through this place and while remaining types of vehicle showed very less in amount during the same period. In this figure (Figure-6), it can be assumed that the incoming motorcycles might have been gone back home since the time of about 2:00 p.m. Those motorcycles may be from the nearby City areas. This site is the only gate which is passed through by the passenger truck to Mandalay from Mogok, Thabeikyin, etc, so that the number of passenger buses have been found at 2nd highest level at the time about 10:00 a.m. (Table 6.a & 6.b). From Mogok, many people used to come in and go out to/from the City by using their owned cars. Hence, the number of saloon also showed as the 2nd highest trend in this figure.

Findings and Suggestions

By considering total number of vehicle all together which are collected at 6 places for a day (i.e., 12 hours), it can be noted that all types of vehicles are accounted for 189,731. It is about 34.65 % of total number of registered vehicles in Mandalay Municipal Area. Out of 34.65 % of vehicles, total number of motor cycles are 136,335 (71.86 %) of vehicles on that

particular day. Therefore, it can be assumed that motor cycle is the major reason to be traffic congested at all sample places, especially for two sites of Theikpan Road & Yangon-Mandalay Highway junction and 62nd & 35th streets junction. To avoid the problem of road congestion by motor cycles in the city, the following measures should be considered.

Regarding Traffic Light

The traffic light should be more number around the city. The present situation about traffic light is seemed incapable to control the traffic congestion. Traffic lights should go with the flow, rather than enslaving drivers to the tyranny of timed signals. The bam, bam, bam of greens allow platoons of vehicles to move smoothly through intersection after intersection. By doing so, no drivers have to wait very long and sections of road don't become so filled with cars that there is no room for entering vehicles when the light does go green. In addition, the traffic lights works should be upgraded and it possible, time manage met for the motor cycles should be taken into account. For example, it there is a specific traffic regulation (green intersection) for two-wheelers, it can reduce the traffic block at a point. (Lights should stay green longer during peak traffic hours and at that time; computers will help prioritize public transit). Moreover, the traffic light should work together by figuring out how charges at each individual intersection would affect the entire system.

Regarding Public Bus Services

To reduce the number of using motor cycle by the City dwellers, more convenient and more reliable bus transport systems should be replaced. The City's current bus system is a cyclical bus route. In such a system, the bus stops frequently to drop off and pick up passengers. The problem with this system is that it takes more time for a passenger to travel long distances when riding a bus then when driving motor cycle or car. It is proposed for developing customized bus routes using computer technology. By creating customized bus routes using commuter information, the public bus services can be promoted in the city. To do that, information of each commuter's originating point, destination point, at time of arrival should be provided.

Regarding City Planners

Effective land use planning, transport planning and coordinated transport development involving all transport modes are fundamentally important to the high transport modes and to the high quality access needed in large urban areas. Road transport policies, however, should seek to manage congestion on a cost-effective basis with the aim of reducing the border that excessive congestion imposes upon travelers and urban dwellers throughout the urban road network. Besides, the congestion management policies should keep track of travel reliability indicators. These may capture the variance in travel times, or alternatively, communicate the amount of time buffers road users have to include in their travel plans to make their trips "on time". In future, demand for use of highly trafficked roads will need to be managed. The authorities have to take necessary actions on motorists who break down the rules and regulation of traffic laws. The width of the existing lanes should be expanded on both sides.

Regarding Alternative Ways

As shown in map (3), the proposed flyovers may help to lessen the traffic congestion for the city. It can be clearly seen that these flyovers should be bridged between the sub-urban areas and to the CBD of Mandalay City especially from southern and eastern entrances. In addition, transport authorities will need to employ a combination of access, parking and road

pricing measures from operational and infrastructure measures aimed at mitigation traffic congestion.

Conclusion

Cities provide access to a wide range of activities, people, services, goods, markets, opportunities, ideas and networks. These benefits can be delivered either through speed or through greater proximity. Congestion may affect travel speed. Fully eradicating roadway congestion is neither an affordable nor feasible goal in economically dynamic urban areas. In Mandalay City, congestion has grown as city has grown and as economic activity has expanded. As the City attracted more people and activities, it has produced more wealth and as a by-product, the roads have become more crowded. However, much can be done to reduce its occurrence and to lesser its impacts on roadway users within Mandalay City. Besides, more studies can be carried out by the other researchers who interest in urban transport systems. This paper is focused only on the selected sample places. Therefore, other vehicle congested places in the City are missed. Besides, intensive attention should be paid for the remaining crowded places throughout the City.

References

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