Study on Trip Generation Rate and Level of Services of Myaynigone Junction

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Abstract— *This paper intends to analyze the causes and impacts of land-use change development projects and their trip generation. Yangon, the former capital of Myanmar faces rapid growth of urbanization since 2016. In recent years, traffic congestion has become a popular subject of debate and policy initiation from government and nongovernment organizations. Most of the traffic congestion is mainly based on urgently growing and changing of built form which is currently developed mixed-use development and shopping centres. Myaynigone junction is the junction of Yangon's inner urban area which was the secondary centre last 15 years ago. The trip generation should be a major factor to control new urban development projects. But, there is little research on the trip generation that focuses specifically on measurement and modeling of existing lane's carrying capacity and level of services.*

The purpose of this paper intends to introduce from academic research to analytical tools for planners and decision-makers to carefully considered trip generation of new development projects. This paper shows site generated traffic and its distribution in Myaynigone junction.

Keywords— **Land use changed development, site generated traffic, trip generation, urban congestion, Yangon.**

1. INTRODUCTION

Yangon is the former capital of Myanmar before 2006 and now she has transformed as a commercial hub of Myanmar after moving new capital to Nay Pyi Taw since 2007. But the urban population of the Yangon City has grown rapidly from 1.3 million in 1950 to 5.3 million in 2019, a proportion that is expected to increase to 0.33% by 2050.[12] Moreover, there are increasing housings needs and housing demands to accommodate people who are need shelter. Then, building construction is booming rapidly. Most of all urban block of Yangon Downtown and suburban area are transformed to above 20 storied high-rise buildings. Although the existing road network system are not improved and still like last decade when Rangoon was planned by Leftinen Frazer in 1885, city area are growing day by day. So far, traffic is congested and crowded. [1]

Due to the development of new satellite towns since 1987, the northwards sprawl of the city has changed to a cross pattern having an east-west axis and a north -south axis. The average population density of the city at present is 30 persons per hector, which is very low compared to other neighbouring countries' capital city. [1]

Large-scale urban development activities have been carried out in Yangon since 1989. Mixed-use developments have come to be undertaken in the central business district and in the areas vacated by large-scale squatter relocations isolated developments of great bulk are beginning to appear in the city. There are office buildings, hotels and shopping mall with apartment. These three elements generally form the skyline of the intensively built up city.

There are fewer shopping malls Yangon in comparison to other Asian cities. On a positive note, this means there is less of a "global market" feel to shopping, but for those looking for a Western shopping experience this is not the greatest of news. Indeed, the malls are a little behind in terms of brand names in comparison to the rest of Asia also, but this is improving. Now in Yangon (24) shopping Malls have been established. These are Junction Square, Myanmar Plaza, Gamone Pwint, Taw Win Center, and Dagon Center etc.

Myaynigone Junction is the one of the crowded and congested area in Yangon because of it is a secondary center of Yangon and it has at least four shopping centers are existed. After 1960, Myaynigone Junction is the most popular in Yangon and one of populated area as well. As a secondary center, there were quite big open market and full of services and amenities. Among them, urban recreational facilities like as parks and garden can provided not only Sanchaung township but also whole Western Yangon area.

In this research, Myaynigone Junction and it's environ are the study area and it will be issued upon the recently developed shopping malls and their impact on their environs and the real situation of traffic congestion, their weakness relating with use and occupancy of shopping mall projects, and lack of considering to draft zoning plan of Yangon. Yangon people needs daily goods , monthly goods for their consumptions and also urban services and amenities, these should be characterized which should be allocated in near community or urban area and which should be placed as out-let facilities located in urban fringe. In this research the following result will find out. These are: which and what kind of urban services and amenities had to be existed in shopping centre near junction. What kind of shopping centre should development and what extent it should be big relating with facilities.

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2. URBAN DEVELOPMENT TRENDS

Early Yangon is called Dagon that is a small Mon fishing village in the 11 century. King Alaungpaya renamed from Dagon to Yangon in 1755. In 1852, the city became commercial and political hub of Myanmar and redesigned by army engineer Fraser for 50,000 populations. Yangon city's area was about 8 square miles around the Sule pagoda. End of 19th century, the city area has 33.2 square miles and 98,745 [13] populations. From this time the city has developed to 5.3 million populations with 231.75 square mile in 2014 [7].
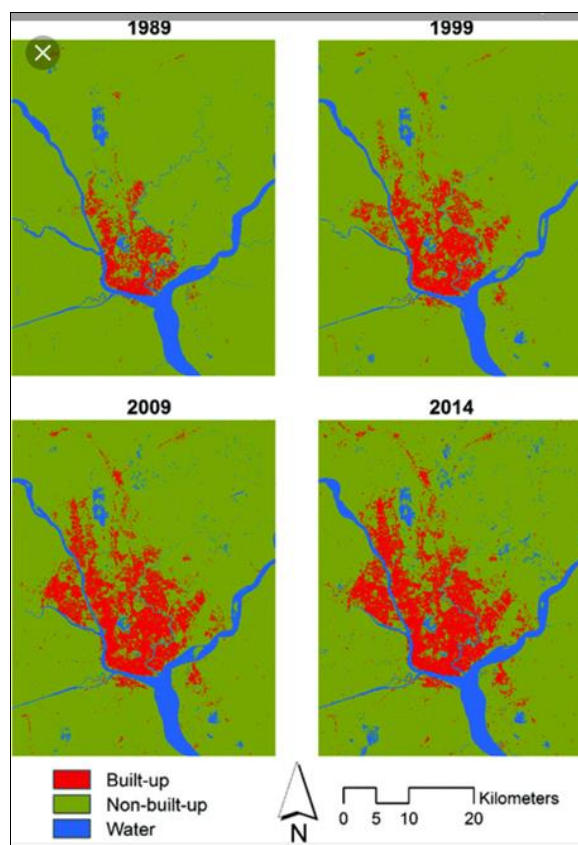

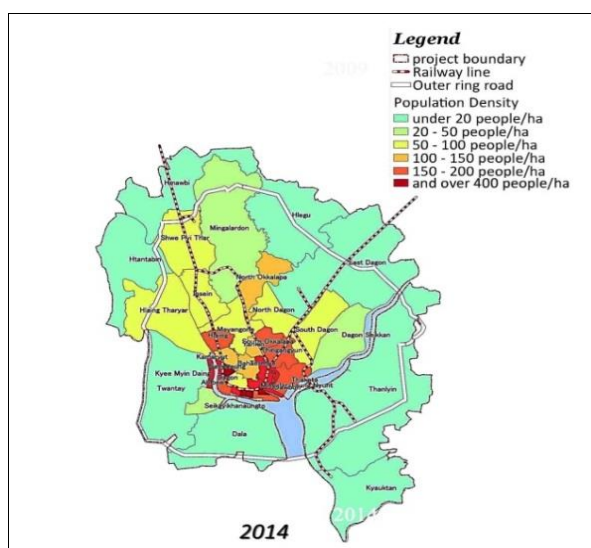**Fig. 1. The development of the city from 1989 to 2014.**

Fig. 2. State-of-the-art of Yangoon in 2014.

After 1988, the government starts to introduce the market oriented economic, many companies came to here for investment. Since that time, large scale urban development activities have been carried out in Yangon city. Mix-used developments have started in central business district and relocate large scale squatter settlement from that area to outer suburb. Isolated developments also started in the city. They are office buildings, hotels and housings. The city has 33 townships. Now, Yangon is the country's main centre for trade, industry, real estate, media, entertainment and tourism [3].

3. SCOPE OF RESEARCH

The scope of the research work is confined to know the extent of problems including traffic congestion causing by major land use development projects especially on the shopping centres which are located on Myaynigone Junction. In this study is shown traffic impact analysis on major road. It includes the detail analysis of trip generation and traffic flow of land use changed development projects affected to existing roads. The detailed counts numbers and the existing capacity on Pyay Road, U Wiser Ya Road and Bagayar Road because most of shopping malls are located in these main roads. This research makes an overview of the traffic flow concepts inherent in capacity and level of service analyses, a discussion of their applications and some suggestions of policy decision making based on this. Above mentioned traffic impact analysis are based on the (6) shopping centres which are currently changed land use development projects.
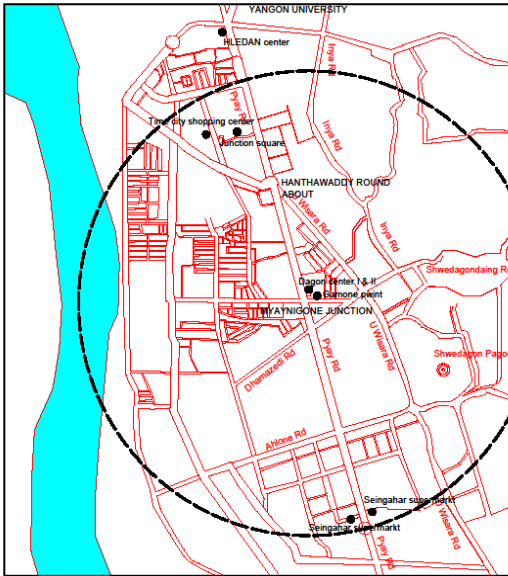
4. RESEARCH METHODOLOGY

This paper uses two sources for data collection as primary and secondary data. Primary data were collected by field survey with interview and secondary data were collected from Yangon City Development Committee (YCDC), Department of Urban Planning and Department of Human Settlement. First is focused on information gathering and including documents collection and field survey. Second is focused on the existing land use planning and infrastructure, urban transport, institutional and organization structures that identifying the problems and current condition of township. Thirdly, predicting the trip generation demand of shopping centres especially for period of peak hour (AM, PM) in weekdays and period of peak hour in weekend. Fourthly, analysis based on the general characteristic of shopping centres issued by ICSC (International Council for Shopping Centres), travel time and distance between selected shopping centres and SWOT analysis of current condition and proposed area need to be redeveloped to make sure systematic potential land use and predicting the trip generation on selected Shopping Centres and its effects on existing Roads and intersections.
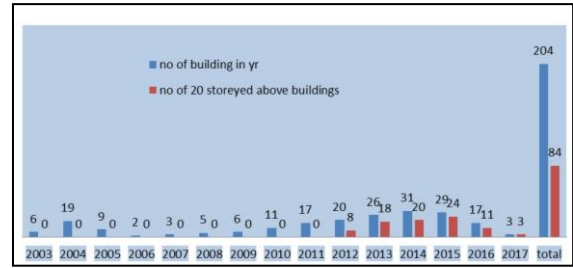
Finally, this research give suggestion for proposed development guide lines of new projects in Junction and near junction (within 1 mile radius) especially Yangon and discussion upon current traffic flow conditions and carrying capacity.

5. ANALYSIS

The analysis prescribes about local case studies in Myaynigone Junction. The biggest shopping centre such as Dagon Centre Shopping Centre Complex is located at Myaynigone Junction. Myaynigone is formerly known as development and crowded area and is the main commercial development corridor in Yangon, Myanmar. Another one is Junction Square, which is also one of the biggest shopping centres in inner urban area of Yangon district, situated at the near CBD and it is also part of the commercial development area.

Fig. 3. High Rise Building Projects (2003-2017)

Table 1. List of High Rise Building Projects (2003-2017)

YEAR	TOTAL BUILDING	No. of 20 storeyed above
2003	6	0
2004	19	0
2005	9	0
2006	2	0
2007	3	0
2008	5	0
2009	6	0
2010	11	0
2011	17	0
2012	20	8
2013	26	18
2014	31	20
2015	29	24
2016	17	11
2017	3	3
total	204	84

Fig. 4. High Rise Building Project in Yangon (2003-2017)

There are Mostly built 10 storeyed and above high rise building. 80% of new projects are opened Shopping Centres [7].

A. Traffic Problems in Yangon

The daily routine problems of the people of Yangon are facing as daily basis is traffic congestion and inappropriate public transportation system.

The problems between the buses and the private cars have counter affects upon each two different modes. The problem is the number of vehicles in the Yangon City jump to over 300,000 in June, 2013 after the Government permit import of vehicles from abroad since the last two years. For now, the registered vehicles increased to over 600,000 in August, 2014 [5].

Fig. 5. Traffic Condition in Yangon.

B. Capacity analysis for background and build out condition

The back ground capacity analyses show how roads and intersections will work if the development is not built, build out capacity analyses show directly comparable result if approval is granted and the development is completed as proposed.

The most generally accepted method for describing road capacities is the level-of-service (LOS) concept. The Figure (4) shows the brief informal description of the meaning of different level of service.

Many road ways and intersections are designed to operate at a level of service C, but in other case level-of-service D is used as a more cost effective design standard. Level-of-service E is the theoretical maximum capacity of a roadway. Beyond a level-of-service E, the capacity of roadway declines sharply.[9]

Fig. 6. Level of Service.

C. Calculation of Trip generation in Selected Area

In this paper, trip generation calculations are shown by each land use type. Trip generation calculation emphasized on only newly build out shopping centres development projects and which are mostly high rise mixed use developments, namely Dagon Centre (1), Dagon Centre (2), Gamone Pwint, 24 hours City Mart, KBZ Tower (Naing Group construction), Spirit Fashion and Accessory. See Appendix (Calculation sheet)

D. Typical Trip Generation Rates

The following table and suggestion show the existing condition of traffic flow and road intersection. There are levels of service calculated by collected traffic volume in week day peak hour [10].

Table 2. Levels of service by collected traffic volume in week day peak hour

USE	UNIT	TRIP RATE PER UNIT	FOR PERIOD
Shopping center	1,000 ft^2 - GFA	1.03	Weekday- AM Peak Hour
Shopping center	1,000 ft^2 - GFA	3.75	Weekday- PM Peak Hour
Shopping center	1,000 ft^2 - GFA	4.9	Weekend- Peak Hour
24- hour market	1,000 ft^2 - GFA	73.1	Weekday- AM Peak Hour
24- hour market	1,000 ft^2 - GFA	53.42	Weekday- PM Peak Hour
Sit down Restaurant	Seat	0.88	Weekend- Peak Hour
Apartment	Dwelling units	0.55	Weekday- AM Peak Hour
Apartment	Dwelling units	0.67	Weekday- PM Peak Hour
Office	1,000 ft^2 - GFA	1.55	Weekday- AM Peak Hour
Office	1,000 ft^2 - GFA	1.49	Weekday- PM Peak Hour

GFA= Gross Floor Area

Source: ITE Trip generation, 7th edition 2004

E. Findings on Analysis Traffic Impact Studies.

Existing capacities for trip generation are calculated in Pyay road, Bagayar Road, Dahmazadi Road, U Wisarya Road and Baho Road. According to the results, Pyay road,

Bagayar Road, and Baho Road are level of service **C**. It means that only three roads can carry extra load of shopping centers, but other adjacent road normally reaches to overload and showing its level are **E** and **F**. The trip for shopping only shows level of service **D** in the weekend as shown in Table (2). It means other land uses are not functioned in weekend.

The most important thing is that trip generation by shopping cannot be added existing traffic volume, because existing conditions are also very worst in some road segments.

Table 3. Comparative analysis on Trip generation by Vehicle per Lane per Minute in Myaynigone junction

Description	Total Trip		Total Trip		
	Weekday AM	Weekday PM	Weekend AM	Weekend PM	Weekend (only shopping)
Trips for (shopping + residential development)/min	45.37	50.93	55.06	51.03	27.73
Vehicle per lane/min (all road are assumed to be 6 lanes)	7.56	8.49	9.2	8.5	4.6
Level of service	E	F	F	F	D

Table 4. Carrying Capacity Each Road by Calculation

NO.	Road Name	Capacity (existing) AM Peak/ hr	Capacity (existing) PM Peak / hr	Level of Service
1	Pyay	2.18		C
2	Bagayar	3.5		C
3	Baho	3.43		C
4	Damnazaydi	9.9	8.33	E
5	U Wisar Ya	12.58	13.31	F

F. Weakness of Traffic Impact in Study Area

a) More than the area of 50,000 sq-ft shopping malls exist in very closed each other.

b) Car parking space cannot be shared for shoppers. Only for Residential and office space, parking is available.

c) Space of road lanes cannot be fully utilized for drivers, because of road side parking and transient sellers, bicycle and stall existed in both sides of road.

d) Transient sellers are placed on the pavement and pedestrians can walk on road lane.

e) New Land use changed development projects are lacking of traffic impact studies.

f) Own vehicle percentage is rising today and traffic management plans are slowly established.

g) Drivers and pedestrians lack of discipline and do not obey rules and regulations.

h) Other road surface condition is very bad for sufficient drive and flow.

6. RECOMMENDATION

As per survey of [5] nos of high rise mixed use development projects in Myaynigone, the current three land uses most commonly included in them are retail in almost all mixed use developments as either the primary or secondary use and virtually always including restaurants), residential, and office. Entertainment, in the form of movie theatres, and hotels are occasionally included, and usually make up a small percentage of the square footage.

ITE's Trip Generation report mentions major [6] land use categories: office, retail, restaurant, residential, hotel, and cinema. Trip Generation report said these [6] land use categories are mainly generated to estimate trip generation for each component land use. Trip generation data for two analysis periods are required: the AM peak period (normal street peak period between 7:00 and 9:00 AM) and the PM peak period (4:00 to 6:00 PM).

As per former studies, new land use changed development projects development have to be seriously considered to traffic impact generated by site. If there exists carrying capacity saturated on existing road, their FAR ratios have to be decreased of proposed land use and zoning draft of YCDC, which is already drafted and not to be issued. The traffic generation and its impact should submit to development control committee.

7. CONCLUSION

As demonstrated in the collected survey and analysis of the research, there is a clear conclusion arising from this study those points towards the development of the idea for land-use potential in Yangon. Yangon is one of the most important commercial centres and cities and has also grown rapidly in recent years. By unplanned and rapid urbanization, population increases and also does the number of vehicles, poor traffic management, and poor road condition. Shopping malls or shopping centres are nowadays arising in the Junction area and near the junction area. In this study, some selected shopping malls are made a case study and detailed analyses are going upon them. These so-called shopping malls are not real shopping center in comparison with ICSC regulation. These centres are mixed-use developments projected and apparently, these should be not existed in CBD and Inner CBD, because of traffic congestion.

Trip capture estimation should not be able to cover all of the land-use combinations. It is expected to develop with some data. However, it is clear from the information in this conclusion that the primary uses today and foreseeable mixed-use developments are retail, restaurant, residential and office. The available resource should be concentrated on those uses, but any procedures developed should be adaptable to all common land uses.

Therefore, in considering internal trip capture, site layout and walking distances must be considered. The mere mixing of uses on a site or in an area will not provide a true characterization of the possible sharing of parking or how internal circulation occurs between component buildings. According to the limited time frame and getting not enough data, this study cannot describe how to reduce new land use changed development projects and how much percentage should be built-in junction area of the inner urban ring.

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