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Analysis on Transportation Network of Shwebo Township

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Abstract- Development gap between rich and poor and also between urban and rural areas is a major problem of globalization age today. The term 'development' is defined by very different ways, very different criteria and even very different parameters. However, there is no universally accepted definition of that term up to present. Instead of this, advanced technology is generally accepted as an essential element of development and one of the most possible ways to portray development is the creation of better transportation and communication systems within a particular area or region. Based on this concept, geographic traces on initial development pattern in Shwebo Township are made focusing on the transportation network. In this analysis, β index method is used. According to the result, it is found that the study area has improved network connectivity from β index= 1.1(complete simple connection, 1948-1965), β index=1.2(interconnection, 1980-1997), β index= 1.3 interconnection,2011) to β index = 1.4 (advanced interconnection, 2020).

Keywords- development, transportation, network, connectivity, interconnection

I. INTRODUCTION

In general, development and improvement in transportation is an important factor for the future development of any region. Shwebo Township is situated at the central position within Shwebo District and hence its influential role in local transportation and trade must be known. The available modes of transportation and transportation network are important for the right time transshipment of goods and movement of people. For the future development planning of any region, transportation network is one of the basic infrastructures and it plays a significant role.

The main aim of this research work is to know the development of transportation network in Shwebo Township. The objectives are (1) to know the physical conditions are the best outline in term of its more important transportation, (2) to study the importance of transportation, (3) to examine transportation network, (4) to know flow and connection of transportation network, (5) to point out its vital role in national economic development, and (6) to form an essential part of the infrastructure of the country's economy.

The motor-car roads, the railways and the waterways are studied carefully and presented. The materials concerned with this research paper are location map and transportation map. The data and information about transportation modes and flows of commodities and people are also basic materials for this research paper.

The require data and information were obtained from the various department of Shwebo District. These obtained data are processed, computerized and required graphical presentation are made. The basic statistical technique used in this paper is: β index = e/v (e = edges, v = vertices).

II. STUDY AREA

Shwebo Township lies in the Central Dry Zone of Myanmar Naing Ngan, between north latitudes of 22° 29' and 22° 41', and east longitudes of 95° 24' and 95° 50'. The township is bounded on the north by Khin-U Township, on the east by Singu Township, on the south by Wetlet Township and on the west by Depeyin Township. It extends 30 miles from east to west and 14 miles from north to south, with a total area of 412.19 square miles or 263,803 acres. Shwebo Township comprises Shwebo and Kyaukmyaung Towns and 72 village tracts. The boundary of Shwebo Township is of two kinds, the land boundary and the river boundary. River boundaries are found on the eastern and western sides of the township with the Ayeyarwady and Mu rivers respectively, while the administrative ones are on the northern and southern border of the township. Shwebo Township has a rectangular shape elongating from east to west. (Figure 1)

Generally, the topography of the township can be mainly divided into two regions: (a) the western lowland and (b) the eastern region of low hills with narrow riverine plains. The western lowland is located on the east bank of Mu River and it is almost flatland area. This region is known as Mu Valley, the area drained by north-south running. The eastern region is on the east of Mandalay-Myitkyina railroad and consists of eastern low hills of Minwun range with parts of Ayeyarwady. The chief rivers of Shwebo Township are Ayeyarwady and Mu rivers. Only these two rivers are perennial. Mu River is very important for agriculture and and it can be said as

the artery of the township. The Ayeyawady passes through for about

27 miles along the eastern boundary of the township. Mu River is the most important river for rice cultivation of Shwebo Township. The river is navigable by local craft in the rainy season before the construction of Kabo Dam. The river is a perennial stream which has a shallow depth of water during the dry period. (Figure2)

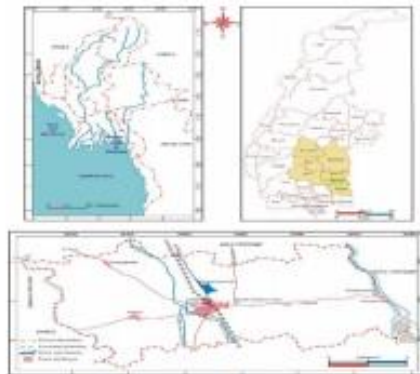


Fig.1. Location map of Shwebo Township

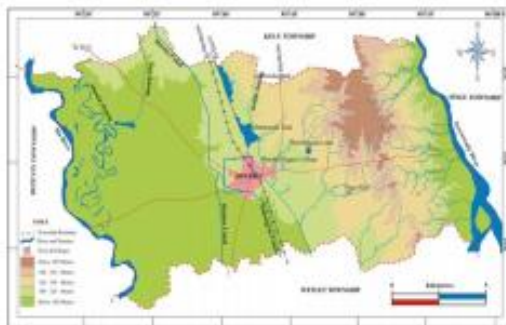


Fig.2. Topography and drainage of Shwebo Township

The climatic condition has a great impact on the socio-economic aspects of a region. In the study area, the temperature is high in summer for every year. Since it lies in Dry Zone of Central Myanmar, the average annual temperature of 30-years period from 1990 to 2019 is 79.68°F. During this period, the average maximum temperature is 92.07°F, while the average minimum temperature is 67.19°F. The average annual total rainfalls amount to 39.51 inches. According to Koppen's classification, this area belongs to the Tropical Savanna (Aw) type of climate.

III. MODES OF TRANSPORTATION

The transportation modes of Shwebo Township are of two types and they are water transportation and land transportation. During the reigns of the Burmese (Myanmar) Kings the inland waterways is a transportation route connected with the economic activities within the region. After the annexation of the British of upper Myanmar (Burma) in 1885, railway lines and motorcar roads were built. Before 1894, the

transportation connected with the economic activities within the region by railroads (trains) was more important than the transportation by car roads (cars). But since 1944, motorcar roads were being used more as a means of transportation than the water routes. The mode of the transportation of Shwebo Township is described as waterway transport, rail transport, and road transport excluding air transport.

A. Waterway transportation

The Ayeyawady River, the life artery of Myanmar, plays an important role in the transportation and communication of Myanmar as well as in Shwebo Township.

Kyaukmyaung river port lies 17 miles east of Shwebo and it is an important port of Shwebo Township. The upstream and down-stream water crafts plying between Mandalay-Bhamo and Mandalay - Thabeikkyin stop at Kyaukmyaung. Steamers plied back and forth between them with monthly trips of 21 trips. They transported 30422 passengers and 6168 tonnage of freight from and to Shwebo Township in 2010-11. In 2019, steamers plied back and forth between them with monthly trips of 17 trips. After the construction of Ayeyarwady Bridge, the passenger and freight are dropped to 27 passengers and 10 tons of freight respectively. But the small villages along the river channel are connected with Kyaukmyaung port which serves as the central base of transportation and commerce.

B. Rail transportation

One of the chief means of transportation of Shwebo Township is railway. The major railway lines of the township are Mandalay-Myitkyina Railroad and Shwebo - Ye-U Railroad. Today the Department of Rail Transport has servicing the up and down trips between Mandalay - Myitkyina, Mandalay - Naba, Shwebo - Kyunhla, and Shwebo - Monyin. They all totaled 5 up and down trains and transported about 10000 passengers per day in 2019.

C. Road transportation

In Myanmar car roads are the most important and that most used means of transportation lines for passengers and the flow of commodities. Motor roads radiate from Shwebo to different regions of Myanmar. They are the most important mean of transportation of the township. In Shwebo Township, there are:

- (1) Shwebo-Myitkyina Road,
- (2) Shwebo-Mandalay Road,
- (3) Shwebo-Kyaukmyaung Road,
- (4) Shwebo-Nyaungbintha-Ye-u Road,
- (5) Shwebo-Seikkhun-Tebin Road,
- (6) Shwebo-Chibar-Plaing Road
- (7) Shwebo-Monywa Road,
- (8) Shwebo-Tagaung Road,
- (9) Shwebo-Khin U-Ye U - Tantze Road,
- (10) Shwebo-Zegone-Kanbalu-Kyunhla Road,
- (11) Shwebo-Mogok Road,
- (12) Shwebo-Yangon Road,
- (13) Shwebo-Naypyidaw Road,
- (14) Shwebo-Wetlet Road,
- (15) Shwebo-Sagaing Road, etc.

There are 24 motorcar associations plying the daily total of 106 various cars (passenger express and Dyna) to the various part of Myanmar (table 1). They have different carrying capacities.

In addition to the mentioned modes of transportation, canal bank tracks and cart-tracks are important means of transportation for local transportation of agricultural products and local communication. They are widely spread within the township; especially canal is in the western and southwestern part of the township.

TABLE 1. DAILY SERVICING MOTORCARS BY MOTORCAR ASSOCIATIONS AND THEIR TRIP DIRECTION IN SHWEBO TOWNSHIP (2020)

From	To	Motorcar Associations	Daily Trips	Direction
Shwebo	Mandalay	Yangyazangman	12	South
		Aungmyazangman	10	
		Nammyit	2	
		Yanayangman	8	
		Aungthekharman	3	
		Nammyit	2	
Seikkhan	Mandalay	Aungmyazangman	1	Southwest, South
Nyauyabuntha	Mandalay	Aungmyazangman	1	West, South
Yegyiwa	Mandalay	Aungmyazangman	1	S Southwest, South
		Yanayangman	1	
Kyaukyang	Mandalay	Aungmyazangman	1	East, South
Kyauhla	Mandalay	Aungmyazangman	1	North, South
Mandalay	Zegone	Yangyazangman	3	South, North
Kabore-Zegone	Mandalay	Shwekyicin	5	Northwest, South
Shwebo	Yangon	Aungmyazangman	2	South
		Fameza	1	
		Aungyadana	2	
		New Seikhtayblaing	1	
		Wirhtar	3	
		Waphyontang	1	
Kyauhla-Kaunhla	Yangon	Aungmyazangman	1	North, South
		Wirhtar	1	
Shwebo	Naypyidaw	Kyattagon	1	Southwest
Shwebo	Kyauhla	Yanayangman	1	North
Shwebo	Monywa	Kanyarrin	12	South
		Yangyazangman	2	
Shwebo	Monywa-Pakkoku	Kanyarrin	1	South, Southwest
		Shwebo	1	
Sagaing	Shwebo	Satanngun	1	South, North
		Mantawetang	1	
		Yadawbuntha	2	
Shwebo	Zin	Yadawbuntha	1	North
		Yadawbuntha	1	
Shwebo	Zin-Katha	Yadawbuntha	1	North
Shwebo	Tagang	Yadawbuntha	3	North
Shwebo	Ye - U	Mandalawoo	3	Northwest
Shwebo	Khin - U - Ye-U	Ayungmye	1	N-Northwest
		Kyethongpant	1	
Tantze	Singu - Mogok	Yanayangman	1	Southwest, East
Ye - U	Shwebo - Mogok	Padaryarwe	1	Southwest, East
		Yanayangman	4	
Shwebo	Mogok	Padaryarwe	4	East
		Padaryarwe	4	
		24	106	

D. The value of traffic and their flow direction

Shwebo Township is situated on the Mu Valley of the Central Dry Zone of Myanmar Naing Ngan. It has good agricultural bases and sufficient amount of agricultural water resource. Thus the region is surplus in agricultural products like rice and pulses. These facts support for the transport of surplus goods to other required regions of Myanmar. Moreover, its central location within Mu Valley plays a major role in the development of transportation and communication of Shwebo Township. Shwebo Township and its hinterlands have high consumption power and thus the purchasing for needed goods also comprises in the development of transportation and in the increase of traffic flow.

The main agricultural surpluses of the region are rice, wheat, and pulses. The local need commodities are various kinds of household goods, construction materials, chemicals such as pesticides and fertilizer, salted fish, dry fish, and fish source. These surplus and needs caused to the high traffic flow to the east and south direction.

As shown in Table (2) the direction of trips and the flow of traffic are highest to the south with the daily trips of 12 and daily traffic flow of 79. In this amount should be added the freight cargo of Road Transport Department. It shows the "interaction" among the surplus regions and required regions.

The second high in direction of flow and trips is to the north with the daily trips of 7 and daily traffic flow of 15. The remaining directions have low trips and decrease flow because of local connection and communication.

TABLE 2. DAILY TRAFFIC FLOW DIRECTION FROM AND TO SHWEBO

Direction	No. of Trips	No. of Traffic
South	12	79
North	7	15
East	5	11
West	1	1
Southeast	1	1
Southwest	4	4
Northwest	3	10
S-Southwest	1	2

IV. ANALYSIS ON TRANSPORTATION NETWORK

Transportation Network or Communication Network is an inter-connected system of fixed lines of movement between Activity Nodes. The main means of carrying traffic are roads, footpaths, railways, and inland waterways. Sea-travel routes and Air Corridors also form part of transport networks but are neither fixed in position nor visible. Each section if fixed line forms a link in a national network connecting junction points at which travelers change mode of travel or terminate a journey.

The transportation routes of Shwebo Township are motorcar roads, railroads and waterways which connect one region to another. The connectivity of transportation network can be measured by means of Graph Theory. In studying it, the tarred roads and every weather route within the township are analyzed. The Indices obtained after calculation can be used as β index. β index is the ratio between the number of the transportation lines "e" and the main stopping or resting region "v".

A network with a β index of less than one means partially connected. If the β index is zero, there is no network system, but less than one there are some routes along which goods or commodities can flow. A network

with a β index of equal to unity can be described as a complete simple network connection (Figure 3).

As shown in Figure (4) β index of the transportation network of Shwebo Township during 1948 and 1965 was 1.1. It means that the network connectivity of Shwebo Township was in the stage of complete simple connection since that time.

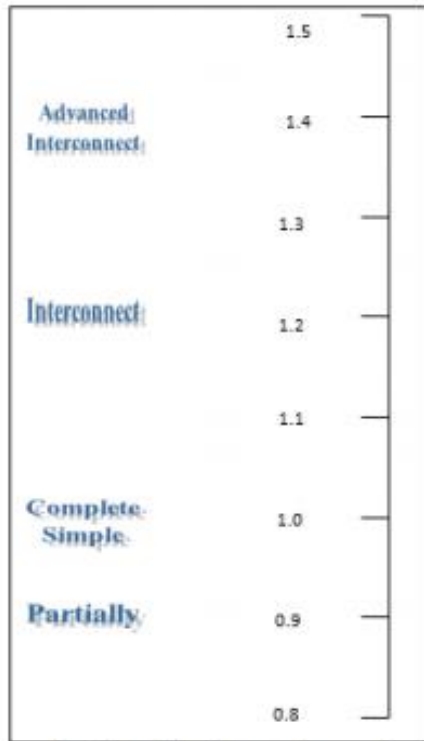


Fig. 3. Connectivity of transportation network (β index value)

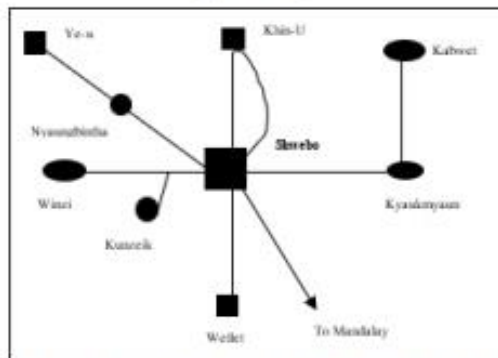


Fig. 4. Development of the connectivity of transportation network β index value of Shwebo Township (1948-1965)

$$\begin{aligned} \beta &= e/v \\ &= 11/10 \\ &= 1.1\# \end{aligned}$$

As shown in Figure (5) β index of the transportation network of Shwebo Township during 1980 and 1997 was 1.2. It means that the network connectivity of Shwebo Township was in the stage of interconnection at that time.

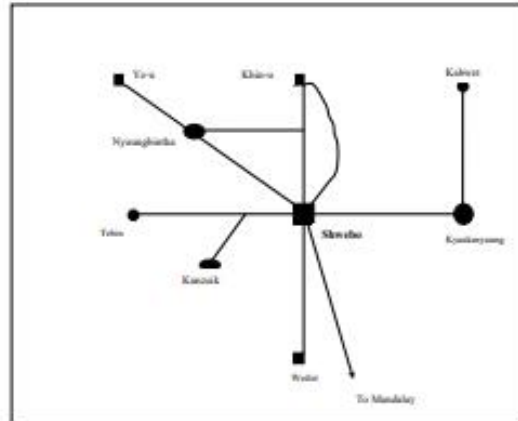


Fig.5. Development of the connectivity of transportation network β index value of Shwebo Township (1980-1997)

$$\begin{aligned} \beta &= e/v \\ &= 13/11 \\ &= 1.2\# \end{aligned}$$

As shown in Figure (6) β index of the transportation network of the township in the year of 2011 was 1.3. It means that the network connectivity of Shwebo Township has been improving and developed to complete interconnection at that time.

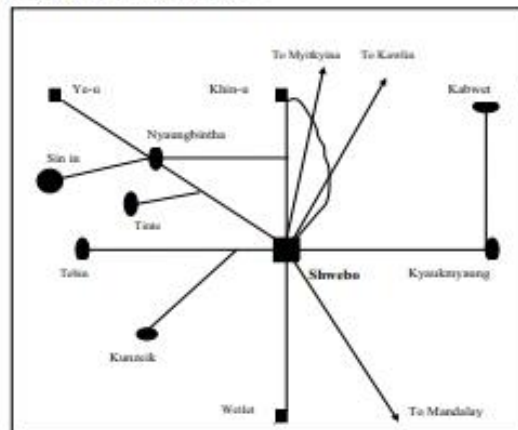


Fig. 6. Development of the connectivity of transportation network β index value of Shwebo Township (2011)

$$\begin{aligned} \beta &= e/v \\ &= 18/14 \\ &= 1.3\# \end{aligned}$$

As shown in Figure (7) β index of the transportation network of the township in the year of 2020 was 1.4. It means that the network connectivity of Shwebo Township is in advanced network connection at the present time.

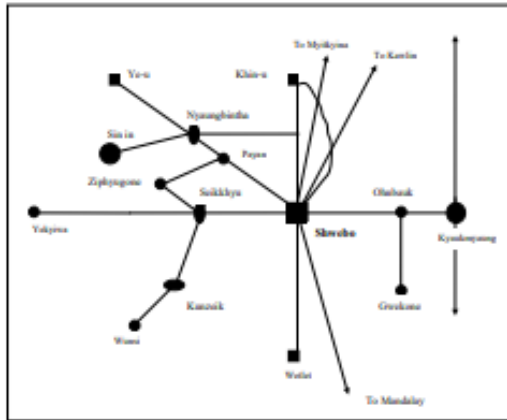


Fig. 7 Development of the Connectivity of Transportation Network β Index Value of Shwebo Township (2020)

$$\begin{aligned} \beta &= e/v \\ &= 22/16 \\ &= 1.4\# \end{aligned}$$

V. FINDING AND RESULTS

This research provides the following results and findings.

- (1) In waterway transportation, steamers plied back and forth between Mandalay - Bhamo and Mandalay - Thabeikkyin stop at Kyaukmyaung with monthly trips of 21 trips in 2010-11. In 2019, steamers plied back and forth between them with monthly trips of 17 trips. They have decreased with monthly trips of four trips. After the construction of Ayeyarwady Bridge, the passenger and freight are dropped to 27 passengers and 10 tons respectively.
- (2) The major railway lines of the township are Mandalay - Myitkyina Railroad and Shwebo - Ye-U Railroad. Today the Department of Rail Transport has servicing the up and down trips between Mandalay - Myitkyina, Mandalay - Nabar, Shwebo - Kyunhla, and Shwebo - Monyin.
- (3) In road transportation, there are 24 motor car associations plying the daily total of 106 various cars (passenger express and Dyna) to the various part of Myanmar.
- (4) The direction of trips and the flow of traffic are highest to the south with the daily trips of 12 and daily traffic flow of 79. It shows the "interaction" among the surplus regions and required regions.
- (5) The study area has improved network connectivity from β index = 1.1 (complete simple connection, 1948-1965), β index = 1.2 (interconnection, 1980-1997), β index = 1.3 (improving and developed to complete interconnection, 2011) to β index = 1.4 (advanced interconnection, 2020).

VI. CONCLUSION

The transportation modes of Shwebo Township are waterway transport, rail transport, and road transport. The Ayeyarwady River plays an important role in the transportation and communication of Shwebo Township. Kyaukmyaung port is the chief port of Shwebo Township. The up-stream and down-stream water crafts plying between Mandalay-Bhamo and Mandalay - Thabeikkyin stop at Kyaukmyaung.

One of the chief means of transportation of Shwebo Township is railway. The major railway lines of the township are Mandalay- Myitkyina Railroad and Shwebo - Ye-U Railroad.

Motorcar roads radiate from Shwebo to different regions of Myanmar. In Shwebo Township, the all-weather motorcar roads are Shwebo - Myitkyina Road, Shwebo - Mandalay Road, Shwebo - Kyaukmyaung Road, Shwebo - Nyaungbintha -Ye-u Road, Shwebo - Seikkhun - Tebin Road, and Shwebo - Chibar - Plaing Road, etc.

The transportation network of Shwebo Township is improving in connectivity, and the traffic flows are also increasing, especially toward the south and the north. With the economic development of the region, there is ever increasing use of motor cycles, private owned light trucks, and agricultural used machinery are on the roads within the township. Thus, the quality of roads, such as width, should be upgraded to avoid unnecessary accidents and death of lives.

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