Study on the Transportation System in the East Coast of Sabah

Mohd Azizul Bin Ladin, Fariq Ismeth Jaimin, Nazaruddin Abdul Taha, Lillian Gungat, Abdul Karim Mirasa, Sidah Binti Idris

Abstract*: *Being situated in eastern Malaysia, Sabah is one of the states which have a firm economic foundation through agriculture, forestry as well as petroleum industries. However, even though it is rich with the natural resources that have long served for the country's economic growth, as a whole, Sabah is considered a little behind her counterparts in the Peninsular Malaysia in terms of infrastructure and development. This study mainly examines the transportation network in Semporna, Tawau and Lahad Datu which is mostly in poor condition. This is because it is extensively used for the industrial activities including logging, palm industries and quarries. Based on the survey, it is found that the road mostly had potholes, edge raveling, uneven surfaces, road rutting, congestion problems and limited parking spaces. Hence, it is recommended to do the pavement repairs, solid foundation work as well as enhancing the existing public transportation system especially in the rural areas in Sabah.

Keywords* : *Eastern Sabah, Transportation Network, Transport Issues, Public Transport, Road Condition

I. INTRODUCTION

Although an oil-rich region part of Malaysia, Sabah is slightly behind its counterpart in the Peninsula. It is one of the three partners along with Singapore and Sarawak that entered a pact with Malaya to form the Federation of Malaysia in 1963, just a few weeks after gaining its independence from the British [1]. It has seen its skyline changed, the city has expanded out towards the sea and in towards the jungle. Unfortunately, similar to all developing nations in the world, there are still issues that have yet to be resolved. Most prominent is the issue of transportation in both urban and rural parts of the nation. When compared between East and West Malaysia, it can be observed that the vehicle preferences are different. In Sabah and Sarawak, the roads are dominated by SUV or other type of four-wheel drive vehicles. This is due to the different road conditions and geography of the region, which is different to the road conditions and network found in the more flat regions in the Peninsula. As such, the road tax is lower for vehicles in Sabah and Sarawak due to its different requirements [2]. Like other developing nations, Sabah can be divided into two areas, urban and rural. Within the urban areas of Sabah, the road networks are better, and some types of public transportation, although unreliable, are available for the public. However, like other urban road networks in the world, it faces its main adversary, the road congestion. This causes pollution and harm to the environment as well as the health of the citizens within the area. Moving on to the rural side of Sabah, congestion is not a serious issue as the road network in the area is not connected enough to even create road congestion. The sight of gravel roads, mud path, and potholes are the norm. When there are paved roads available, some areas are poorly lit as there is no streetlamps installed, making travel during the night dangerous. Mobility for people in rural areas is only practical by owning a car. This is the same case in Western Europe, which in turn has a dense population compared to the situation here. The rural areas are usually lacking in public transportation or has insufficient standard to guarantee independent travel [3]. To bridge the gap between urban and rural areas, the transportation network must be improved. Therefore, this study was initiated to study the transportation system in the east coast of Sabah. There have been many studies on the problem of transportation, however, most of these studies are focused on the objective of minimizing travel costs, or enhancement of capacity [4]. These objectives are more focused on urban areas and it is not applicable to rural areas. On the other hand, for a rural road network, the objectives should be adjusted accordingly, as road expansion is not a priority for rural transportation, but cost minimization or maximization of coverage area should be a top priority [5].

Figure 1.1: Example of the rural road condition in several areas in Sabah

In rural areas, poor road surface condition as shown in Figure 1.1 directly affects the vehicle operation cost and travel time. Which in turn negatively impact the socio-economic costs [6].

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Further elaborating on this, bad road condition increases the rolling resistance and road roughness, which directly influences the vehicle speed, fuel consumption and repair costs. Thus, by improving the road surface, it will directly contribute to the improvement of the operation costs. Another pressing issue in rural road network is the insufficient road coverage. Improvement of road network coverage is essential for the development of the area and also to provide opportunity for social and economic activities [5]. Several researches have been conducted in developing nations with the focus on the relationship between road network conditions and economic developments [7; 8; 9].

The general public also widely accepts that improvement of road network will bring about significant social benefits. These benefits in most cases are not measurable in monetary terms, such as improved access to schools and healthcare [7]. Other benefit includes reduced excessive walking and porterage especially among women [10;11]. Although it is widely accepted that the improvements in rural road network do provide benefits in terms of social and monetary indicators, it is not guaranteed. This has been observed by several researchers [12;13;14]. All these authors argued that the general assumption that road network improvements will lead to more improvements of public transportation does not always apply. It is argued that a better understanding of the situation and the area is important to leverage the actual livelihood benefits more effectively.

II. OBJECTIVES

The main objectives of this study are as follow:

1. To evaluate the accessibility of the existing transportation network (road, air, and water) for Semporna and Tawau.
2. To identify the possible transportation network and contribution towards socio-economic development for Lahad Datu, Semporna and Tawau.
3. To propose options for connectivity improvement.

III. METHODOLOGY

Survey questionnaires are used during this study, which consists of several different subjects of research. The subjects are based on the stated research objectives. The target population for this study is the remote area in the East Coast of Sabah namely Lahad Datu, Tawau, and Semporna.

The scope of work is illustrated in Figure 1.2. It is divided into three main parts, which is the preliminary or desk studies, site visitation and data collection, data analysis, and lastly proposal of improvement options.

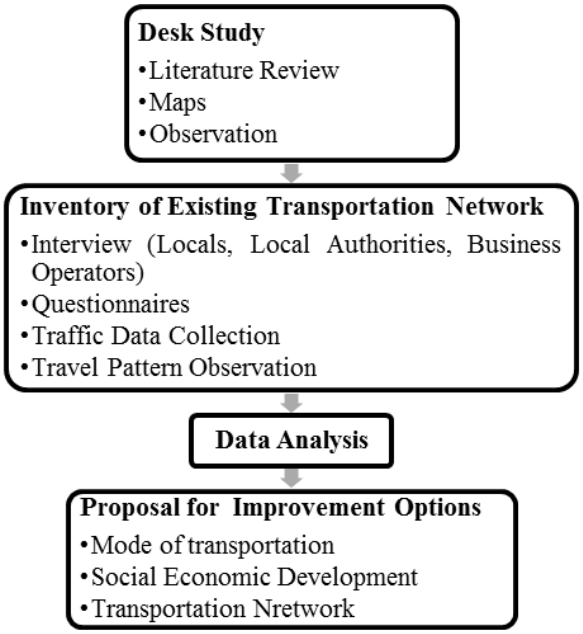

Figure 1.2 Scope of works of the research

IV. DISCUSSION

The Tawau Division is approximately 14,905 square kilometres in area which is about 20% of the total area in Sabah, while the estimated population in this division is at 412,375 people as of 2010 [1]. The ethnic indigenous people here make up to 79.8% of the total population, while the second largest group is the ethnic Chinese which is estimated to be at 17.2%. There is about 0.4% of Indian population in Tawau, and 2.6% of the people are grouped as 'others' according to the Department of Statistics Malaysia (2010). The main indigenous group of Tawau consists of Bajau, Suluk, Ida'an, Tidong, Cocos, Murut, Lun Dayeh/Lun Bawang, and there are also several minority mixed ethnic groups [15; 16]. Tawau has two (2) main airports located in Lahad Datu district and another in the Tawau district. The Tawau Airport is closest to all three districts except for the district of Lahad Datu. Tawau is the third largest town and has the third largest port in Sabah after Kota Kinabalu and Sandakan. The main export of the port is timber and agricultural products. The town is located at the south eastern part of Sabah, and shares a border with North Kalimantan. It is also surrounded by the Sulu Sea and Celebes Sea. Semporna is a district to the eastern side of Tawau district, and to the south of Kunak and Lahad Datu. The town is approximately an hour and a half drive from Tawau airport, and is connected to the rest of Sabah via roads. According to the Department of Statistics Malaysia (2010), the population of Semporna is estimated to be around 137,868 as of 2010. According to study done by Assoc. Prof. Dr Ismail Ali of Universiti Malaysia Sabah, a large population of the nomadic sea people, Bajau Laut also known as Pala'u is found in Semporna [17,18]. Historically, they lived in boats in the middle of the ocean and drifted between the seas of the Philippines, Malaysia, and Indonesia.

As time progressed, some of the Pala'u have moved on to living on lands and some have chosen to live on top of water villages in the islands, and there are still some that continue to live in boats floating on the seas [19]. The status of these people is still unclear as they are people with no nationality and not illegal immigrants [20]. In Figure 1.3 below, it can be seen that they travel primarily using small boats crafted from logs. On the background, the water villages of the Pala'u can be seen.

Figure 1.3: Bajau Laut children on the sea begging to tourists

Other than the two (2) airports in Tawau and Lahad Datu, the only means of connectivity for these four districts with each other is via road or water. The only highway that connects these four districts is the Malaysian Federal Route 13, which is now part of the Pan Borneo Highway. This however does not extend into Semporna, but only to the end of the district area where the local dubbed it as Kunak checkpoint. As this is the main route used by all vehicles, including heavy vehicles, the overall road condition of the route was poor due to the lower standard of construction used which was JKR R3. This standard has a design speed limit of 70 km/h with a minimum lane width of 3m [21;22]. After the research that was done by the Public Works Department, the Federal Government initiated the Pan Borneo Highway project and it will be constructed using the JKR R5 standard which has a design speed limit of 100 km/h, and a minimum lane width of 3.5m. The Pan Borneo Highway project was initiated to upgrade the existing route and is expected to be completed by 2025 [19].

A. Transportation Network Issue in the East Coast of Sabah

Based on the preliminary site visitation done on the 24th to 26th of December, several transportation network issues have been identified for both Tawau and Semporna. Table 1.1 illustrated the problems identified from the preliminary visit of the study location.

Table 1.1 Problems identified from the preliminary visit at the study area

POTHOLES	EDGE RAVELING
	
- Small, bowl shaped depression formed on the surface of the pavement that penetrates down deep into the base course of the road. - Have sharp edges and vertical sides near the top and most likely to develop in road surfaces with a thickness of 25mm to 50mm. - Developed when cracking on the roads become critical and forms multiple small interconnecting cracks that over time are dislodged by vehicles passing over them. -Increased risk of traffic accidents.	- A condition when the edge of the pavement cracks and breaks loose. - Occurs more in rural areas as most of the paved roads in these areas are constructed without curbs or paved shoulder or due to asphalt binder aging. -If left unfixed, it will eventually make itself onto the lanes itself and creating the same hazardous condition as potholes
UNEVEN ROAD SURFACES	**ROAD RUTTING**
	
Occurs due to the condition of the soil itself as some areas where roads are constructed across a swampy area. Due to inadequate compaction of the subgrade, overtime as load is applied, the road sinks and thus creating a road surface that is uneven.	-Occurs due to the movement of the pavement layers or the subgrade of the pavements. -Several underlying causes of rutting which usually either insufficient thickness of the pavement, lack of proper compaction of the subgrade, weak asphalt mixes, or moisture infiltration. -In Semporna, this area is an accident-prone area as it appears to have a straight line going towards the bridge. However, upon careful observation, it can be seen that there is rutting on road surfaces and can cause vehicles to lose control when driving with speed.
CONGESTION	**INSUFFICENT PARKING SPACE**

	
As more and more vehicles are purchased in these areas, it creates more demand for road usage. However, the paved roads in these areas are usually single carriageway.	As more vehicles are used, the parking spaces that were constructed years ago are unable to cope with the increased demands. In some areas, there are roadside shops and stalls. The locals tend to park dangerously at the roadside as the parking space is not available. This in turn creates congestion on the road due to oncoming traffic tries to maneuver past these parked vehicles safely.

B. Solution to Rural Transportation Problem

Depending on the type and severity of each of the problems discussed previously, most of the problem can be solved theoretically. In most cases, the main challenge is not finding the appropriate solution, but in fact it is the cost of implementing the solution. For example, it is widely known that for a pothole, the most obvious solution is to patch the affected area. Transport is clearly a significant factor in rural growth, because its presence or absence restricts rural people's ability to boost their social and economic well-being [23]. However, as the road is maintained by the government, there will be cases where financial constraint is the main factor for the repair works to be delayed.

- **Pavement Repairs And Overlay**

This method is used to remedy both potholes and raveling. There are several methods that can be used for patching potholes. The most common solution used is called the semi-permanent pothole repair. Semi-permanent includes cleaning debris, paving and compacting mixture with vibratory compactors [24]. For this method, any content in the pothole must be cleaned out first, then a cut will be made along the sides of the patch area. The cut must be made in sound pavement to provide the best result. Mix materials are then placed into the hole created. For this method, either hot or cold mix material can be used. The last step is to compact the patch area using a compactor such as vibratory plate. Another method which is much cheaper is the throw-and-roll repair. This is the most basic method and is only advised to be used as a temporary solution. As the name suggests, the method only requires that the cold or hot mix materials to be placed into the pothole and is compacted using a heavy vehicle by driving over it several times. In some cases, it can be compacted by using a hand tool. Then, when vehicle starts to drive over it, it continues to compact it. However, this is recommended to only be a temporary solution, the best solution is still to lay over the whole stretch of road with the proper subbase and subgrade design to prevent failure before reaching its design capacity. Overlays on existing pavements are usually used to improve the load bearing capacity of an existing pavement or to correct a defective condition of the existing pavement [25]. For a raveled pavement, the root cause of failure should be identified prior to performing any repair work. It should be identified whether the pavement was constructed using the correct standard or is the grade used is not suitable for the condition of the area. In general, for small and localised edge raveling, the affected pavement can be removed and patched. The method for this repair is almost similar to the semi-permanent pothole repair method. If the pavement in question is still structurally sound, the raveled area can be repaired by using a fog seal or a slurry seal. For large areas, it is usually an indication of pavement failure and a total pavement overlay is required. When performing a total pavement overlay, it is best to provide a higher grade of construction than the previous pavement, and to identify the root cause of the failure to prevent a similar failure.

- **Geotechnical Works**

The issue of uneven road surfaces and rutting can be prevented by having a solid foundation work prior to the construction of the road. In all cases, prevention is better than reparation. Proper earthworks should be conducted before construction to prevent settlement of the roadway after the construction has been completed. The existing soil condition in the construction areas can significantly affect the rate of settlement of soil, which is the main factor for uneven road surfaces. For areas with softer ground, several methods can be used to ensure that the ground does not undergo severe settlement after construction which in this case results in uneven road surfaces. In most engineering work, soil settlement cannot be prevented, however there are methods to induce the rate of settlement also called primary settlement to reach a stable state where further significant settlement rarely occurs. The secondary settlement is usually very rare and happens slowly over a period of years, in sandy areas, it is negligible, however, soil with higher organic content will have a significant effect. The most commonly used method used to stabilise the construction area is by soil compaction. It is a process done to remove the pore spaces within the soil structures and prevents water and air to penetrate the soil. Another method that can be used is Prefabricated Vertical Drains (PVDs) or Wick Drains. The ground improvement technique using prefabricated vertical drains (PVD) is one of the most suitable methods to overcome the problem of compressible, saturated soils like soft clay, excessive settlement on structure. The primary functions of PVDs are to filter the excess pore water from the consolidating soil and to carry the pore water away from the soil layers by vertical flow through the drain [26]. These are plastic cores with geotextiles placed into the soil to accelerate the rate of primary settlement. Once placed into position, a preload is applied onto the area interested to increase the surcharge of pore water into the vertical drain, thus compacting the soil. The illustration can be referred to Figure 1.4.

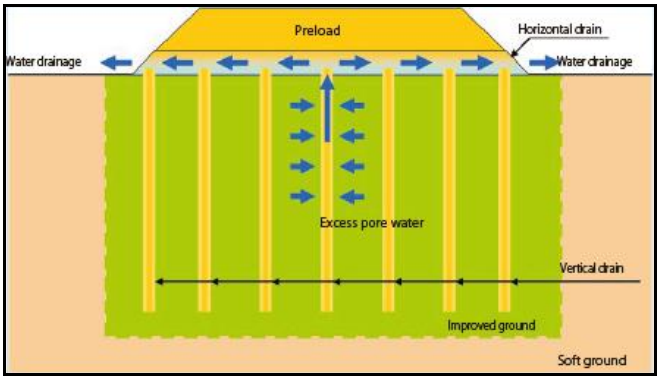

Figure 1.4: Prefabricated Vertical Drain (PVD) illustration

- **Alternative Transportation**

In order to implement good-quality transport in rural areas, which are becoming increasingly important segment of transport policy, it is necessary to have an adequate definition of rural areas at a sufficiently disaggregated level to enable the detection of specific transport needs and rural population travel characteristics [27]. Although a public transportation system is available in Sabah, it is totally inefficient. Unfortunately, efforts by the government to abolish this system and implementing a new system has been met with mixed reception. While the general public agrees that a total revamp is required, the bus operators are concerned that their livelihood will be affected. The reason being that the bus in Sabah is operated mostly by individual that was granted a license to operate by the Commercial Vehicle Licensing Board (LPKP). Thus, a solution for this issue is by centralising the public bus system and providing job opportunities for the current operator to ensure that their livelihoods are protected. Other than that, for areas that are remote, alternatives such as providing bicycles should be considered to reduce the burden of walking long distances. Vehicle lanes should not only be used solely for vehicle, especially in the rural areas as it is impractical to build pedestrian and bicycle lanes if it is underutilised. The term of emergency lanes should be abolished and instead turned into a shared lane for bicycles, pedestrians, emergency service vehicles, and emergency lanes for vehicle to stop in case of vehicle breakdown.

V. CONCLUSIONS

As a conclusion, the main issue plaguing the rural community in Semporna, Tawau and Lahad Datu is the poor road conditions and lack of accessibility and coverage. Hence, the government should be responsible to take effective actions for the remedial process on the poor road network regardless of the industrial activities done. It is also noted that in any sustainable development, the application of a public transportation system is a must. Due to that, the public transport system and the transportation facilities should have been improved to fulfill the public demand and satisfaction which can sustain equivalent to the development of the populations.

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