

Tourist Transportation Strategy for Pante Lake Lut Tawar in Central Aceh Region

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ABSTRACT

The growing level of tourist activities in the Pante Menye Danau Lut Tawar area, located in Central Aceh Regency, is not supported by sufficient public transport options designed for tourism. This research seeks to develop efficient routes, create operational frameworks, and evaluate Vehicle Operating Costs (VOC) along with suitable fares for eco-friendly tourist transport. The analysis of route selection and macroscopic transport modeling was conducted using PTV Visum and ArcGIS software via the PuT Assignment method. After simulating the route network load with PTV Visum, it is suggested to operate Route 1 (through Kebayakan) over a distance of 23 km, using a small bus with a capacity for 14 passengers. The operational schedule is intended for 10 hours each day (07.00 - 17.00 WIB), aiming for a speed of 40 km/hour. Based on the analysis using Visum software, the best route for Pante Menye Lake Lut Tawar tourist transportation was selected, namely Route 1 (via Kebayakan), by visually observing the resulting load. Route 1 (via Kebayakan) is 23 km long. This route serves: Jl. Pengulu Gayo - Jl. Lebe Kader - Jl. Abdul Wahab - Jl. Sp. Kebayakan-Bintang. The recommended vehicle type to meet tourist needs and is adjusted to the road dimensions is a Small Bus with a capacity of 14 passengers. The tourist transportation operates 10 hours per day (7:00 AM - 5:00 PM) WIB. The Pante Menye tourist transportation operates at an operating speed of 40 km/h. This route has a travel time of 35 minutes. The number of vehicles required is four with an 18-minute headway

INTRODUCTION

Indonesia possesses abundant natural resources and a significant human resource base, providing the foundation for tourism development. Tourism has become one of the largest and fastest-growing industrial sectors in the world (Takome et al., 2021). In this era, tourism is an integral part of human life. It is an integral part of the community's economic life (Said, Ririn, Maitimu Anthoneta, Talakua, 2022). As a development instrument, tourism contributes significantly to national Gross Domestic Product (GDP), and regional income has continued to increase in recent years. The tourism sector is the second-largest contributor to Indonesia's foreign exchange earnings after oil and gas. In 2012, its direct and indirect contribution to Indonesia's Gross Domestic Product was 12 percent. This consists of a direct contribution to GDP of 4 percent and an indirect contribution of 8 percent (Nurmansyah, 2014).

Tourism development requires a strategy that integrates various aspects, both directly and indirectly related to the tourism sector, to ensure the sector's sustainability. One important step in this regard is improving tourist attractions to attract more tourists, which in turn will benefit the government and local communities. Planning in tourism development is a dynamic, ongoing process, requiring constant evaluation and adjustment based on monitoring and feedback on the implementation of previous plans. In this regard, tourism promotion initiatives should be an integral part of the sector's development, in addition to improving tourist facilities and attractions. The tourism sector also encompasses a wide range of businesses, including travel agents, airlines, accommodations, restaurants, tour operators, local artisans, and the maintenance and expansion of tourist attractions. Therefore, effective and efficient management of all these aspects is crucial to support the success of the tourism sector. (Maskun et al., 2024)

Tourism activities can increase local revenues from taxes, parking fees, and tickets, or generate foreign exchange from international tourists. (SIREGAR, 2024) The more tourists visit an area, the more revenue the tourism sector generates. The longer tourists stay in an area, the more they spend on various needs, such as accommodation, transportation, food, and souvenirs. Special interest tourism, such as nature tourism, cultural tourism, and religious tourism, can attract tourists with specific interests and generate higher revenues. (Fadilla, 2024)

According to Law Number 23 of 2014 concerning regional government, regional governments are granted the principle of decentralization, granting them the authority to manage and regulate their own affairs. Based on the optional government affairs, each region is given the authority to explore its potential in various sectors, as stipulated in the Regional Government Law, including the tourism sector, as outlined in letter b of the law.

Regional-Owned Enterprises (BUMD) are a crucial asset for regional governments in participating in national and regional economic development. Each region is granted the right to obtain financial resources, including through the management of separated regional assets, sourced from a portion of the profits of Regionally-Owned Enterprises (BUMD) or from collaborations with

third parties. Furthermore, a Regionally-Owned Enterprise (BUMD) is an organizational unit within a regional government established to generate revenue for the establishing regional government (Sinurat & Mourivar, n.d.).

Nanggroe Aceh Darussalam Province is one of Indonesia's tourism destinations, possessing significant potential. In addition to its panoramic views and natural beauty, and its mild climate in some areas, Nanggroe Aceh Darussalam also boasts diverse customs, languages, and arts, as well as historic sites and buildings. This diverse and rich cultural heritage constitutes a valuable asset that deserves protection and preservation (Yuli Santri Isma, 2025). Developing tourism rooted in local culture and ecotourism also holds significant potential for raising public awareness of the importance of nature conservation. By fostering close collaboration between the government, the community, and various relevant parties, the potential of this local wisdom can be optimized to support nature conservation efforts (Ramadhanti, 2020).

However, the development of tourism potential in the Gayo Highlands remains uneven. Many other attractive tourist attractions await development and promotion. Central Aceh Regency is one of the regencies with beautiful and diverse natural attractions. Aceh's natural beauty and cultural diversity have attracted tourists to visit and enjoy its tourist attractions. Aceh is now a popular tourist destination, as seen by the increasing number of tourists visiting Aceh each year. (J. Teknik et al., 2015)

Central Aceh Regency, Laut Tawar Lake, has its own unique characteristics, surrounded by mountains and hills, featuring the distinctive depik fish. The natural beauty, cool climate, arts and culture, local wisdom, and superior products (Gayo Arabica coffee and Gayo tobacco) with their distinctive flavors and renowned internationally make Central Aceh Regency a must-visit for domestic and international tourists visiting Aceh Province. (Nazar & Amri, 2025)

Lake Laut Tawar also offers several other attractions for tourists to enjoy while visiting Central Aceh, such as Bur Telege, Pantan Terong, and Bur Lancuk Leweng, which directly overlook the lake and Takengon City. The beauty of Lake Tawar also offers overnight camping destinations, including Pante Menye Beach, Atu Nunang Beach, and Mendale Beach. The legendary historical sites include Loyang Kor Cave and Putri Pukes Cave (Agustinawati, 2023).

Menye Beach (Manja Beach) is a highly attractive tourist attraction. It's not only strategically located but also offers stunning views. It's located in Bintang District, precisely to the east of Lake Laut Tawar. There are two routes: the northern and southern routes. The northern route is approximately 18 km through Takengon, while the southern route is slightly longer, approximately 24 km (J. Teknik et al., 2015).

In the heart of Central Aceh Regency lies Lake Lut Tawar, a tectonic-volcanic lake covering an area of 5,472 hectares. It spans three districts: Kebayakan, Lut Tawar, and Bintang. This lake is not only a water source for the local community but also a major tourist attraction, offering aesthetic views and cool air (Mukhsin et al., 2024).

Tourism is closely linked to the transportation sector. For tourism, the transportation sector serves as a provider of access to a destination. Tourism activities are highly dependent on the transportation and telecommunications sectors. A growing transportation sector means driving the progress of the tourism sector, or conversely, expansion in the tourism industry can create demand for transportation to meet tourist needs (Nugroho et al., 2020). Transportation is the process of moving or transferring people or goods from one place to another. This process can be carried out using transportation facilities in the form of vehicles or without vehicles. The purpose of transportation is to realize the provision of safe, secure, fast, smooth, orderly and comfortable transportation services and support equitable growth and stability, as a driver, driver and supporter of national development. Transportation plays a crucial role in tourism as a primary accessibility provider, connecting tourists from their place of origin to their destination, and influencing comfort and travel decisions (Sitorus & Sitorus, 2017).

The increase in tourist visits during holidays often causes congestion at crucial points around Lake Lut Tawar. This is due to illegal parking on several roads using the road shoulder. High roadside activity can disrupt traffic flow. Conflicts such as delays have the potential to cause congestion. Congestion can reduce the level of safety and comfort for road users, reduce travel speeds, increase travel time, and increase vehicle operating costs. The higher the roadside activity, the lower the road capacity and the higher the degree of saturation value. (F. Teknik et al., 2018). There is a growth in motorcycle ownership and use from year to year. This has the consequence of an increasingly dominant proportion of motorcycles compared to the percentage of vehicle types on the highway. This condition has given rise to various traffic problems. (Pratama & Tjendani, 2023). The impact of this congestion also affects the environment due to uncontrolled transportation planning. Based on its source, air pollution can be classified into mobile and non-mobile sources. Power plants, industry, and households are sources of non-mobile air pollution. Meanwhile, air pollution from moving sources includes transportation activities on both land and sea (Biology, 2024).

Based on the problems and impacts of air pollution and the potential for global warming, efforts to control environmental damage are needed to minimize the impact, particularly that resulting from transportation activities, particularly land transportation. These control efforts can be implemented through an environmental sustainability approach in the Transjakarta mass transit system, thus realizing sustainable transportation (Ulumidin et al., 2019). Planning environmentally friendly or mass transit-based tourist transportation is an urgent need to maintain environmental sustainability.

The hilly and winding geography around Lake Lut Tawar demands high transportation safety standards. Providing tourist transportation requires several safety aspects, including vehicle roadworthiness, driver competence, route risk management, and strict regulations to prevent fatal accidents.

The implementation of vehicle roadworthiness tests is regulated in Law Number 22 of 2009 concerning Traffic and Road Transportation, specifically Article 48 paragraph (1), which states that every motorized vehicle operated on

the road must meet technical and roadworthy requirements. Avoid, in practice, there are still vehicles that do not meet these requirements but continue to operate, which can endanger the safety of other road users. (Rifka Alkhilyatul Ma'rifat, I Made Suraharta, 2024). Tourist buses show an alarming accident rate, with a fatality ratio reaching 67%. Accident data on tourist buses shows that more than 80% of the causes of accidents involve human and vehicle factors. Therefore, it is necessary to analyze accident characteristics, identify factors causing accidents based on human error, and compare safety standards to formulate appropriate recommendations for improving the safety of tourist buses in Indonesia. (Fajar et al., 2025).

Accessibility is a measure that shows how easily a location can be reached from another location via the transportation system. Developing tourism destinations requires accessibility that meets tourist needs, such as easy access to destinations and the availability of signs to facilitate directional navigation (Candra & Sari, 2024). Currently, access to the Lut Tawar Lake area is still dominated by private vehicles and public land transportation. There is no integrated tourist transportation system specifically designed to serve routes around the lake; therefore, tourism transportation planning is urgently needed in Central Aceh Regency.

Tourism transportation planning cannot stand alone. There must be integration between transportation to Central Aceh Regency (such as Paya Ilang Terminal or Rembele Airport) and specialized/tourist transportation. Intermodal integration itself is the use of two or more modes in a single journey. Different modes are complementary to each other, with each mode serving a specific route, demonstrating technical and economic advantages, with each trip utilizing road transportation as a feeder and connecting point. (Madini et al., 2024).

One of the key drivers of tourism transportation planning is collaboration between the government and the private sector to develop and explore the tourism potential of Lake Lut Tawar. The government plays a crucial role, particularly in protecting tourists and enriching or enhancing their travel experiences. It also acts as a guarantor and supervisor of investors investing in tourism development. (LIDIA SARI RAHAYU, 2018).

Transportation development will be more optimal if a prior study is conducted. This study serves as a reference for establishing policy frameworks to ensure public transportation operates in an orderly, comfortable, and sustainable manner. (Putri, 2022)

Providing sustainable transportation requires the use of informative, interactive, easily accessible, and personalized technology to assist tourists in their travels and foster positive memories. A web-based reservation information system is the right choice, as it can be accessed anytime and anywhere by both visitors and managers. This system can provide centralized, real-time, and accurate information regarding ticket availability, visit schedules, and booking specific tourist activities (Ndoloe et al., 2025).

The purpose of analyzing the demand for tourist transportation is to determine the potential number of passengers and the travel patterns of

passengers using which routes. These travel patterns can then be used to determine the best routes for tourists to reach tourist attractions. Planning for tourist transportation requires a sound operational system to improve accessibility for tourists visiting Central Aceh Regency. It is hoped that the analysis will maximize the value of every rupiah invested in public transportation development (Veronica et al., 2025). Planning for tourist transportation requires an analysis of tourist demand, as effective planning must be based on user needs. A potential demand analysis can be defined as an analysis to determine the number of potential tourist transportation passengers who are willing to switch from using private vehicles.

Potential demand is derived from interviews conducted using a sample calculation method based on the Slovin method with a significance level of 5%. (Alvionita, n.d.). The Slovin method is used to select respondents or samples for public transportation planning. This method is often chosen due to its simplicity, speed, and practicality, allowing for calculating a minimum sample size from a population whose size will later be known. (Maulidya et al., 2025).

Determining tourist transportation routes is based on an analysis of destination location, potential demand, ease of access (road infrastructure), and travel time to optimize travel efficiency. Route determination is crucial for connecting main destinations (tourist spots) with tourist area entrances (airports/terminals/hotels) to create efficient connectivity. (Melasti et al., 2021). To determine the route, the method used is GIS-based spatial modeling techniques to analyze road (line) and point (node) connectivity to find the optimal route, the shortest distance, or the nearest facility. Furthermore, PTV Visum and Geographic Information Systems (GIS) are closely related in the fields of transportation modeling and traffic planning. GIS serves as the infrastructure provider of location and asset data, while Visum serves as an analysis engine that processes this data to predict the flow of people and vehicles across a large area.

The results of the tourism transportation need analysis not only illustrate the magnitude of potential travel demand but also serve as a key instrument in formulating effective and efficient public transportation operational system planning, including determining routes, service schedules, fleet capacity, and service levels that can meet tourists' mobility needs sustainably.

The increase in tourism activity in Central Aceh Regency is not matched by a corresponding increase in tourism facilities, particularly the availability of tourist transportation. Currently, tourists only use private vehicles to reach tourist areas due to the lack of tourist transportation in Central Aceh Regency. Therefore, it is necessary to develop transportation with dedicated routes connecting tourists to tourist attractions in Central Aceh Regency. Therefore, the research on "Planning Tourist Transportation to Pante Menye Danau Lut Tawar in Central Aceh Regency" is highly relevant as a basis for formulating more effective, efficient, and sustainable tourism transportation development.

THEORETICAL REVIEW

Research conducted by (Nugroho et al., 2020). The title of the research is "Analysis of Transportation Mode Selection in Tourist Visits." The objectives of this research are to analyze the priority criteria in tourist travel transportation mode preferences, analyze the order of alternative transportation modes for tourist trips for each criterion, and analyze the main priorities of alternative transportation modes for tourist trips at tourist attractions in Cilacap Regency. The research method used is qualitative research. The results of the study, based on the AHP analysis, showed that the priority order of tourist criteria for traveling is safety, followed by comfort, time, access, and lastly, cost. Meanwhile, the priority order of alternative transportation modes preferred by tourists for traveling is private vehicles as the first priority, followed by trains, buses, planes, and ships.

Research conducted by (Gayatri, 2018). The title of the research is "The Potential of Public Transportation in Supporting Tourism Development in Palangka Raya City." The objective of this research is to improve tourist accessibility by integrating intermodal transportation or the availability of adequate public transportation to align the functions and objectives of tourism, thereby boosting the economy and the quality of human resources in Palangka Raya City. The results of this research are that the availability of good public transportation increases the mobility and accessibility of tourists to tourist destinations, which will ultimately improve the economy and quality of human resources in Palangka Raya City.

METHODOLOGY

Several theories serve as the basis for this research. The theories used in this study include the following:

Transportation

Transportation is the activity of moving people or goods from one place to another using specific means (vehicles) and infrastructure (roads, rail, ports, airports, and so on) to reach a destination. The definition of transportation according to experts is:

Transportation is literally the physical movement of people or goods from one place to another within a specific time period, using or being moved by humans, animals, or machines. Generally, transportation is divided into land transportation, sea transportation, and air transportation (Said et al., 2022).

Transportation can be defined as the effort to move, transport, or divert an object from one place to another, where the object is more useful or can be utilized for specific purposes (Karim et al., 2023).

Transportation serves as a means of connecting people with activity/land use systems. The function of transportation as a development supporter is to provide services for various development activities, such as in the agriculture, plantation, fisheries, health, trade, industry, and tourism sectors (Nur et al., 2021).

Transportation Planning

Transportation planning is a process aimed at developing a transportation system that enables people and goods to move or relocate safely, cheaply, quickly, and comfortably (Ofyar Z. Tamin 1997).

Transportation planning is a process aimed at developing a system that enables people and goods to move or relocate safely and cheaply. Transportation planning is essential as a consequence of growth, traffic conditions, and urban development (Warpani, 1990).

Transportation planning is an activity aimed at moving or transporting something from one place to another, where planning includes facilities, infrastructure, and the people/goods being transported (Morlok, 1985).

Tourism

Tourism is a human activity involving temporary travel from one place to another for sightseeing or recreation (Yoeti, 1996). Another opinion states that tourism is a series of activities involving the temporary movement of people to a specific destination outside their home or work environment, along with the provision of services to meet their needs during the trip and at the destination (Mathieson and Wall, 1982).

Tourism is a complex, multifaceted system with various interrelated and interdependent aspects. In recent decades, tourism has become a driving force for social dynamics and socio-cultural change (Pitana, 2006). Tourism is everything related to tourism, including the management of tourist objects and attractions, and related businesses. Tourism is everything related to tourism management (Soekadijo, 2011).

Tourists

According to Law of the Republic of Indonesia Number 10 of 2009 concerning Tourism, tourists are people who engage in tourism activities. The definition of tourism is a travel activity undertaken by an individual or group of people visiting a specific location for recreation, personal development, or to study the uniqueness of the tourist attractions visited for a temporary period (Ministry of Culture and Tourism, 2009).

Tourists are people who travel from their place of residence without staying there. More specifically, a domestic tourist is a citizen of a country who travels within their own country's borders without crossing its borders (Soekadijo, 2000:3). Another definition defines a tourist as a person who voluntarily travels or makes a temporary visit to a location outside their usual residential environment for a specific purpose and does not earn a regular income from the destination visited (Summeng, 2000:1).

Tourist Transportation Performance Parameters

This is a measure used to assess the level of service provided to users. This performance reflects how well the transportation system is able to serve public travel demands effectively, efficiently, and reliably. Evaluation of operational performance is important because it is directly related to the level of user satisfaction and public interest in using transportation.

In calculating the Transportation Performance Parameters, researchers referred to Decree of the Directorate General of Land Transportation Number 68 of 2002 concerning Technical Guidelines for the Implementation of Public

Passenger Transportation in Urban Areas on Fixed and Regular Routes, which outlines the calculation of transportation performance parameters, namely:

a) Design Speed

Design speed is the planned average speed for a trip in km/h. Under normal conditions, it is 20-40 km/h, depending on the characteristics of the study location.

b) Travel Time

Vehicle travel time is the ratio of the distance traveled to the operating speed required by the vehicle to reach the destination. The calculation is:

$$WT = PL \times 60 \quad (2.3)$$

KR

Where:

WT = Travel Time (minutes)

PL = Route Length (km)

KR = Design Speed (km/h)

c) Headway

Headway is the time difference between two modes of transportation, namely the time between one vehicle and the vehicle immediately behind it.

$$H = T_n - T_{n-1} \quad (2.4)$$

Where:

H = Headway

T_n = Arrival time of the second bus

T_{n-1} = Arrival time of the first bus

d) Frequency

Frequency is the number of tourist transportation trips on a route within one hour of operation. The frequency obtained from the analysis is as follows:

$$F = \frac{60}{H}$$

Where:

F: Frequency (vehicles/hour)

H: Headway (minutes)

e) Mileage/Rout

Mileage/Rout is the distance traveled by a vehicle in two trips (round trip).

$$JR = \frac{WO}{WP}$$

Where:

JR: Number of trips (trips/vehicle)

WO: Vehicle Operating Time (minutes)

WP: Travel Time/vehicle circulation time (minutes)

f) Circulation Time

Circulation Time is the travel time from the origin to the destination and back.

$$CTABA = (TAB + TBA) + (\sigma_{AB} + \sigma_{BA}) + (TTA + TTB)$$

Description:

CTABA = Circulation time from A to B back to A (minutes)

TAB = Average travel time from A to B (minutes)

TBA = Average travel time from B to A (minutes)

σ_{AB} = Average travel deviation from A to B (minutes)

σ_{BA} = Average travel deviation from B to A (minutes)

TTA = Vehicle stopping time at A (minutes)

TTB = Vehicle stopping time at B (minutes)

Determining Mode Type

The vehicle used for tourism transportation in Central Aceh Regency is determined by passenger needs. The type and type of vehicle are influenced by the number of passengers traveling on tourism transportation per trip, which determines the type of vehicle based on its capacity.

Furthermore, in determining the type of vehicle to be operated, it is necessary to pay attention to the capacity of the road infrastructure to be used, where each road section has dimensions and tonnage that can be served. These provisions are contained in Government Regulation No. 55 of 2012 concerning Vehicles and Regulation of the Minister of PUPR No. 5 of 2018 concerning Determination of Road Classes Based on Function and Traffic Intensity as well as the Carrying Capacity to Receive the Heaviest Axle Load and Dimensions of Motor Vehicles.

Determining the Need for a Tourism Transport Fleet

In general, the need for public transportation is influenced by several key factors, including passenger numbers, vehicle capacity, operating hours, and expected service levels. Furthermore, technical factors such as route length, travel time, and road network conditions also determine the required fleet size. A mismatch between service capacity and travel demand will lead to operational inefficiencies, resulting in either under-occupied vehicles or excess passengers, which reduces comfort and service quality (Saudi et al., 2023). To determine the required fleet size for tourism transport, the following calculation is used:

$$k = \frac{CT}{H \times fA}$$

Description:

k = Number of Vehicles

CT = Circulation Time (minutes)

H = Headway (minutes)

fA = Vehicle Availability Factor

Determining the Path/Route

To determine the optimal path, researchers used map-based applications, namely ArcGIS and PTV Visum. Network Analyst is an extension provided in ArcGIS software that can perform network analysis. In analyzing a network, Network Analyst will find the path with the least impedance, thus finding the best path from one location to another, or finding the best path to reach multiple locations simultaneously.

ArcGIS is an integrated GIS (geographic information system) software solution. ArcGIS contains several geographic information system applications with their own functions, for example, ArcReader, ArcCatalog, ArcMap, and ArcView (Awaluddin, 2010).

Scheduling

Tourism transportation scheduling is carried out to ensure that the transportation being operated runs as efficiently as possible. Things to consider in tourism transportation scheduling:

- a. Pay attention to arrival times.
- b. Use of standard time periods, meaning that the transportation arrival and departure schedules have a schedule that is easy to remember. For example, every 10 minutes or every 20 minutes.
- c. The tourism transportation departure schedule takes into account holidays (weekdays) and weekdays (weekends).

Vehicle Operating Costs

Based on Minister of Transportation Decree Number 251 of 2022 concerning Guidelines for Vehicle Operating Cost Components Calculated in Providing Subsidies or Compensation and Calculating Tariffs for Public Passenger Transportation Services in National Strategic Areas, the basic cost per vehicle/km is calculated by summing direct and indirect costs.

$$\text{Total BOK} = \text{Direct Costs} + \text{Indirect Costs.}$$

To calculate average vehicle operating costs, use the following formula:

$$\text{Average BOK} = \frac{\text{Overall Results} - \text{Total BOK}}{\text{Number of Fleet}}$$

Fare

Tariffs for tourist transportation in Batang Regency are determined using an analysis based on vehicle operational costs. This calculation allows us to determine the fare per passenger. The load factor used is 70%, as stipulated in Decree SK. 687/AJ. 206/DRJD/2002 (Ministry of Transportation, Directorate General of Land Transportation, 2002).

Passenger fares are calculated after including a reasonable profit margin for the operator. A reasonable profit margin is 10% of the costs incurred, calculated using the formula:

$$\text{Fare (10\% Margin)} = \frac{\text{BOKT} + 10\% \text{ Margin/KM}}{\text{Number of Passengers/KM}}$$

RESULTS AND DISCUSSION

Route Determination Analysis

Determining the route design for tourism transportation operations involves considering the origin and destination points of tourists based on data obtained from tourist interviews. This data is then used to determine routes based on demand in each zone using the Vissum software application using the PuT assignment method to obtain optimal routes. Several factors are considered in determining transportation routes, including:

1. Land use patterns in the study area
2. Tourist locations of the research objects
3. Demand for tourism transportation
4. Origin and destination of tourists using tourism transportation

The tourism transportation plan for Pante Menye Danau Lut Tawar in Central Aceh Regency is divided into two distinct routes: Route 2 (via Lut Tawar) and Route 1 (via Kebayakan). The starting point for all routes is the Paya Ilang

Type A Terminal. This starting point was chosen because it has a large parking area and a transit point for public transportation such as intercity and intercity buses. The end point for all routes is at Pante Menye Danau Lut Tawar.

Based on the results of the demand plotting for each section on the road network map, the demand on that section will then be planned as a tourism transportation route by considering these provisions, namely determining which road sections have a high number of tourist demand. Based on the results of the loading, there are road sections that have a high number of people's requests per day so that they can be used as a reference in determining the proposed tourism transportation route. Based on the results of the plotting of potential demand for each section on the road network map, the demand on those sections is then connected to form several route networks that are made as alternative routes for the tourism transportation service plan. After the demand analysis on route 2 (via Lut Tawar) has a very low number of tourist transportation requests, so the route used is only route 1 (via Kebayakan). Due to the low demand on route 2 (via Lut Tawar) it will result in a load factor analysis below 50% per hour.

Vehicle Type Determination Analysis

The planned tourism transportation model should meet tourist needs and support tourism activities in Central Aceh Regency. When determining the type of vehicle to be operated, consideration must be given to the capacity of the road infrastructure to be used, as each road section has its own dimensions and tonnage. Provisions regarding this are attached to Government Regulation No. 55 of 2012 concerning Vehicles and Minister of Public Works and Public Housing Regulation No. 5 of 2018 concerning the Determination of Road Classes Based on Function and Traffic Intensity, as well as the Carrying Capacity for the Heaviest Axle Load and Motor Vehicle Dimensions.

In the operation of this tourism transportation, the road infrastructure used is Class I and Class III roads with arterial or collector road functions. Based on the description above, the operation of tourism transportation in Central Aceh Regency will be more efficient with the use of small buses on route 1, assuming that these vehicles can adapt to the characteristics of land use and road conditions in Central Aceh Regency. This assumption is used as a reference for calculating vehicle operating costs and calculating fares.

Vehicle Operating Cost (VOC) and Tariff Analysis

Vehicle Operating Cost (VOC)

The calculation of vehicle operating costs is based on Decree of the Director General of Land Transportation Number: SK.687/AJ.206/DRJD/2002 concerning Technical Guidelines for the Implementation of Public Passenger Transportation in Urban Areas on Fixed and Regular Routes.

These VOCs include expenses incurred by transportation operators on a daily, monthly, and annual basis for vehicle maintenance and business operations.

There are many components to consider when calculating vehicle operating costs. From a transportation business perspective, the costs incurred for producing transportation services sold to users can be divided into three parts:

1. Costs for company management

2. Costs for vehicle operations and
3. Costs for levies, contributions, donations, and those related to business ownership and operations.

To facilitate the calculation of prime costs, it is necessary to group costs using the following approach:

1. Cost groups by primary activity function
 - a. Production costs are costs related to production functions or activities within the production process.
 - b. Organizational costs are all costs related to the company's administrative and general costs.
 - c. Marketing costs are costs incurred for marketing activities related to the production of services.
2. Cost groups according to their relationship to the production of services.
 - a. Direct costs are costs directly related to the service product produced.
 - b. Indirect costs are costs indirectly related to the service product produced.

Tariff Determination Based on Vehicle Operating Costs

Based on the analysis of vehicle operating costs, the tourism transportation fare per tourist can be determined. The load factor used is 70%, in accordance with the Decree of the Directorate General of Land Transportation No. SK. 687/AJ.206/DRJD/2002. The following is an example calculation:

Route 1 (via Kebayakan)

Basic fare (BOK/pnp per km) = Basic Cost / (70% x C)

= Rp. 8,855 / 0.7 x 14

= Rp. 904

After obtaining the basic tourist fare, the following tariffs are obtained:

BEP Fare = (Basic Fare x Distance)

= Rp. 904 x 23

= Rp. 20,783

To achieve a profit, the existing fare is increased by 10%. The following are the costs a traveler must incur for a single trip:

Fare = (Basic Fare x Distance) + 10% Break-even Fare

= Rp. 20,783 + Rp. 2,078

= Rp. 22,861 *Return fare

= Rp. 11,431

So, the fare for a single trip is Rp. 11,500

CONCLUSION AND RECOMMENDATION

Based on the analysis using Visum software, the best route for Pante Menye Lake Lut Tawar tourist transportation was Route 1 (via Kebayakan) based on visual load analysis. Route 1 (via Kebayakan) is 23 km long and serves: Jl. Pengulu Gayo - Jl. Lebe Kader - Jl. Abdul Wahab - Jl. Sp. Kebayakan-Bintang.

The recommended vehicle type to meet tourist needs, and adjusted to the road dimensions, is a small bus with a capacity of 14 passengers. Tourist transportation operates 10 hours per day (7:00 AM - 5:00 PM WIB). Pante Menye tourist transportation operates at a speed of 40 km/h. This route has a travel time of 35 minutes. Four vehicles are required with an 18-minute headway.

Based on the calculation, the Vehicle Operating Cost (VOC) for a 14-seat small bus on Route 1 (via Kebayakan) is IDR 1,000,000. 8,855 with a passenger fare of Rp. 11,431 per trip.

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