Planning tour transport connectivity in Tomohon City

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Abstract. Tomohon City is one of the tourist destinations which is currently experiencing an increase in tourist visits. This impacts traffic density because tourists still use private vehicles and large buses originating from Manado. Therefore, transportation and accessibility and connectivity are needed to connect one area to another through planning tour transport connectivity. The method used in this research is field data collection and descriptive quantitative and qualitative analysis. After going through the data processing, the result is the type of vehicle used to plan of tour transport in Tomohon City is a small bus with 16 passengers. With the number of vehicles needed in the planning of tour transport, there are ten vehicles to accommodate the highest number of tourist visits on holidays with IDR. 400.000 / bus. The alternative route chosen is Tomohon Extreme Market - Lake Linow - Tomohon Prayer Hill.

Keywords: tourist, tour transport, accessibility, connectivity, route

1. Introduction
Tomohon City has a very rapid development of tourism. Based on data from tourist visits, the past five years obtained from the Department of Culture and Tourism of the City of Tomohon showed an increase in tourist visits, both foreign and domestic tourists. The high number of tourist visits impacts the increasingly high level of traffic density in the tourist destination [1]. Because to visit the tourist attraction, the tourists still use private vehicles (such as private cars and motorbikes) and large buses originating from Manado, which cause congestion on the access in and out of attractions. This is because the City of Tomohon does not yet have a Tourist Transport that connects one tourist attraction to another tourist object, taking the tourists to go to the destination. Also, road conditions are inadequate both in terms of geometric and width of the road body, especially in some tourist objects with a width of ± 7 m that are traversed by private vehicles and large tourism buses, which causes congestion on roads that have a width of fewer than 7 m and traffic jams in and out of tourist attractions [2].

As a tourist destination, the City of Tomohon requires transportation and accessibility, to support tourists to enjoy the attractions in the city of Tomohon and the development of Tomohon City as a Tourist City [1] [3] [4]. Also, the existence of these tourist transportation must connect one tourist attraction with other attractions, which can save time and money [5]. Thus we need a transportation plan that can overcome the problem that is by planning a transportation connectivity that can connect one tourist attraction with other attractions as well as an easy [5], smooth and comfortable transfer by paying attention to inadequate road conditions both in terms of geometric and width the road body so as not to cause traffic jams in
and out of attractions. Based on this background, the authors are interested in raising the issue as a study entitled "Planning Tour Transport Connectivity in Tomohon City."

2. Methodology
The research locations were Tomohon Beriman Terminal, Tomohon Extreme Market Attraction, Lake Linow Tomohon, and Tomohon Prayer Hill in November 2019. These three tourist sites are part of the master plan of tourism development in Indonesia in 2010-2025 [6]. Data collection was carried out through field research by observing survey and interview objects and collecting secondary data obtained from the Tomohon City Transportation Agency [4], Tomohon City Regional Planning and Development Agency, Tomohon City Culture and Tourism Office. Besides that, it is also supported by library research, and previous research relating to tourism transportation planning and connectivity. The method used in this study is the collection of field data and qualitative descriptive analysis and quantitative descriptive [3]. A descriptive analyzing model is a way of analysis by describing data that has been collected, including characteristics of tourists, vehicle operations, vehicle operating costs, tariffs [5] [7] [8].

3. Results and discussion

3.1. Analysis of tourist characteristics
3.1.1. Vehicles used by travelers

Figure 1 To go to Tomohon City travel destinations

Based on the table and graph above (Figure 1), it can be seen that the vehicles used by tourists to Tomohon City attractions are on weekdays, most tourists use large buses and on holidays, 51 percent use large buses on Saturdays and 44 percent use motorbikes on Sundays.

3.1.2. Travel expenses
Based on the results of an interview survey that has been carried out, the highest tourist travel costs in visiting tourist objects in the City of Tomohon are more than IDR 75,000 with a
percentage of 48%, and then the lowest travel costs are IDR 5,000 - 25,000 with a percentage of 27% (Figure 2).

![Figure 2 Percentage of tourist travel costs in visiting Tomohon City tourism object](image)

**Source: Analysis results, 2020**

**Figure 2** Percentage of tourist travel costs in visiting Tomohon City tourism object

3.1.3. Tourist willingness to switch modes to use tour transport

![Figure 3 Percentage of tourist willingness to switch mode using travel transport](image)

**Source: Analysis results, 2020**

**Figure 3** Percentage of tourist willingness to switch mode using travel transport

After the interview, it is found that most tourists are willing to move to the mode of tourism transportation that will be planned with a percentage of 82% of tourists and for tourists who are not prepared for 18% (Figure 3).

3.1.4. Tourist destinations most attracted by travelers

As mentioned above, in Tomohon there are three tourist sites that are often visited by visitors, namely Extreme Market, Linow Lake and Tomohon Prayer Hill. Extreme market is a place to buy and sell extreme food such as dogs, bats, snakes and others. Linow Lake is a tourist
destination that offers beautiful views around the Lake from above. While Tomohon Prayer Hill is a tourist area with religious purposes, especially for Christians, but everyone, other than Christians can visit this tourist site. These 3 locations were chosen because these attractions are in one lane and are the most popular tourist attractions in Tomohon City.

From the analysis results conducted with an interview survey of tourists, 41% of tourists chose the Extreme Market as a tourist attraction most interested in visiting. Then in the second position is 35% of tourists choosing the Linow Lake tourist attraction after the Extreme Market and the next is Tomohon Prayer Hill which is 24% (Figure 4).

**Figure 4** Percentage of tourist attractions most attracted by travelers in Tomohon City

3.2. Transportation connectivity index

Transportation infrastructure connectivity index can be measured based on distance/length of route, travel time from origin to destination, and availability of public transportation modes [9].

3.2.1. Transportation connectivity used by travelers in Tomohon City mileage

| No. | Origin - Destination          | Distances (Km) |
|-----|-------------------------------|----------------|
| 1   | Extreme Market-Linow Lake     | 9              |
| 2   | Linow Lake - Prayer Hill       | 13             |
| 3   | Prayer Hill - Extreme Market  | 5              |

*Source of data: Analysis results, 2020*

Based on the above table, the total distance from the starting point to the endpoint is 22 km, and the distance from the starting point to returning to the starting point again is 27 km.
3.2.2. Traveling time

| No. | Origin - Destination          | Minutes |
|-----|-------------------------------|---------|
| 1   | Extreme Market-Linow Lake     | 25      |
| 2   | Linow Lake - Prayer Hill      | 35      |
| 3   | Prayer Hill - Extreme Market  | 15      |

*Source: Analysis results, 2020*

Based on the above table, the travel time from what is needed from the starting point to the endpoint is 60 minutes and the time required from the starting point to return to the starting point is 75 minutes.

3.2.3. Accessibility index

Based on an interview survey of tourists in Tomohon City, the tourists still use private vehicles and use large buses to go to tourist destinations in Tomohon City. Besides, tourists outside the island who do not use private vehicles must rent a vehicle to reach tourist attractions in the City of Tomohon. So the accessibility of tourists in reaching Tourism Objects in the City of Tomohon is still lacking due to the absence of tourist transports that deliver tourists to be able to reach attractions in the City of Tomohon in a connected way.

3.3. Actual and potential demand

The actual demand is the number of tourists who are visiting the Lake Linow tourist attraction and the Tomohon Prayer Hill tourist attraction obtained from one day at the busiest hour. Meanwhile, potential demand is obtained from the number of tourists who can come back using tourist transportation, which will be planned to accommodate the number of tourists on weekdays and holidays (Table 3).

| No | Days     | Actual Demand | Potential Demand |
|----|----------|---------------|------------------|
| 1  | Monday   | 55            | 68               |
| 2  | Tuesday  | 58            | 77               |
| 3  | Wednesday| 38            | 49               |
| 4  | Thursday | 44            | 59               |
| 5  | Saturday | 101           | 140              |
| 6  | Monday   | 69            | 106              |
| TOTAL |        | 365           | 499              |

*Source: Analysis results, 2020*

3.4. Route choice

The next step is to determine the best travel route after determining the origin and destination of the travel. The determination of transportation routes to tourist destinations in Tomohon
City is precisely important due to the lack of accessibility of transportation infrastructure in Tomohon City [7] [8]. The path that will be taken to get to the tourist destinations in Tomohon City by transport. Tomohon Lake Linow, then Tomohon Prayer Hill, and finally back to Believers Terminal, is the first route. In choosing the route, there are three criteria: the shortest route length, the dense land use of prospective tourist destination passengers, short travel times. The map of transport routes to tourist destinations in Tomohon City is as shown in Figure 5.

![Transport route map towards tourist destinations Tomohon City](source: Analysis results, 2020)

**Figure 5** Transport route map towards tourist destinations Tomohon City

3.5. **Operations planning**
3.5.1. **Type of vehicle**
Determination of the type of tourist transport fleet uses MINIBUS vehicles with a capacity of 16 passenger seats, assuming that the vehicles have small dimensions to match the characteristics of land use and road conditions at the tourist sites [4].

3.5.2. **Service indicators**
3.5.2.1. **Load factor**
The planned vehicle loading factor is 95% of the number of tourists in the highest volume hours with a vehicle capacity of 16 seats.
3.5.2.2 Traveling time

The time required for tourist transportation to get to the tourist location can be determined by calculation using the formula:

\[ WT = \frac{PR}{KR} \times 60 \]  

\[ = 44 \text{ minutes} \]  

Information:

\( WT \) : travel time  
\( PR \) : length of the route  
\( KR \) : speed of plan

3.5.2.3 Travel transport circulation time

The circulation of tourist transportation is the travel time of tourist transportation from origin to destination and back again to the beginning [10].

\[ CTABCA = (TAB + TBC + TCA) + (\sigma AB + \sigma BC + \sigma CA) + (TTA + TT + TTC) \]  

\[ = 62.1 \text{ minutes} \]  

Information:

\( CTABCA \) : the time between circulation from A-B-C back to A  
\( TAB \) : average travel time from A to B  
\( TB \) : average travel time from B to C  
\( TCA \) : average travel time from C to A  
\( \delta AB \) : travel time deviation from A to B  
\( \delta BC \) : deviation of travel time from B to C  
\( \delta CA \) : deviation of travel time from C to A  
\( TTA \) : vehicle downtime in A  
\( TTB \) : vehicle downtime in B  
\( TTC \) : vehicle downtime in C

3.5.2.4 Time between vehicles (headway)

Here is the headway calculation formula [7] [10]:

\[ H = \frac{60 \times C \times Lf}{P} \]  

\[ \text{Headway on weekdays} \]  
\[ H = 15.72 \text{ minutes, for actual demand} \]  
\[ H = 11.84 \text{ minutes, for potential demand} \]  

Headway on weekend

\[ H = 9.03 \text{ minutes, for actual demand} \]  
\[ H = 6.51 \text{ minutes, for potential demand} \]  

Information:

\( H \) : the time between vehicles (minutes)  
\( P \) : average number of passengers per hour in the most populous section  
\( \text{(number of passengers obtained on average from 3 busy hours)} \)
3.5.2.5 Frequency

Frequency is the number of tourist transport trips on one route within one hour. The frequency obtained from the analysis results are as follows:

\[ F = \frac{60}{H} \] (4)

Frequency on weekdays

- For actual demand: \( F = 4 \text{ vehicles/hour} \)
- For potential demand: \( F = 5 \text{ vehicles/hour} \)

Frequency on weekend

- For actual demand: \( F = 7 \text{ vehicles/hour} \)
- For potential demand: \( F = 9 \text{ vehicles/hour} \)

Information:

- \( F \) : Frequency (vehicle/hour)
- \( H \) : Headway (minutes)

3.5.3. Number of vehicle needs

The number of fleets is determined by the vehicle's circulation time and the time between vehicles [8]. The number of circulation fleets required is calculated using the formula:

\[ K = \frac{CT}{H \times f} \] (5)

Number of pessimistic vehicles

\[ K = \frac{62.1}{1.69 \times 100\%} = 5 \text{ vehicles} \]

Number of optimistic vehicles

\[ K = \frac{62.1}{6.38 \times 100\%} = 10 \text{ vehicles} \]

3.5.4. Vehicle operating cost analysis

Table 4 Recapitulation of transport transport operational costs

| No | Recapitulation of cost/km | Price      |
|----|-------------------------|------------|
| 1  | Direct Cost             |            |
|    | a. Depreciation          | IDR4,394.90|
|    | b. Capital Interest      | IDR2,966.56|
|    | c. Driver's Salary and Allowances | IDR2,996.52 |
|    | d. BBM                   | IDR1,044.44|
No Recapitulation of cost/km Price
1 Direct Cost e. Tire IDR156,00
f. Small Service IDR279,00
g. Large Service IDR119,88
h. Over Houl Engine IDR55,00
i. Over Houl Body IDR599,30
j. Terminal Retribution IDR18,52
k. STNK /Vehicle tax IDR48,44
l. Kir IDR12,98
m. Insurance IDR49,44
2 Indirect Cost a. Non-Bus Employee Salary Costs
b. Cost Management IDR77,91
3 AMOUNT IDR12,818,91

Source: Analysis results, 2020

From the recapitulation of the operational costs of the tourist transport vehicle, then: Vehicle operating costs / vehicles / km = direct costs + indirect costs = IDR12,818,91

3.5.5. Tourist transport cost (tariff) analysis
Tourist transport in this study, the tourist transport rates were measured taking into account the vehicle's operational costs, the operating cost and revenue balance point (BEP) and the expected profit rate (10 percent). The total cost is calculated for one trip from Extreme Market - Lake Linow to Prayer Hill, per passenger unit (IDR/pers) or per bus unit. The overall cost of a bus is a fare multiplied by the average number of passengers per bus for each passenger. The bus under consideration is a bus with a capacity of 16 seats. Here is the estimate of the tariff at issue.

\[
\text{BEP Cost of Extreme Market to Lake Linow} = \text{IDR } 7,590,15 \\
\text{BEP Cost of Lake Linow to Prayer Hill} = \text{IDR } 10,963,55 \\
\text{BEP Cost of Prayer Hill to Extreme Market} = \text{IDR } 4216,75
\]

\[
\text{Tariff (Cost of Transport)} = \text{Cost (BEP)} + (10\% \times \text{Cost (BEP)})
\]
\[
\begin{align*}
\text{Cost of Extreme Market - Lake Linow} & = \text{IDR } 8,349,17 \\
\text{Cost of Lake Linow-Prayer Hill} & = \text{IDR } 12,059,91 \\
\text{Cost of Prayer Hill – Extreme Market} & = \text{IDR } 4638,43 \\
\text{Total Cost/pers} & = \text{IDR } 25,000 \\
\text{Total Cost/Bus} & = \text{IDR } 400,000
\end{align*}
\]
Based on the calculation above, assuming the average number of passengers is 16 passengers per vehicle, the transportation cost from Extreme Market - Lake Linow - Prayer Hill and return to Extreme Market is IDR. 25,000/passenger or IDR. 400,000/bus.

4. Conclusion
The average time taken by tourists to visit tourist destinations in Tomohon City from Tomohon Extreme Market-Lake Linow-Pray Hill of Tomohon- Tomohon Extreme Market in 60 minutes. Meanwhile, when planned tourist transport connectivity in Tomohon City with the calculation result is 44 minutes. Determination of alternative routes from interviews, namely the tourist objects that are most in-demand by tourists in Tomohon City, namely from Tomohon Extreme Market - Lake Linow Tomohon-Tomohon Prayer Hill-Extreme Market. The type of vehicle used is a small bus with 16 seats, with the number of vehicles needed is ten vehicles, and the operating time for tourist transportation is 9 hours. The operational cost of the vehicle/vehicle / km is IDR. 12,818.91, then the planned fare for tourist transportation in Tomohon City is IDR. 400,000 per bus.

The operation of tourism transportation in Tomohon City is expected to be held soon to help tourists reach the tourist objects with ease. The number of vehicles provided is 5 armadas for the initial stage, then you can add up to 10 fleets according to the calculations above to accommodate the number of tourists on holidays. To realize the operation of Tomohon City tourism transportation, the transportation and tourism department can fulfill the required fleet.

References
[1] Basuki I and Amos S 2015 The Potential of Public Transportation in Tourism in the Special Region of Yogyakarta Yogyakarta 15(2):135–42
[2] Indonesia Transportation Department 2009 Constitution No. 10 Year 2009 about Tourism 4(3)
[3] WidyastutiH, Marsoyo A and Setiawan B 2019 Analysis of Connectivity Between Coastal Tourism Destinations in the Special Region of Yogyakarta 14(1):1–12
[4] Rismarini N, Munawar A and Priyanto S 2018 Tourism Transport Planning as a Link for Accommodation and Tourist Destinations in Yogyakarta City Yogyakarta 19-20
[5] Hartanto and Budi D 2014 Tourism Transport Planning in the Special Province of Yogyakarta (DIY) Implement Sci. 39(1):1-15
[6] Government of Republic of Indonesia 2011 PP No.50 year 2011 about The Master Plan for Tourism Development RI 2010-2025
[7] Rien T, Akhmadali and Kadarini S N 2002 Pontianak City Tourism Transportation Planning Pontianak 1-10
[8] Lestari D A, Suthanaya P A and Wedagama D M P 2017 Planning of the Transportation Transportation Operational System in the City of Denpasar Denpasar 5(1):64–70
[9] Indonesia Transportation Department 2009 Constitution No. 22 Year 2009 4(3)
[10] Land Transportation Agency of Transportation Departement of Indonesia 2002 Technical Guidelines for the Implementation of Public Passenger Transport in Urban Areas in Fixed and Regular Routes (SK.687/AJ.206/DRJD/2002):2–69