Exploring the Role of Transportation Demand Omotenashi (TDO) in the City Center Plaza of Batu

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Abstract. City center plaza of Batu is one of the icons of Batu city because of its strategic location and attractive design. The large number of visitors to City center plaza of Batu makes the area have a high number of trip attractions. Therefore, it is necessary to have integrated planning, especially in the city center plaza of Batu. The concept of TDO is hospitality, familiarity, and warmth which are considered the right solution to overcome traffic problems in Batu City, especially in the city center plaza of Batu. The research used Transportation Demand Omotenashi Concept and Process Hierarchy Analysis (AHP). The results obtained in the research are in the form of strategies that will be applied to the city center plaza of Batu, namely pedestrian arrangement, pedestrianway addition, enforcement of traffic regulations, improvement of public transport services, and parking management.

Keywords: Transportation-Demand-Omotenashi, City-Center-Plaza, Batu-City

1. Introduction

Transportation problems in Indonesia arise because of an imbalance between facility transportation capacity (supply side) and the movement of people (demand side). This resulted in traffic congestion, delays, noise, and air pollution [1]. The approach that is always used by urban transportation planners is to accommodate every transportation growth in the form of increasing the capacity and efficiency of the infrastructure network system. One way that is often conducted is the implementation of management on transportation needs, also known as Transport Demand Management (TDM). The strategy that results in more efficient use of transportation resources is a general term for TDM [2]. Implementation of the TDM concept and its dependence on technology, and several previous studies have focused on definitions and policy characteristics [3,4].

TDM is one way of managing vehicle demand in the transportation system, by reducing the number of private vehicles by encouraging public transportation modes and reducing the need for expensive planned repairs, such as widening roads or new highways. Decreasing the number of vehicles can reduce emissions, increase air quality, and save energy [5]. One of the Transport Demand management (TDM) strategies is TDO (Transportation Demand Omotenashi) which uses the concept of "Omomotenashi" which is a mindset of Japanese-style prime service with the concepts of friendliness, kinship and warmth [6]. Omotenashi also means hospitality, namely the concept of hospitality in service.

There are some research related to Transportation Demand Management such as [7] examines the role of TDM policy interactions at the macro and micro level. They adopted the mode choice model of the city of Tehran. [8] explained the methodology for predicting the effects of active transportation and
demand management (ATDM) measuring highway performance that can be applied using microsimulation or Highway Capacity Manual (HCM) analytical technique. [9] has hypothesized that TDM policy might offer important potential to reduce the problem of traffic congestion in Istanbul because very minimal demand-side management measures have been implemented. In this case, one goal is to investigate and test the potential of the right TDM policy that offers a solution to the problem of traffic congestion in Istanbul. Conventional economic variables are not enough to increase demand for public transport [10]. Park and Ride is one of the Transport Demand Management, the TDM scheme, which is very popular in several densely populated cities with large parking areas on the border line or suburban areas [11].

Batu City is a newly formed city in 2001 as a fraction of Malang Regency. The population of Batu City in 2017 was 203,997 people with a population density of 4,965 people / km² [12]. Batu City is known as one of the leading tourist cities in Indonesia because of its potential for natural beauty, and has become one of the best-selling tourist destinations in East Java Province. The city center plaza of Batu is one of the icons of Batu city, because of its strategic location (in the city center) and it has an attractive design. The large number of visitors to the city center plaza of Batu makes the area has a high number of trip attraction. This resulted in the accumulation of private vehicles, so that congestion is frequently found at several points, one of which is on Diponegoro Street. Therefore, it is necessary to have integrated planning, especially in the city center plaza of Batu. Transportation Demand Omotenashi (TDO) with the concept of hospitality, familiarity and warmth is considered the right solution to overcome traffic problems in Batu City, especially in the city center plaza of Batu. The research was conducted by taking a case study in the City Centre Plaza of Batu City. The concept of Transportation Demand Omotenashi in the research using analysis of process hierarchy (AHP).

2. Methods

2.1 Location

The research location is in Batu City which is known as one of the leading tourist cities in Indonesia because of the potential of natural beauty and become one of the best-selling tourist destinations in East Java Province. The population of Batu city is 163,393 people with a density of 806 people/km² (Fig. 1).

![Figure 1. Research Location](image-url)
2.2 Transportation Demand Omotenashi

Analysis of Transportation Demand Omotenashi (TDO) is an analysis used to assess the possibility of applying TDO in Batu City. TDO used the concept of hospitality, familiarity and warmth. The concept of hospitality is focused on the road’s level of service, pedestrian way performance by using customer satisfaction index. The familiarity concept focuses on parking capacity and evaluative descriptive analysis. In the concept of warmth, the analysis used is evaluative descriptive analysis [13].

2.2.1. Hospitality

A. The Road’s Level of Service Analysis

The road performance analysis is carried out by measuring the road’s level of service on the 29 selected road segments. The road’s level of service (LoS) can be obtained from a comparison between traffic volume and road capacity [13,14].

\[
VCR = \frac{V}{C}
\]

VCR = volume capacity ratio (service level value)

\( V = \) traffic volume (pcu/hour)

\( C = \) road capacity (pcu/hour)

B. Pedestrian-way Performance Analysis

The relationship between speed, density, and traffic flow is high, if the density of pedestrians increases, the speed of movement of pedestrians on the pedestrian-way will decrease [13,15]:

\[
\upsilon = S \times D
\]

\( \upsilon = \) pedestrians flow (ped/min/ft)

\( S = \) pedestrians speed (ft/min)

\( D = \) pedestrians density (ped/ft)

C. Customer Satisfaction Index Analysis

The Customer Satisfaction Index is used to determine the level of overall visitor satisfaction by looking at the importance of the product / service attributes [16].

\[
CSI = \frac{\sum P_{MS_i}}{KS} \times 100\%
\]

\( WS_i = \) weigh scores

\( HS = \) maximum scale used

2.2.2. Familiarity

A. Parking Capacity Analysis

Parking capacity is how much capacity is available in the study area, at a certain time [13,14]. Parking capacity is calculated by the formula:

\[
\text{Capacity} = \frac{S}{D}
\]

\( S = \) total official stall (stall)

\( D = \) parking duration (hour)
B. Descriptive Evaluative Analysis

Evaluative descriptive analysis aims to describe the description of the object under study and measure the success of an activity that has been carried out. Research that uses evaluative methods is a research activity that evaluates an activity / program that has a goal to measure the success of a program activity and determine the success of the program, whether it has been in line with expectations [17]. In this study evaluative descriptive analysis was used to determine the percentage of passengers who is engaged in social interaction.

2.2.3. Warmth

The warmth concept assessment uses evaluative descriptive analysis. Evaluative descriptive analysis is an analysis that aims to describe the description of the object under study and measure the success of an activity that has been carried out. In this study evaluative descriptive analysis was used to determine the physical attractiveness of the region, the social attractiveness of the region, and the historical attractiveness of the region.

2. Process Hierarchy Analysis (AHP)

Process hierarchy analysis is a decision-making technique developed by Thomas L. Saaty to solve complex multi-factor problems or multi criteria into a hierarchy. In this study process hierarchy analysis was conducted to determine the priority strategies that can be done to create the TDO concept based on the variables of Hospitality, Familiarity and Warmth in the city centre plaza of Batu City (Fig. 2).

![Process Hierarchy Analysis (AHP)](image)

Figure 2. Process Hierarchy Analysis (AHP)

3. Result and Discussion

3.1. The Possibility of TDO in the City Centre Plaza of Batu City

An assessment of the possibility of applying the TDO in the Batu City Square was carried out by analyzing the three concepts used, namely the concepts of Hospitality, Familiarity, and Warmth.

3.1.1. Hospitality

A. The Road’s Level of Services

Road performance is known after calculating the capacity and volume of traffic in the road segment under study. Analysis of road performance obtained is:
| Location                                                                 | LoS Weekday | LoS Weekend | Hospitality Level Weekday | Hospitality Level Weekend |
|-------------------------------------------------------------------------|-------------|-------------|---------------------------|--------------------------|
| Ahmad Yani Road to Brantas Road                                          | 0.18        | 0.19        | A                         | Hospitable               |
| Brantas Ke Jalan Ahmad Yani                                             | 0.24        | 0.21        | B                         | Hospitable               |
| Brantas Road                                                            | 0.51        | 0.52        | C                         | Sufficient               |
| Semeru Road                                                             | 0.94        | 1.00        | E                         | Unhospitable             |
| WR Supratman Road – Diponegoro Road (Right)                             | 0.18        | 0.18        | A                         | Hospitable               |
| WR Supratman Road – Diponegoro Road (Left)                              | 0.05        | 0.05        | A                         | Hospitable               |
| Diponegoro Road (Left to the Right)                                    | 0.34        | 0.42        | B                         | Hospitable               |
| Diponegoro Road (Right to the Left)                                     | 1.52        | 1.50        | F                         | Unhospitable             |
| Diponegoro (Right) - WR Supratman Road                                 | 0.05        | 0.05        | A                         | Hospitable               |
| Diponegoro Road (Left to WR Supratman Road)                             | 0.11        | 0.11        | A                         | Hospitable               |
| WR Supratman Road – Ahmad Yani Road                                     | 0.11        | 0.12        | A                         | Hospitable               |
| WR Supratman Road – Suropati Road                                       | 0.07        | 0.07        | A                         | Hospitable               |
| WR Supratman Road – Sudarno Road                                        | 0.02        | 0.03        | A                         | Hospitable               |
| Ahmad Yani Road - WR Supratman Road                                     | 0.18        | 0.18        | A                         | Hospitable               |
| Ahmad Yani Road – Suropati Road                                         | 0.09        | 0.10        | A                         | Hospitable               |
| Ahmad Yani Road – Sudarno Road                                          | 0.01        | 0.02        | A                         | Hospitable               |
| Suropati Road - WR Supratman Road                                       | 0.08        | 0.09        | A                         | Hospitable               |
Overall, out of 29 road segments, the city centre plaza of Batu City has 17.5% or 5 road segments that are not hospitable, and 24 road segments are hospitable for motorized vehicle drivers. Therefore, roads that are sufficient and unhospitable require transportation management strategies to prevent congestion.

**B. Pedestrian Way Performance**

Assessment of pedestrian way performance can show the level of performance of pedestrian facilities having a density problem.

**Table 2. Pedestrian Way Performance**
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Location | Ratio V/C | LoS | Hospitality Level
---|---|---|---
| Weekday | Weekend | Weekday | Weekend | Weekday | Weekend |

Sudiro Selatan Road (City Centre Plaza of Batu) | 1.0 | 2.1 | A | A | Hospitable | Hospitable |
Kartini Utara Road (the front of Pawnshop office) | 0.3 | 0.3 | A | A | Hospitable | Hospitable |
Kartini Selatan Road (the front of Slamet’s Bebek Restaurant) | 0.3 | 0.4 | A | A | Hospitable | Hospitable |
Ahmad Yani Road | 0.9 | 0.9 | A | A | Hospitable | Hospitable |
Brantas Road | 0.6 | 0.9 | A | A | Hospitable | Hospitable |
Semeru Road | 0.7 | 0.8 | A | A | Hospitable | Hospitable |
Diponegoro Road | 0.6 | 0.7 | A | A | Hospitable | Hospitable |
WR Supratman Road | 0.7 | 0.8 | A | A | Hospitable | Hospitable |
Suropati Road | 0.4 | 0.9 | A | A | Hospitable | Hospitable |
Sudarno Road | 0.9 | 1.0 | A | A | Hospitable | Hospitable |
Bromo Road | 0.6 | 0.9 | A | A | Hospitable | Hospitable |
Kelud Road | 0.5 | 1.0 | A | A | Hospitable | Hospitable |
Munif Road | 1.2 | 1.5 | A | A | Hospitable | Hospitable |
Agus Salim Road (City Centre Plaza of Batu) | 0.9 | 1.1 | A | A | Hospitable | Hospitable |

The LoS A value shows pedestrians can walk freely and can determine the direction of walking at a relatively fast speed without causing interference between fellow pedestrians. The number of pedestrians who have little or large influence also, because of the effective width of the pedestrian way is not disturbed by street vendors. So, 17 pedestrian way segments fulfill the concept of hospitality.

C. Public Transport Passenger Satisfaction
Attributes to measure satisfaction level consist of five aspects, namely security, safety, affordability, and order. The following is the result of the Customer Satisfaction Index (CSI) obtained based on calculations.

**Table 3. Public Transport Passenger Satisfaction**

| Aspect | Attribute | average value |
|---|---|---|---|---|
| | Level of Importance | Level of Satisfaction | Weight Factors | Weight Score |
| Security | A1 | 4.15 | 3.59 | 7.62 | 0.27 |
| | A2 | 4.02 | 1.6 | 7.38 | 0.12 |
| | A3 | 4.18 | 2.8 | 7.68 | 0.22 |
| | A4 | 3.69 | 2.86 | 6.78 | 0.19 |
| Safety | B1 | 4.72 | 2.65 | 8.67 | 0.23 |
| Comfort | C1 | 4.25 | 2.78 | 7.8 | 0.22 |
| | C2 | 3.64 | 1.86 | 6.68 | 0.12 |
| | C3 | 4.04 | 1.84 | 7.42 | 0.14 |
| Affordability | D1 | 4.29 | 2.72 | 7.88 | 0.21 |
| | D2 | 4.32 | 3.45 | 7.93 | 0.27 |
| Regularity | E1 | 4.51 | 2.83 | 8.28 | 0.23 |
| | E2 | 4.24 | 3.02 | 7.79 | 0.24 |
Based on the results of the Customer Satisfaction Index (CSI), it can be concluded that the level of customer satisfaction for service quality performance is 54%, so that customers can be said to be quite satisfied.

3.1.2. Familiarity
A. Parking Capacity
Parking capacity is the parking capacity provided by the manager. On street parking in the City Centre Plaza of Batu is located on five road segments, namely Diponegoro Road, Agus Salim Road, Munif Road, Sudiro Road, Gajah Mada Road. The location of on-street parking is located on the left side of the road as many as 10 parking lots and there are 8 units on the right side of the road (Fig. 3). The number of on-street parking vehicles in the area of City Centre Plaza of Batu as much as 94% does not exceed the parking capacity and 6% exceeds the parking capacity. The number of parking vehicles that exceed the parking capacity is on the right side of Sudiro Road, due to the presence of dense service trade activities. In addition, on the left side of Sudiro Road there is the City Centre Plaza of Batu, so that many visitors to the City Centre Plaza of Batu their motorbikes on the on-street parking area of Sudiro Road.

![Figure 3. Parking Capacity](image)

B. Public Transport Passenger Interaction
Social interactions that occur include two conditions, namely the existence of social contact and the occurrence of communication between passengers. Based on the results of the questionnaire, it can be seen that 68% of respondents knew new people in transportation, 60% of respondents interacted in transportation. As many as 45% of respondents boarded their own transportation, 23% of respondents boarded transportation with friends, 17% of respondents boarded transportation with children, and 15% of respondents boarded transportation with their husbands/wife.

3.1.3 Warmth
A. Regional Attraction
Ferris wheel, fountain, and apple statue are icons of the Batu City. Ferris wheel rides can be enjoyed from day to night and to ride the Ferris wheel just pay the ticket 8000 Rupiah, so it can be reached by all circles. The sparkling lights that glow the Ferris wheel and the fountain at night further add to the physical attraction of the City Centre Plaza of Batu.
B. Social Attraction
In the central area of the square there are empty spaces equipped with seating for visitors. This seat is often full of visitors who talk and rest by enjoying snacks sold on the sides of the square. Facilities in the City Centre Plaza of Batu area consist of children’s playgrounds, seats, toilets and information rooms.

C. Historical Attraction
The historical attraction of the City Centre Plaza of Batu area is located in the 1967 Sticky Rice Post. This sticky post has its own historical appeal for it has been around since 1967. The building has been modest and has not changed until now, but it has always been filled with the visitor. In addition, on all sides of the square there are also locations that become tourist attractions, Laron Market (Senggol), Batu Plaza, Square Culinary Tourism, and An-Nuur Mosque.

3.2. Strategy for Application of TDO in the City Centre Plaza of Batu
Priority strategies used in implementing the TDO strategy in the City Centre Plaza of Batu area, namely the arrangement of pedestrian ways, the development of pedestrian way, enforcement of traffic regulations, improvement of public transport services, and parking management.

Based on AHP calculations, the concept of TDO can be applied in the study area but on the condition that it is able to overcome transportation problems in Batu City. The priorities of the TDO strategy based on the opinions of experts are as follows:
1. Arrangement of Pedestrian way (13.10%)
2. Enhancement of Pedestrian way (22.89%)
3. Law Enforcement (31.52%)
4. Improvement of Public Transportation (10.39%)
5. Parking Management (2310%)

| Expert | Arrangement of Pedestrian way | Enhancement of Pedestrian way | Law Enforcement | Improvement of Public Transportation | Parking Management |
|--------|-------------------------------|-------------------------------|-----------------|--------------------------------------|---------------------|
| R 1    | 0.11                          | 0.22                          | 0.28            | 0.08                                 | 0.31                |
| R 2    | 0.12                          | 0.23                          | 0.30            | 0.12                                 | 0.22                |
| R 3    | 0.17                          | 0.20                          | 0.36            | 0.11                                 | 0.16                |
| Inconsistency | 0.13 | 0.22                          | 0.32            | 0.10                                 | 0.23                |

4. Conclusion
TDO is the right solution to overcome the problems of public transportation, parking and pedestrians in the City Centre Plaza of Batu, using the concept of hospitality, warmth and familiarit which will be a variable to measure the possibility of applying the TDO strategy in the City Centre Plaza of Batu. It can be seen that the geometric of pedestrian ways found in the City Centre Plaza of Batu area does not meet the concept of hospitality, but 24 road segments and pedestrian ways in the area have met the concept of hospitality. The existence of public transportation in the area can encourage community interaction so that it meets the familiarity concept, while the parking characteristics found in the City Centre Plaza of Batu have not met the familiarity concept because most parking lots do not have parking lots and the number of vehicles exceeds the parking capacity. Therefore, the strategy that will be applied to the City Centre Plaza of Batu area is structuring rigid pedestrian ways, arrangement of pedestrian way, enforcing traffic regulations, improving public transportation services, and parking management.

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