JIMMA UNIVERSITY

JIMMA INSTITUTE OF TECHNOLOGY

SCHOOL OF GRADUATE STUDIES

FUCULTY OF CIVIL AND ENVIROMENTAL ENGINEERING

HIGHWAY ENGINEERING

Assessment of Transport Terminal Operation with Respect to Vehicle Assignment and Passengers' Perception: Case Study at Jimma Bus Terminal

A Research Thesis Submitted

to School of Graduate Studies of Jimma University in Partial Fulfillment of the Requirements

For Degree of Masters of Science in Civil Engineering (Highway Engineering Stream)

Fikraddis Jima

November 2017

Jimma, Ethiopia

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Declaration

I, the undersigned, declare that the work which is being presented in this thesis titled **"Assessment of Transport Terminal Operation with Respect to Vehicle Assignment and Passengers' Pereption: Case Study at Jimma Bus Terminal"** is original work of my own, and It has not been presented for a degree in any other university.

By

Fikraddis Jima _____ _____

Signature Date

A Thesis submitted to the School of Graduate Studies of Jimma University in Partial Fulfillment Of the Requirements for the Degree of Master of Science in Civil Engineering

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Abstract

Movements of people, goods and information have always been fundamental components of human societies. Transport system is one of the most essential services and a vital force for determining the upward direction of development. To achieve the desired transportation balance and the system to be effective and efficient, it is essential to provide organized facilities in all parts of the system. One such facility is a bus terminal. A bus terminal is a point where transport route starts and ends where the vehicles stop, reverse and wait, before departing on a return journey.

This research primarily focused on assessments of transport terminal operation with respect to vehicle assignment and passengers' perception regarding to the service given in the terminal. Descriptive cross sectional study research type is used to identify problems in the area. Desk study was used to check vehicles' data from terminal and questionnaires were distributed to passengers to analyze their level of satisfaction regarding to internal facilities of the terminal. In order to carry out this research, similar researches as a literature review were reviewed and different books and documents written on the subject matter from internet and library were also reviewed. Finally, in this research, IBM SPSS version 20 is used to develop regression model for vehicle assignment in order to have proportinal distribution of vehicles through the routes. And Microsoft Excel was used to represent data by chart and in addition AUTOCAD 2007 was used to visualize the bus terminal.

*Based on finding of this thesis it is indicated that there was unproportional vehicle assignment throughout the route. In addition, there were also problems such as insufficient vehicles, absence of route information, issue of theft and discomfort of terminal to passsengers is available in terminal and passengers were not satisfied regarding to service given in the area. Therefore, to get proportional distribution of vehicles, such regression model was developed Y=21.487+0.017*No. passenger, for routes categorized under short distance routes, Y=16.363+0.066*No. passen-0.707*N. seat, for medium distance routes and Y=42.789-0.632*No. seats for long distance routes, where Y stands for number of predicted vehicles and accuracy of model depends on R values in the output table and vary from 0.3-1.0 for best correlation. Finally, internal facilities should have to provide to solve mentioned problems in the terminal.*

Key words: Transport Terminal Operation, Management Team, Vehicles, Passengers

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Finally, I would also like to use this opportunity to convey my gratitude to my Husband. Without his support and encouragement, I couldn’t have this opportunity to complete my study.

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List of Acronyms

SPSS Statistical Package for the Social Sciences

BTT Bus Transport Terminal

PIS Passengers' Information System

LDR Long Distance Route

IBM International Business Machines

JBT Jimma Bus Terminal

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

For as long as the human race has existed, transportation has played a significant role by facilitating trade, commerce, conquest, and social interaction, while consuming a considerable portion of time and resources. The essence of urban planning is to provide adequate and equitable service to all groups. Murray et al., (1998) stated, Transport service has influence impact on regional patterns of development, economic viability, and environmental impacts and on maintaining socially acceptable levels of quality of life. Transport is an absolutely necessary means to an end and allows people to carry out the diverse range of activities that make up daily life (Hanson, 1995).

The transport system improves the social, economic, industrial, commercial progress and transfers the society into an organized one. It is one of the most essential services, vital force for determining the direction of development. To achieve the desired transportation balance and the system to be efficient, it is essential to provide organized facilities in the system, one such facility is a bus terminal. A bus terminal is the point at the start/end of a transport route, where the vehicles stop, reverse and wait, before departing on the return journey. It also serves as a station for passengers to board and alight. Evidently, at a bus terminal, parameters addressing passenger and operator requirements overlap. It is the site for interchange between large volume of bus and passenger traffic. This demands that the facilities at a bus terminal be planned systematically and that user requirements are addressed in such planning, or else the lack of an efficient and functional environment will lead to friction, ultimately compromising the attractiveness of the bus system (Rodriguez, 2012).

The aim of this study is to assess operation in bus terminal in case of Jimma, Ethiopia. It is specifically focus on current situation of the terminal such as, way of vehicle assignment to respective route, conformity of terminal for passenger, safety and security concern are also other issue in the study.

1.2 Statement of the problem

Movements of people, goods and information have always been fundamental components of human societies. Contemporary economic processes have been accompanied by a significant increase in mobility and higher levels of accessibility. Although this trend can be traced back to the industrial revolution, it significantly accelerated in the second half of the twentieth century as trade liberalized, economic blocs emerged and these conditions are interdependent with the capacity to manage, support and expand movements of passengers as well as their underlying information flows (slack B, 2006).

All special flows, with the exception of personal vehicular and pedestrian's trips, involve movements between terminals. With these two exceptions, all transport modes require assembly and distribution of their traffic. For example, passengers have to go to bus terminal first in order to reach their final destination. Terminals are therefore, essential links in Transportation chain

Due to internal problem of terminal such as vehicles assignment, internal facilities for passengers, and other transport related problem in Jimma bus terminal, every time user waste their time and energy. The issue of thefts has been one of the most severe problems confronting all types of transport terminals, especially where high value goods are being handled. This also results in delay of time to reach their destination, develops illegal transport that leads to unexpected cost to get their destination (comtois C, 2012).

This study is made to assess uniformity in distribution of vehicles throughout the routes and to find out passenger's perception with the bus terminal in Jimma. This study also includes, identifying the present condition of transport infrastructure and the safety and security in the bus terminal. From these factors, this study is being able to conclude what were their expectations towards bus terminal in order to let the government make improvements.

1.3 Research Questions

1. Is there Proportional distribution of vehicles assignment throughout the routes?
2. How looks passenger's perception to transport service given in Jimma bus terminal?
3. What will be the solution for problem occurs in terminal?

1.4 Objectives of the Study

1.4.1 General Objective;

The general objective of this research was to assess transport terminals operation with respect to vehicles assignment and passengers' perception in Jimma Bus Terminal.

1.4.2 Specific objectives

- To investigate proportionality of vehicle assignment throughout all routes.
- To assess passengers level of satisfaction regarding to service given in the terminal.
- To develop vehicle assignment model and recommend possible remedial solution for the problems identified.

1.5 Scope of the Study

This research focused on having efficient, safe and easily accessible transportation through a case study. For these purposes, vehicles assigned by the terminal and registered at the exit while released from the terminal and passengers using those routes were selected for the case study. One week registered number of vehicles trip to different routes data were used for the study in order to compare with number of vehicles assigned per day from the terminal. Data collection was limited to time and finance.

CHAPTER -TWO

LITERATURE REVIEW

2.1 General Overview

Transport is believed to be one of the most important human activities worldwide and an indispensable component of the economy. It therefore, provides an integral function in the formation of special relations between locations (Rodriguez et al., 2006).

As Onokala, 2001. Said, transport is important for the survival of modern society and there would be no life in the city without transportation. As an essential service in urban Centre, transport enables people, firms and other organization to implement their activities at sites selected for these purposes in separate locations in the cities. (Buchannan, 1969; Hoyle and Smith, 1992) explained that transport as it provides a key to the understanding and operation of many other systems at many different scales and is an epitome of the complex relationships between social and political activities and level of economic development.

2.2 Transportation and development

Urbanization and development are inalienably interlinked in the sense that one is both the cause and consequence of the other (Mathewos consultant, 2006). Transport is another aspect of this strong correlation and linkage between urbanization and development. Transport facilitates the movement of goods and service from area of production to areas of demand. Diffusion of innovation is made possible through transport.

2.3 Transportation Terminals

According Slack, B.et al., (2002), a terminal may be defined as any facility where passengers are assembled or dispersed. Passengers have to go to bus terminal first to reach their final destination. Terminal may also be a point of interchange involving the same mode of transportation. Transport terminals, therefore, are central and intermediate locations in the movement of passengers.

Terminals are central and intermediate locations in the movements of passengers and often require specific facilities and equipment to accommodate the traffic they handle.

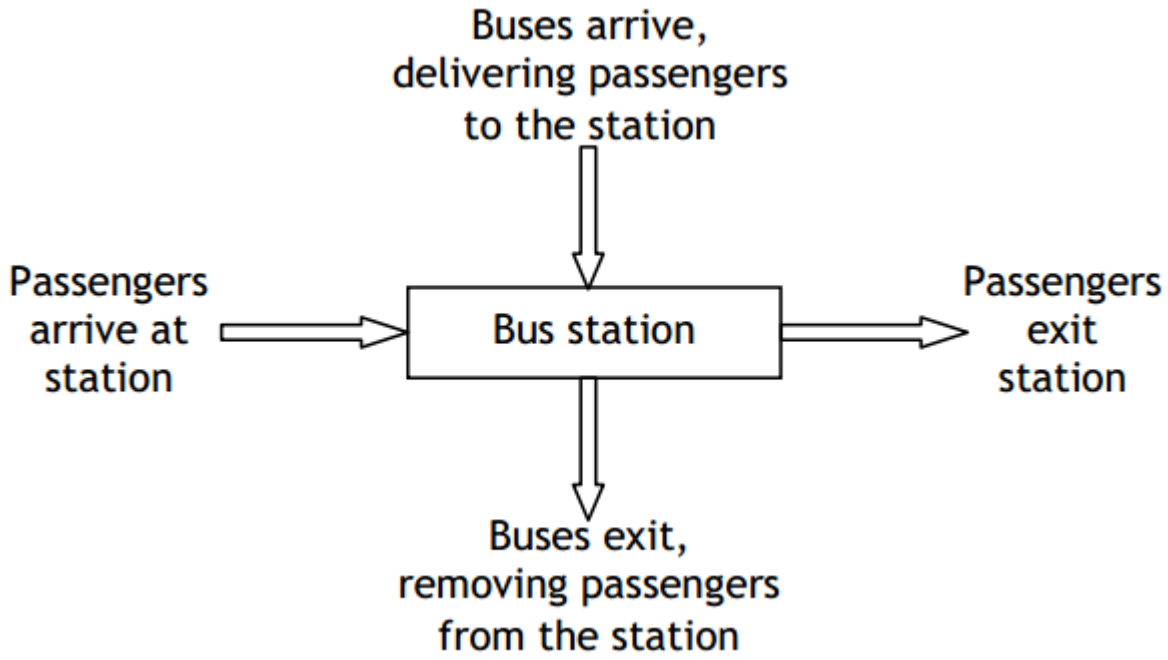

Figure 2. 1: Function of terminal

2.4 Planning Considerations for Bus Terminal

As transportation involves the movement of the people and goods, there is a need of an "access point" in transport system to use it. These access points are known as "Terminals" or the fixed facilities. Terminals are one of the main components of any mode of transportation (Hong kong, 2014). land requirement for bus terminus or public transport interchange is determined by several factors which include the number of route served and their peak frequency volume of waiting passengers, space for bus staking during off peak/meal break period, overtaking and vehicle and passenger circulation. There are four planning criteria for terminal (Shubham, 2017).

- ✓ Need
- ✓ Size
- ✓ Location
- ✓ Design

2.5 Principle of Terminal Planning and Design in India

As technical document produced by SGArchtect, New Delhi, Vasant K, 2015, principles governing how to approach the planning of bus terminal are focused toward ensuring enhanced passengers experience and level of service. There have been listed below, and may be applied during the design development process.

Access and approach: traditional bus terminal facilities fail to provide convenient access to public buses; and their closed confines make access extremely difficult for passengers. Current attempt to improve bus based public transport access are only concerned with improvement of street infrastructure, and focused mainly on pedestrian facilities and bus stops (Vasant K, 2015).

Access to the terminal should be convenient, barrier free, and facilitate streamlined internal circulation. Additionally, the ingress and egress points should be so located that they are not in conflict with traffic circulation at the peripheral road network (planning department of Hong Kong 2014). One way of achieving this is by creating alternative access/egress point by integrating multi modal facilities with the bus terminal; this can further convenient commuters by providing access/egress choices.

Location: locational characteristics make for the key factors attracting passengers using bus terminal (Trans link transit Authority 2011). Centrally located (core city areas) bus terminals are desirable for operational efficiency and passenger's convenience, as they provide ample interchange opportunities. Additionally, they are potential candidates for using terminals as vibrant city space. Peripheral terminals, when integrated with depot function, work best in minimizing dead mileage.

Operational parameters: planning and designing bus terminal is significantly influenced by terminal's operational attributes. Several operational parameters bear up on a bus terminal's requirements. These includes the number of routes served and their peak frequency, volume of waiting passengers, spaces for bus stacking (idle parking), mix of terminating and passing service and passenger circulation (Trans link transit Authority 2011). Thus essential to the terminal planning and development process that the operational parameters are fully understood and accounted for.

Existing capacity and future demand estimation: in addition to operational requirement, terminal design and planning should also factor in the estimate existing capacity and future

(horizon year) demand. The considerations for redressed of potential short term and long term capacity constraints, and future expansion on the basis of estimated horizon year demand should be incorporated early in the planning stage (Trans link transit Authority 2011). Enhance level of service: The basic premise of the level of service (LOS) framework is compromised by crowding; they perceive it as a deterioration of service (Transportation Research Board 2011). LOS is an indicator of how good the present situation in the given facility is, and helps determine the environmental quality of a given space based on the function it is serving. To plan for critical LOS requirements for a terminal (as listed in different standards), one must first understand the entire journey of a passenger through the facility. Each activity planned for the passenger/commuters to offer a base line level of service as per space standards and area allocation (Vasant K, 2015).

Integrating universal design: India's Disability Act of 1995 suggests that public infrastructure be barrier free for all. This implies that bus terminal facilities should be inclusive and accessible for all, including differently abled people, people carrying luggage, pregnant women, children, people travelling with infants (in hand or stroller) etc. all passengers should be able to cover their journey in a seamless manner with minimum effort (Trans link transit Authority 2011).

Integrating sustainable development practices: infrastructure plans and development practices should consider green building technologies to reduce the overall carbon footprint and adverse impact on the environment, both during the development and operational phase.

Construction practices may employ material (and techniques) with low embodied energy, while energy requirements for the terminals operations may be met through sustainable means and use of efficient technologies. This may include use of solar energy, passive cooling/heating measures, higher reliance on natural lighting etc. additionally, techniques for noise control, solid waste management (planning department of Hong Kong 2014).

2.5.1 Essential requirements

The guideline intends to provide standards and recommendations for planning and designing bus terminals, per the Indian context. For this, a list of board infrastructural requirements has been drawn up, as primary infrastructure requirements and supporting infrastructure requirements (Vasant K, 2015).

A. Primary infrastructural requirement

The infrastructure requirements for bus terminals respond to the bus and passenger demand within a given site. Identified infrastructural elements consume space based on planned capacity, which when aggregated defines the site area requirement for a proposed terminal facility. This infrastructural element includes bus transfer, park-and-ride, drop-off, vehicular parking, and meet –and –greet areas, as well as the various inside-terminal elements such as walkways, stairways, escalators, elevators, turnstiles, ticket machines and platforms. They vary with the requirements of passenger, staff and drivers. Ancillary facilities that act as feeder to bus terminal also need attention. The building area that houses these facilities needs to respond to a defined level of service in order to accommodate the required footfall. Space and architectural standards define the relationship between spatial requirements and level of service. Primary elements to be considered with regard a bus terminal's infrastructural development can be classified for two different user types. These include passengers and terminals staff (Vasant K, 2015).

1. **Passenger areas**
    a. Ticketing and queuing
    b. Passenger waiting areas
    c. Passenger conveniences (drinking water facilities and toilets)
    d. Passenger circulation
    e. Boarding /departing areas
    f. Facility entry

2. **Areas for terminal staff**
    a. Revenue office
    b. Security and information
    c. Ticketing booth
    d. Resting room
    e. Staff conveniences (drinking water facilities and toilets)
    f. Maintenance staff (chairs and lockers)

B. Supporting infrastructure

Bus terminal infrastructure planning is not just about provision of requisite facilities, but also about how these facilities serve the terminal users. It has been observed that even large and newly constructed terminals fail to meet commuter requirements and expectations. This can be attributed to poor functionality and upkeep of provided facilities, such as shabby waiting areas, lack of connectivity, dilapidated rest sheds, sticking environs, poor ambience etc. Supporting infrastructure refer to the additional facilities which aid in enhancing user experience, efficiency, and attractiveness of bus terminals. These include provision for feeder infrastructure, seating, landscaping, lighting, way finding (passenger information systems (PIS), signage and marking), public art, and breakdown services (Trans link transit Authority 2011).

Feeder infrastructure: The infrastructure which connects the bus terminal with the city is referred to as supporting access (or feeder) infrastructure. It includes provision for various modes that provide access-and act as feeder-to the bus terminal. These include parking for private vehicles; drop-off and pickup bays for private vehicles, taxis, auto rickshaws cycle rickshaw, shared vehicles such as vans/jeeps etc.; and bays and /or stops for local bus services. Integration of all these modes makes for higher passenger convenience and increased intermodal accessibility (Trans link transit Authority 2011).

Seating: seating in and around the bus complex shall be planned to cater to a minimum of 30% of all passengers in the facility (Vasant K, 2015). Seating is required to avoid obstruction to the flow of passenger traffic through the complex; it should be designed to combine comfort, ease of maintenance and resistance to vandalism.

Hardscape and landscaping: it is important to ensure that landscaping complements the special design and enhances the visual appeal of the terminal. Outdoor and indoor passenger areas should be smoothly hard escaped, to facilitate easy connection between site's periphery and the terminal. The paving's surface quality should ensure durability as well as resistance against wear, walking comfort and usability by wheelchairs, prams and baggage trolleys.

Lighting: lighting should be designed to meet minimum illumination level and quality standards for both indoor and outdoor application. Natural lighting elements such as sky lights shall be used to enhance lighting level without increasing the energy load of the

terminal facility. Lighting fixtures should be energy efficient, require low maintenance, and minimize light pollution and glare (Trans link transit Authority 2011).

Signage: PIS including both dynamic and fixed signage constitute an integral part of the terminal's way finding infrastructure, and play an important role in regulating vehicular and pedestrian movement. They provide relevant information, warnings and directions, thus facilitating ease of access, convenience and safety (Vasant K, 2015). They should be strategically placed, consistent and easy to interpret.

2.6 Transport policy in Ethiopia

The city's road network, roundabouts, junctions, terminals and parking spaces are basic components of traffic management. However, some of these aforementioned road engineering elements have great influence on the traffic flow. Facilities like taxi stations, parking spaces, and traffic calming measures are not available in many corners of the city. Most of The available bus stops are not constructed to the standard and without due consideration of proper shades for passengers which, in turn, forced users to wait for the service in open air. Road ways do not give consideration for priorities for buses and mass transport vehicles and are not designed for longer trip lengths. Even the recently constructed ring road faces critical challenges to be used for the intended objective due to implementation problems. Periodic maintenance on some of the roads is not sufficient. There is no sufficient expansion of interlink ages between functional roads. Above all, sufficient and comfortable pedestrian walkways are not constructed for the pedestrians who account the major trip percentage in the city. Though, there are demands for bicycle use, there is no sufficient and convenient bike-ways and bike-bays. This has rendered impact in making the traffic management activity inefficient (Mathewos consultant, 2006).

2.7 Quality Indicators of Bus Terminal Transportation

Quality of service is defined as the overall measured or perceived performance of terminal from passenger's point of view. The quality of transport service can be measured against reliability, convenience, safety, security and comfort (Iles, 2005 and et.al). Speed, accessibility in time, reliability, and frequency…are quality indicators of transport services (Wood and Johnson, 1989).

Reliability: is an important element of service quality, which determines the level of passengers' satisfaction. Provision of reliable service enables service providers to retain passengers for long period (Iles, 2005).

The primary determinant of service reliability is the reliability of the vehicle itself (Ibid, 2005). Availability of sufficient numbers of vehicles will attract more passengers to use terminal for their daily traveling needs (Andaleeb, S. A. ,2007).

Reliability of public transport systems has been considered critically important by most public transport users because passengers are adversely affected by the consequences associated with unreliability such as additional waiting time, late or early arrival at destinations and missed connections, which increases their anxiety and discomfort (Bates et al., 2001; Reitvield et al.,2001). Reliability has also been identified as important in determining the mode choice (Tumquist and Bowman, 1980). Therefore, it may be stated that unreliability in public transport drives away existing and prospective passengers.

Convenience: it comprises accessibility, waiting time, interchangeability between services, travel expenditure, ease of payment, and availability and accuracy of information as an important element, which determines the quality of the service (Iles, 2005).

Security: in many transport system, passengers are not secured from pickpocket both on buses and at bus stops and terminals. In some case it is common that passengers are violently robbed.

The way in which transport is operated determines the level of insecurity. While the presence of inspectors or conductors on the vehicles, good lighting on buses and at bus stop have a beneficial effect in reducing the opportunity for robbery (Iles, 2005).

Comfort: is an important element of service quality considered by passengers using public transportation services (Andaleeb, S. A. ,2007).

passenger and operators' facilities and security and safety installations: such as queue railing, toilets, seating facilities, ticket machine, public telephones, fire-fighting equipment, regulators' office, etc. Subject to availability of space, it is recommended that these essential facilities should be provided at the public transport interchanges (Hong Kong up to 2016).

Passenger information facilities: such as passenger information, direction signs, route/destination display, departure time indicator, etc. To enhance passengers to transfer

between modes, an efficient message displays and directional signs or public announcement systems which help channelize passengers to their required destinations should be provided (Hong Kong up to 2016).

CHAPTER THREE

METHODOLOGY

3.1 Study Area

The study area selected for this study is in Jimma, bus terminal of Jimma. Jimma is the largest city in south-western Ethiopia. It is a special zone of oromia region and surrounded by Jimma zone. It has a latitude and longitude of $7^0$40'N $36^0$50'E. The town was the capital of Kaffa province until the province was dissolved. Prior to the 2007 census, Jimma was reorganized administratively as a special zone (Matthias D., 2014).

This city has a total population of 120,960, of whom 60,824 are men and 60,136 women. With an area of 50.52 square kilometers, Jimma has a population density of 2,394.30 all are urban inhabitants by (CSA, 2007) ... Jimma bus terminal is formed in 1978 having total area coverage of 27000 m^2 and responsible to assign vehicle for 32 respective routes for short and medium distance to surroundings zone other than assigned from federal for long distance transport.

Figure 3.1: Map of Jimma city

Here under, drawing the researcher tried to show terminal from the top using AUTOCAD 2007.

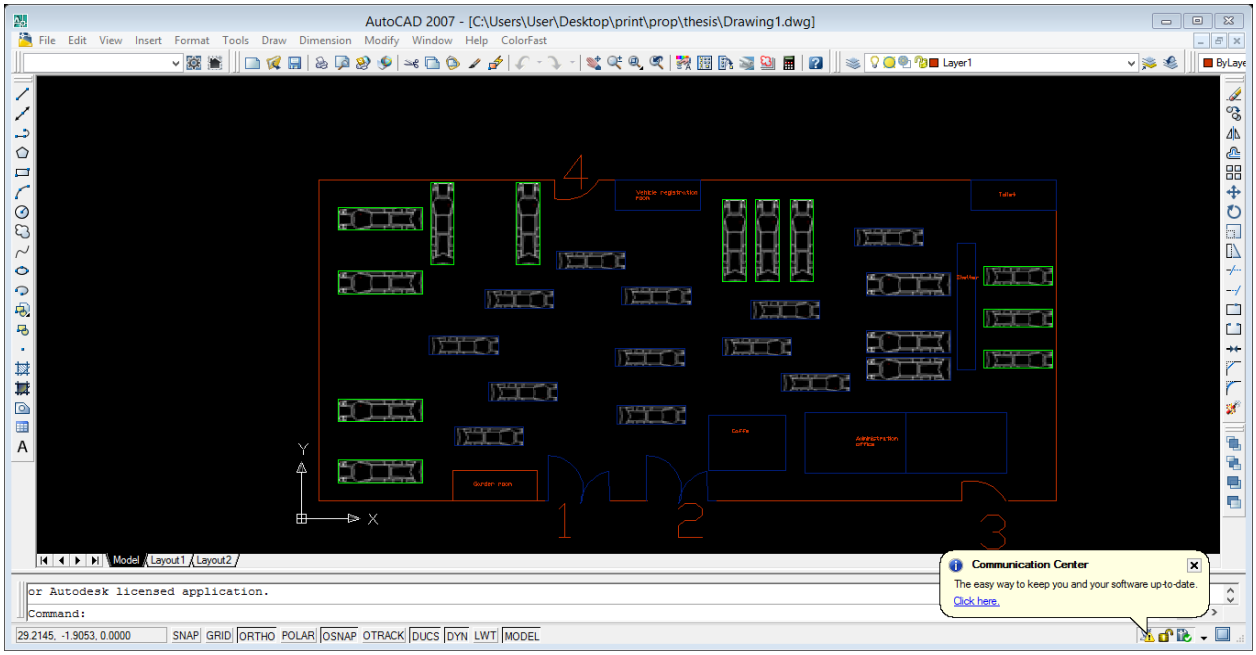

Figure 3.2: Top view of the terminal (prepared by researcher)

From the above drawing number one indicate that operating gate for both vehicles and passengers, number two is non-operating or closed door of the terminal, number three is gate of terminal for passenger and finally number four indicates exit door for vehicle but exit as well as entrance door for passengers.

3.2 Research Strategy

Two types of research strategies are used as studies, qualitative and quantitative research. According to this thesis, both types were used. Regarding to qualitative the current environmental situation of the terminal was mentioned. In the other hand, quantitative research strategy was used to express number of passenger, number of vehicle and linear regression model of this thesis.

3.3 Study Design

Descriptive design was used in this study with qualitative and quantitative data type collected from questionnaires, interviews and observations as primary data, data from terminal management team is used as secondary data.

3.4 Sample Size Distribution and Sampling Procedure

3.4.1 Sampling size

Jimma bus terminal operate for short, medium and long distance route. But the terminal is responsible to assign vehicle for short and medium distance route. While the rest, for LDR

vehicle is assigned from Federal, public transport owner association. So, the terminal is currently assign vehicle across to the zone of Jimma and to outer surrounding of Jimma zone for about 28 destinations as following table.

Table 3.1: Summary of table including routes information in the terminal

No.	starting	Destination	Distance in KM	No. of vehicle assigned daily/schedule of terminal
1	Jimma	Chida	84	0
2	Jimma	Teppi	245	3
3	Jimma	Mizan	230	3
4	Jimma	Nekemte	237	3
5	Jimma	Mettu	259	3
6	Jimma	Tercha	164	15
7	Jimma	Saja	117	9
8	Jimma	Sokoru	100	18
9	Jimma	Mole	37	19
10	Jimma	Bilda	21	0
11	Jimma	Dedo	20	23
12	Jimma	Shebe	52	58
13	Jimma	Seka	20	37
14	Jimma	Gojeb	79	0
15	Jimma	Limmu	88	16
16	Jimma	Yebu	20	24
17	Jimma	Serbo	20	22
18	Jimma	Bedele	142	29
19	Jimma	Welkite	188	74
20	Jimma	Bonga	115	40
21	Jimma	Asendabo	54	63
22	Jimma	Agaro	45	49
23	Jimma	Ako	88	0
24	Jimma	Sentema	33	0
25	Jimma	Deneba	87	0
26	Jimma	Babu	33	0
27	Jimma	Atinago	53	0
28	Jimma	Nada	67	0

But for the future terminal has plan to reach about 32 destinations. The study focuses on vehicles assigned from terminal and passengers in the terminal it contains average number of passenger per day about 7717.

A sample is small proportion of population selected for observation and analysis. The samples were selected randomly from the passengers.

$$SS = \frac{Z^2 * (p) * (1-p)}{C^2} \quad \text{……equation 3.1}$$

SS = Sample Size

Z = Z-value (e.g., 1.645 for a 90 percent confidence level)

P = Percentage of population picking a choice, expressed as decimal (0.05 for sample size used)

C = Confidence interval, expressed as decimal (e.g., .04 = +/- 4percentage)

$SS= (1.645^2*0.05*0.95)/0.04^2=80$

Assuming finite population and use the following formula

$$\text{New SS} = \frac{SS}{(1 + (SS - 1)/pop)} \quad \text{……. equation 3.2}$$

Where SS=80

Pop is average number of passenger's researcher got from terminal =7717

Therefore, New SS=79

3.4.2 Sampling procedure

Based on sample size determined above, 79 number of passenger were selected from selected terminal for distributing questionnaire. To get representative sampling, passengers to every 28^{th} route operating from this terminal was selected using systematic sampling technique and on average 3 passengers was randomly selected from each of these routes. Finally, 5 representative officials and 3 representatives of non governmental association from JBT were selected using purposive sampling technique to get some fact about status of service. And quaestionnaire for passengers was in the form of interview since they were ready to journey.

3.5 Data analysis

Source of the data for this thesis was Questionnaire, interview, observation and desk study from the terminal. Questionnaire data collected from passengers and terminal management was analyzed by Microsoft excels. On the other hand, in order to get proportional vehicle assignment thtoughout the routes, vehicle assignment model was developed using SPSS software. Finally, AUTOCAD 2007 was used to visualize a way of vehicles standing in the

terminal. In the analysis, both quantitative and qualitative data approach were used to analyze collected data.

3.6 Study variables

Dependent variable: Transport Terminal Operation

Independent variables:

- Number of passengers.
- Number of vehicles.
- Number of trips
- Security in terminal
- Comfort of terminal
- Passengers information system

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

Analaysis was made on the gathered qualitative and quantitative data. Here under, data collected from passengers and concerned officials of Jimma Bus Terminal is presented and analyzed using table and figures. In detail, problem in the terminal that affects efficiency of transportation and passengers' perception towards service given in the terminal were assessed.

Based on sample size determined in Chapter Three, 79 survey questionnaires were distributed to passenger of JBT. However, from total 79 survey questionnaire, nine (9) were not fully and correctly answered and five (5) were not turned back. As a result, data presentation and analysis is based on response of 65 passengers.

The researcher got number of passengers by multiplying number of vehicles registered while exiting from the terminal by their number of seat in each vehicle for each respective routes. Number of seats for vehicles vary from routes and summarized as follows. It is assumed that there is no overloading in each vehicle counted.

Table 4. 1: Summary of table for number of seats in vehicles

City	Number of seats			
	13-14(M.bus)	24-28	29-44	60-63(Bus)
Agaro	*			
Yebu	*			
Serbo	*			
Asenadabo	*			
Seka	*			
Shebe	*			
Deneba	*			
Wolkite	*			
Gojeb	*			
Bilida	*			
Bedele	*			
Limmu	*			
Bonga	*			
Saja	*			
Sokoru	*			
Sentema	*			
Babu	*			
Mole		*		
Ako		*		
Sentema		*		
Dedo		*		
Chida		*		
Tercha			*	
Ako			*	
Atinago			*	
Teppi				*
Nekemte				*
Mizan				*
Mettu				*

As mentioned in specific objectives of this paper, the first task was identifying problems in the terminal. So, based on questions prepared it was distributed to respondents based on sample size determined before. Therefore, following are some problems stated regarding to the service given in the terminal.

4.2 Result of Desk Study

4.2.1 Vehicle Supply and Demand of Passengers

A. Average number of trip of vehicles per day

In order to know as assigned vehicles is balanced with number of passengers, the researcher take the five days' data of vehicles trip registered at the exit and determine average of vehicles out going from the terminal per day. And then after comparing with number of vehicles proposed for a day in order to compare demand and supply of vehicles per day and following data is found. Here under, vehicles going to 22 routes were selected as a case-1 since daily trip available and for the rest six routes vehicles were exit once a week and that's is explained as case-2 in the analysis.

Case-1

Table 4. 2: One week's data of vehicles trip in each day

Data of vehicles exit from terminal in date of 17/11/2009 -23/11/2009									
		No.of vehicle trip							
no.	Destination	17/11/09	18/11/09	19/11/09	20/11/09	21/11/09	22/11/09	23/11/09	Average/ day
1	Agaro	169	125	113	102	115	117	101	120
2	Yebu	27	36	38	25	30	29	24	30
3	Serbo	63	20	27	27	26	25	19	30
4	Asendabo	55	56	55	39	46	51	38	49
5	Shebe	20	23	16	24	23	21	14	20
6	Gojeb	39	38	27	24	27	25	19	28
7	Welkite	25	54	24	31	29	32	25	31
8	Bonga	45	56	43	42	45	44	35	44
9	Bedele	31	33	27	29	31	32	25	30

1	Limmu	38	27	29	22	31	28	21	28
11	Seka	36	20	28	31	28	29	19	27
12	Sokoru	10	5	15	7	8	9	4	8
13	Saja	10	8	4	3	5	5	2	7
14	Bilda	13	25	12	12	16	14	11	15
15	Tercha	2	2	4	5	4	5	3	4
16	Mole	10	7	8	8	8	9	5	9
17	Dedo	14	14	17	24	18	13	11	18
18	Chida	1	1	1	4	3	1	1	2
19	Teppi	1	1	2	4	2	3	2	2
20	Mizan	2	1	1	3	1	2	1	2
21	Nekemte	1	1	2	1	1	1	1	2
22	Mettu	1	1	3	2	2	3	2	2
	Total	613	554	496	469	499	498	383	508

From the above table, we have seen that minimum number of vehicles released from the terminal is 2 and maximum number of vehicles trip exit from the terminal is 120.

As observed from the above table, maximum numbers of passengers were traveled along Agaro relative to other routes. And the next largest trips with respect to other were along Asendabo route and it continues as their descending order such as Bonga, welkite, Bedele, Serbo, yebu, Limmu, Gojeb, and Seka routes.

Average Number of Passengers per Day Travel from Jimma Bus Terminal

Converting the above data to passenger's number per day traveling to their respective route by multiplying with their number of seats in vehicles and following result is found.

Table 4. 3: Average number of passenger's trip data per day

	average number of passengers per day								
no.	Destination	17/11/09	18/11/09	19/11/09	20/11/09	21/11/09	22/11/09	23/11/09	average per day
1	Agaro	2416	1622	1014	1843	1650	1580	1384	1644
2	Yebu	476	393	333	496	420	389	335	406
3	Serbo	262	711	356	342	410	350	310	392
4	Asendab	721	793	547	752	625	550	495	640
5	Shebe	267	338	331	222	311	335	250	293
6	Gojeb	519	520	327	486	499	484	320	451
7	Welkite	362	789	454	348	505	455	321	462
8	Bonga	638	817	622	618	623	630	589	648
9	Bedele	519	439	440	387	458	445	370	437
10	Limmu	617	367	373	422	402	425	351	422
11	Seka	364	282	428	373	365	381	263	351
12	Sokoru	140	68	98	206	108	154	59	119
13	Saja	111	179	42	56	84	115	43	90
14	Bilda	172	325	158	158	158	158	141	181
15	Tercha	73	83	202	160	159	183	90	130
16	Mole	240	168	192	181	178	189	155	186
17	Dedo	442	336	674	448	420	486	345	450
18	Chida	13	24	106	28	28	35	27	37

19	Teppi	63	60	252	60	63	120	63	97
20	Mizan	63	88	132	88	60	63	123	88
21	Nekemte	63	63	60	126	60	63	126	80
22	Mettu	104	44	104	167	126	123	122	113
	Total	8645	8499	7245	7967	7712	7713	6252	7717

In order to express the above data by figure, it seems as follows.

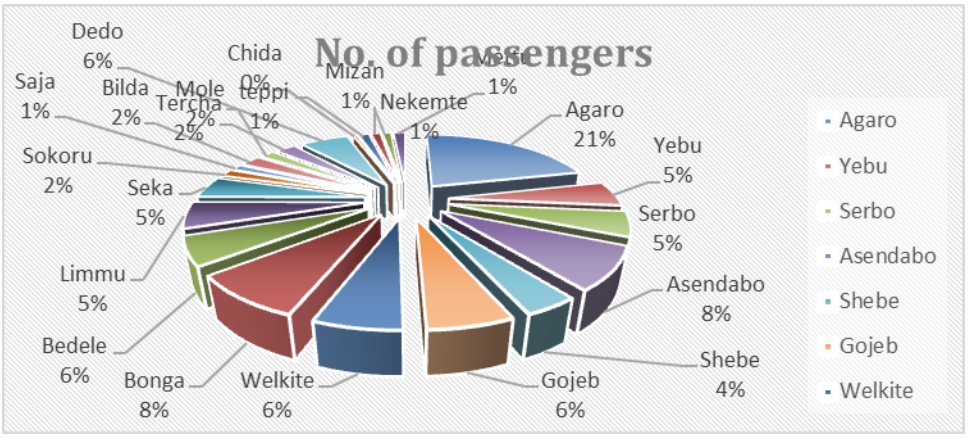

Figure 4.2: Average numbers of passengers' trip per day

As we have seen from the above chart 21% of total passengers were use the route along Agaro. Next 8% of them use Asendabo, and Bonga routes. Whereas 6% of them travel to Welkite, Gojeb, Bedele and Dedo ways. In other hand 5% of passengers use Seka, Limmu, Serbo and yebu routes and 4% of them use Shabe route. For the rest Sokoru, Bilida, Mole, Tercha were 2% of them and Mizan, Mettu, Nekemte, Teppi and saja cover 1% of passengers.

Case-2

Data of the remaining six routes having trips twice a week namely Nada, Ako, Babu, Deneba, Sentema and Atinago is analysed as follows. From the table we have observed that maximum number of vehicle trip per week was along Nada. But, for these routes there were not specified number of vehicles in monthly schedule of the terminal.

Table 4. 4: Vehicles trip per week for six routes

	Ako	Atinago	Babu	Deneba	Nada	Sentema
Vehicle	1	3	4	3	6	1

B. Vehicles Supplied from the Terminal per Day

Based on the result found in desk study, the following table contains number of vehicles assigned per day as per monthly schedule of the terminal.

Table 4. 5: Number of existing vehicles in schedule of the terminal per day

no.	destination	n. veh.assigend
1	Gojeb	0
2	Bilda	0
3	Chida	0
4	teppi	3
5	Mizan	3
6	Nekemte	3
7	Mettu	3
8	Saja	9
9	Tercha	15
10	Limmu	16
11	Sokoru	18
12	Mole	19
13	Serbo	22
14	Dedo	23
15	Yebu	24
16	Bedele	29
17	Seka	37
18	Bonga	40
19	Agaro	49
20	Shebe	58
21	Asendabo	63
22	Welkite	74
	total	508

In order to show the above data by figure it seems as shown below.

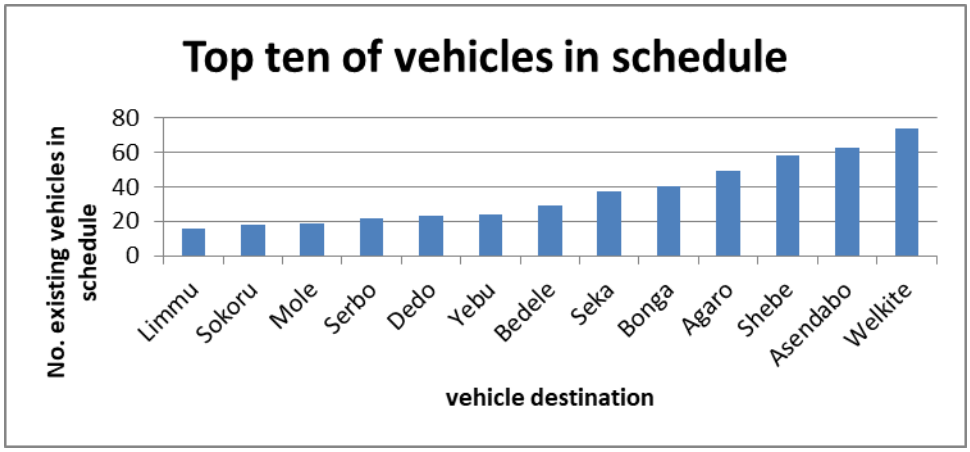

Figure 4.3: Top ten large numbers of existing vehicles assigned from terminal

From above data we have observed that number of vehicles assigned for routes such Agaro, yebu, Limmu, Serbo and Saja needs additional number of vehicles per day according to their trip. On the other hand, number of vehicles assigned for routes such as shabe, Seka, Welkite, Mole, Asendabo, and Tercha are excess beyond the demand of passengers. However, there is number of passengers go along routes such as Chida, Gojeb and Bilida, there were not specified number of vehicles decided for those route in monthly schedule is the terminal. As the workers there said vehicles for those mentioned route as well as along shortage of vehicles, vehicle assigner would divert vehicles assigned to other routes by adding percentage of payment from 35%-50% to passengers beyond normal price. Vehicles assigned for remaining routes are fair. Generally, vehicle distribution in the terminal is not uniform throughout every route according to data we observed.

In addition to desk study as data gained from interview of the member of official from the terminal, criteria for vehicle assignment was depend on the interest of the owner of the vehicles from non-governmental association in bus terminal that may lead to unfair distribution of vehicles throughout the routes. There are totally 16 non-governmental association having contribution in assigning vehicles to terminal based on data collected from the terminal. Roles of these associations in terminal are:

- They function as a third party between owner of vehicles and the terminal.
- They assign route for new vehicles which has no specified direction to work.
- They prepare monthly schedule of vehicle assignment and give to terminal in order to verify it.
- They collect 5% of passenger's payment money from each vehicle in order to pay salary for their employee since they are non-governmental organization

4.3 Result of Questionnaire to Identify Terminal Problem

4.3.1 Availability of sufficient vehicle in terminal

Based on question raised to passengers, concerning availability of sufficient number of vehicles, response is analyzed as follows.

Table 4. 6: Passenger's level of satisfaction based on availability of sufficient number of vehicles

	Frequency	Percent	Cumulative Percent
very satisfied	13	20.0	20.0
Satisfied	24	36.9	56.9
Average	18	27.7	84.6
Dissatisfied	9	13.8	98.5
Very dissatisfied	1	1.5	100.0
Total	65	100.0	

In order to present the above table clearly in easily understandable way the following figure is shown.

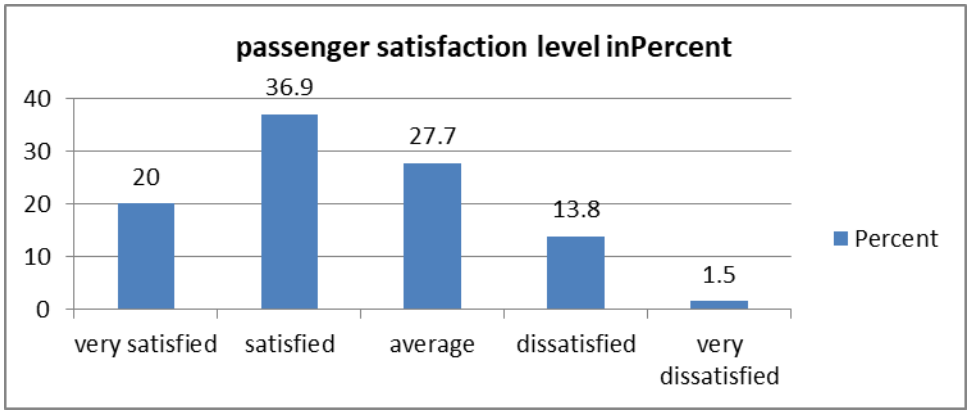

Figure 4.4: Passenger's satisfaction level on availability of sufficient number of vehicles

As above tables and figure indicate, about 36.9% of respondent were satisfied with number of vehicles available and 20% of them also very satisfied. Whereas 13.8% of respondents were dissatisfied and 1.5% of them also very dissatisfied with availability of sufficient number of vehicles. And the remaining 27.7% of the respondents' rate in range of average.

Table above confirmed that large numbers of respondents react as they satisfy by on availability of sufficient number of vehicle since the answer was analyzed depend on the routes of passengers. But from the remaining respondents we can predict that as there was shortage of vehicles in some routes.

4.3.2 Availability of route information board

Passengers were asked about their level of satisfaction regarding to availability of route information board in bus terminal and answer is analyzed as follows.

Table 4. 7: Passengers level of satisfaction availability of route information board in terminal

	Frequency	Percent	Cumulative Percent
very satisfied	1	1.5	1.5
Satisfied	11	16.9	18.5
Average	17	26.2	44.6
Dissatisfied	20	30.8	75.4
Very dissatisfied	16	24.6	100.0
Total	65	100.0	

In order to present the above table clearly in easily understandable way the following figure is shown.

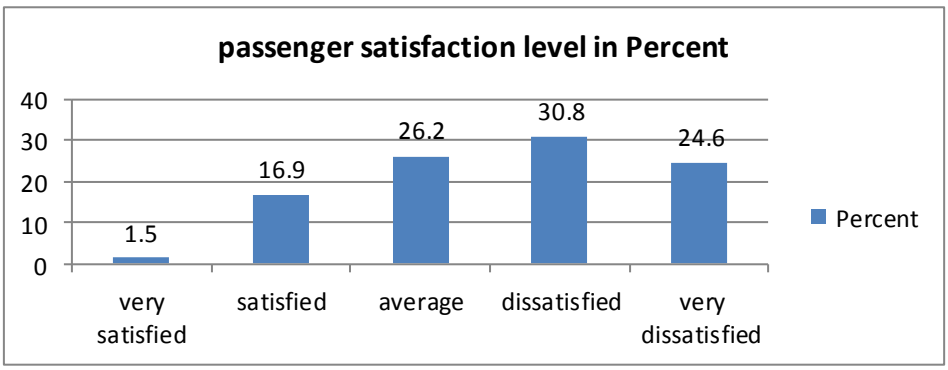

Figure 4.5: Passenger's level of satisfaction availability of route information board in terminal

The above figure indicates that more than 55% of respondents are dissatisfied (24.6% very dissatisfied and 30.8% were dissatisfied) regarding to the availability of information board in the terminal. On the other hand, 18.4% of respondents are satisfied (1.5% very satisfied and 16.9% are satisfied). Remaining 26.2% of respondents have rated their level of satisfaction as average.

From this data it could be possible to infer that there is no clear indication sign or route information board that will direct the passenger in order to get their way easily (Hong Kong up to 2016)

The researcher has also observed that as there was no precise indicator at exit and entrance of the bus terminal. Hence passenger as well as vehicles were not identified while entering and exit from the terminal. In addition to that based on researcher observation there was no structured indicating mounted symbol showing vehicles with their respective route in order to make it easy to get their way for the passengers rather than calling passengers one by one. Moreover, in the terminal route information written on printed paper is attached on the wall which is not clearly visible for passengers as shown following.

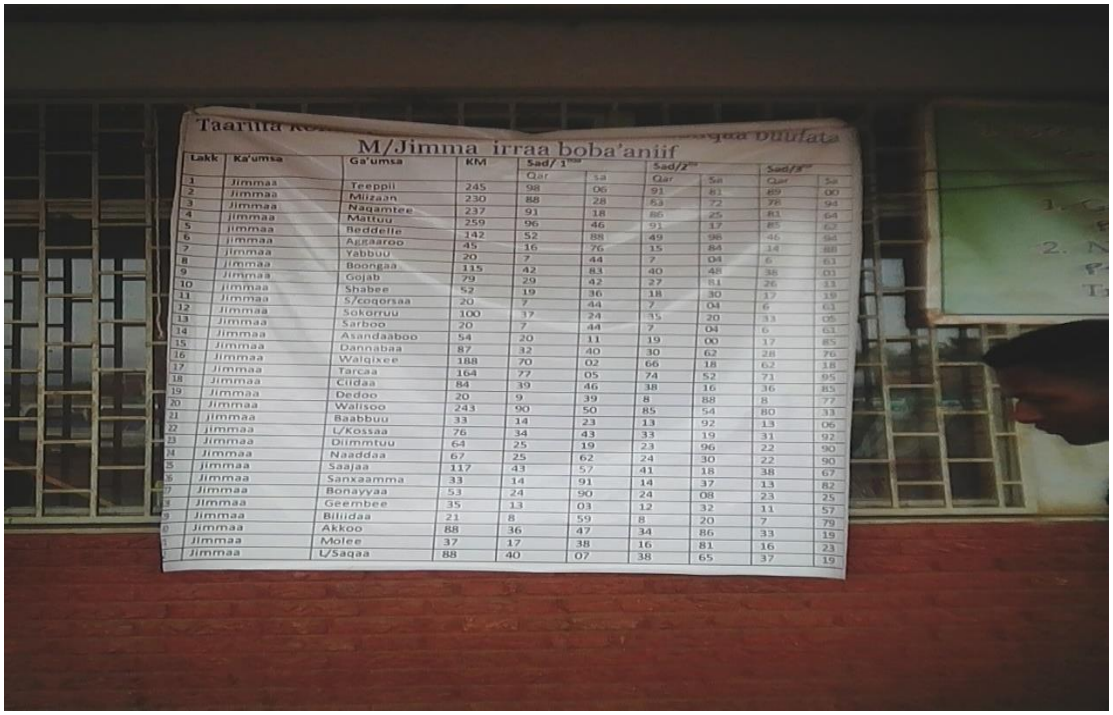

Figure 4.6: Route information (picture taken by researcher)

As shown from above drawing there is no gate restricted for vehicle only or passenger only.

4.3.3 Security of passenger

Due to overcrowding at bus terminal passengers are most of the time vulnerable to pick pocketing and they lose their wallets and properties (Iles, 2005,).

Regarding to security of terminal, questions were forwarded to passengers to measure their level of satisfaction and result is analyzed as follows indicated by table and figure.

Table 4. 8: Level of passenger's satisfaction based on security of passengers in terminal

	Frequency	percent	Cumulative Percent
very satisfied	10	15.4	15.4
Satisfied	17	26.2	41.5
Average	17	26.2	67.7
Dissatisfied	17	26.2	93.8
Very dissatisfied	4	6.2	100.0
Total	65	100.0	

In order to present the above table clearly in easily understandable way the following figure is shown.

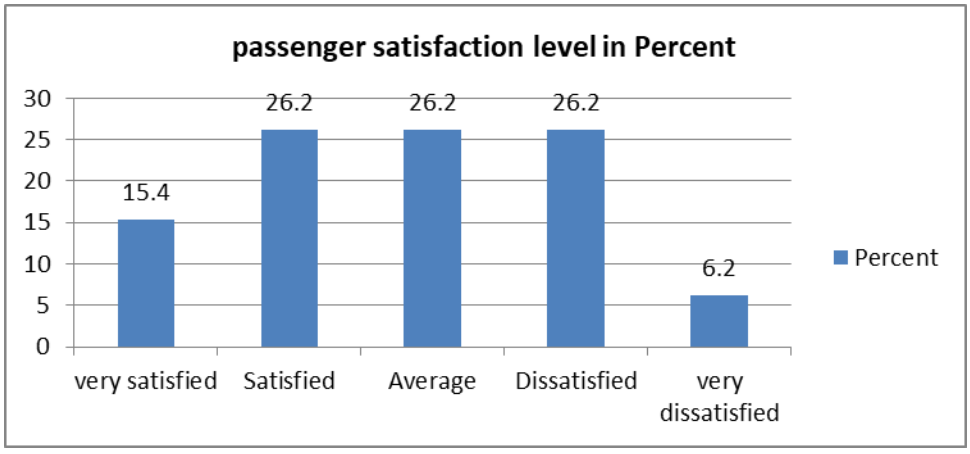

Figure 4.7: Passengers' satisfaction about security from robbery in terminal

The above figure indicates that more than 41% of respondents are satisfied (15.4% very satisfied and 26.2% were satisfied) regarding to the availability security in the terminal. On the other hand, 32.4% of respondents are dissatisfied (6.2% very dissatisfied and 26.2% are dissatisfied). Remaining 26.2% of respondents have rated their level of satisfaction as average.

From this data it could be possible to infer that there is a problem concerning security of passengers in terminal from robbery.

4.3.4 Comfort of passengers

For high comfort of passengers, good seats, cleanliness and shelters at bus terminal are some factors (Iles, 2005). To measure passenger's satisfaction regarding comfort of the terminal questions were addressed to passengers and analyzed as follows.

A. Availability of Seat

Provision of seats at bus terminal is high priority item for elderly and ambulatory person with a disability. Standing for even short period proves to be uncomfortable, even painful and great impedes accessibility to terminal.

Table 4. 9: assengers' level of satisfaction based on availability of seat for passengers in terminal

	Frequency	Percent	Cumulative Percent
very satisfied	1	1.5	1.5
Satisfied	11	16.9	18.5
Average	13	20.0	38.5
Dissatisfied	20	30.8	69.2
Very dissatisfied	20	30.8	100.0
Total	65	100.0	

In order to present the above table clearly in easily understandable way the following figure is shown.

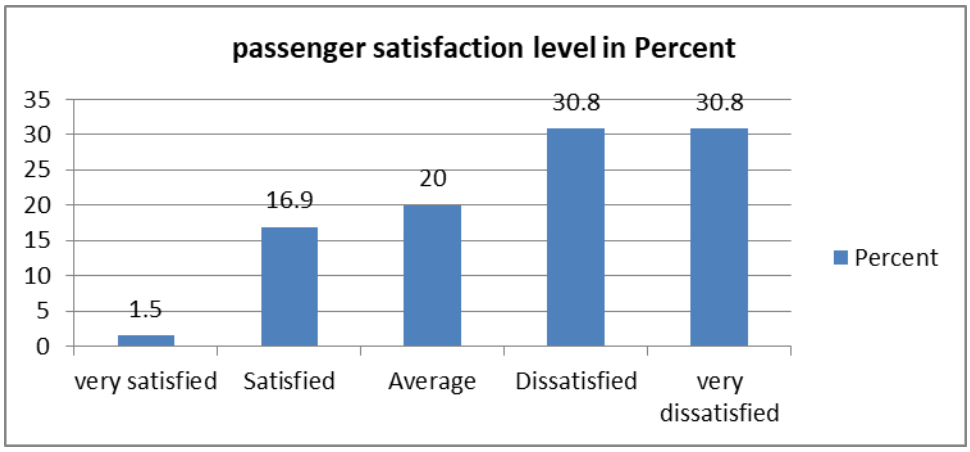

Figure 4.8: Passenger's satisfaction based on comfort of terminal (source survey data, 2017)

The above figure indicates that more than 61% of respondents are dissatisfied (30.8% very dissatisfied and 30.8% were dissatisfied) regarding to the availability seat in the terminal. On the other hand, 18.4% of respondents are satisfied (1.5% very satisfied and 16.9% are satisfied). Remaining 20% of respondents have rated their level of satisfaction as average. The above data indicates that there is a problem concerning availability seats in the terminal.

In addition to passenger's response, the following also image from what researcher observe from study area. As we can see from image below, passengers were standing in order to wait for the vehicle going to their way.

Figure 4.9: Image showing absence of seat for passengers (picture taken by researcher)

Figure 4.10: picture showing standing of passengers to wait vehicle due to lack seat pictures taken by researcher.

B. Cleanliness of terminal

Passengers were asked about their level of satisfaction concerning to cleanliness of the bus terminal and following result is found.

Table 4. 10: Passenger's satisfaction regarding to cleanliness of the terminal

	Frequency	Percent	Cumulative Percent
very satisfied	1	1.5	1.5
Satisfied	8	12.3	13.8
Average	11	16.9	30.8
Dissatisfied	18	27.7	58.5
Very dissatisfied	27	41.5	100.0
Total	65	100.0	

In order to present the above table clearly in easily understandable way the following figure is shown.

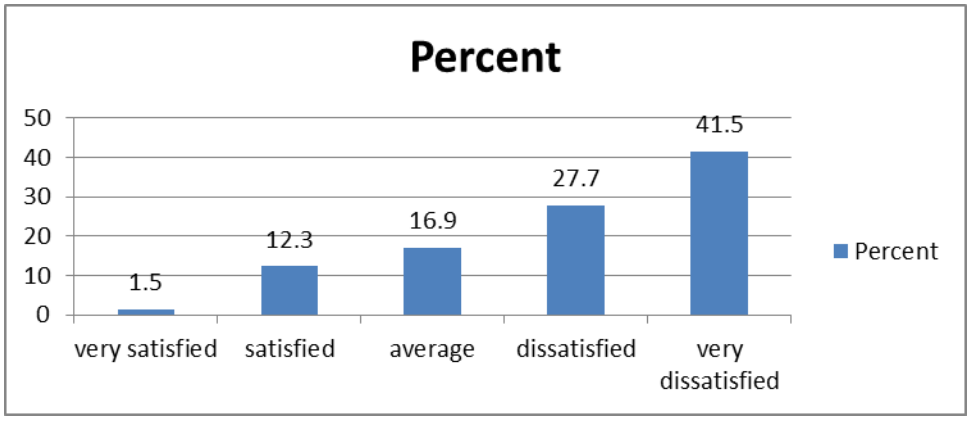

Figure 4.11: Passenger's satisfaction regarding cleanliness of terminal

The above figure indicates that more than 69% of respondents are dissatisfied (41.5% very dissatisfied and 27.7% were dissatisfied) regarding to cleanliness of bus terminal. On the other hand, 13.8% of respondents are satisfied (1.5% very satisfied and 12.3% are satisfied). Remaining 16.9% of respondents have rated their level of satisfaction as average. The above data indicates that the terminal is not clean. Even if toilet is available in the terminal, some of the people were not use the toilet they use space in the terminal other than the toilet based on researchers' observation.

In addition to passengers' response, the following also image from what researcher observe from study area. From the following picture it's possible to infer that the pavement in the terminal is distorted and it will create discomfort to the passengers.

Figure 4.12: Picture indicating floor of terminal picture taken by researcher

Figure 4.13: Picture indicating sewerage of terminal (taken by researcher).

Figure 4.14: Picture showing potholes in terminal (taken by researcher)

4.4 Remedial Solution to Problems

Based on the findings of the study the following recommendations are forwarded to improve mentioned problems according to specific objectives of this research.

4.4.1 Developed Model for Vehicle Assignment

To make number of vehicles supplied balance with number of passengers, linear regression model could be developed using software SPSS IBM version 20 for those 22 routes operate all day in a week. But it's difficult to apply this software for those routes only functional per week because there were no specified number vehicles in schedule. And the data provided in the software to develop the model are number of passengers, number of seats in vehicles and

number of trips of vehicles in a day and number of vehicles supplied from terminal included in monthly schedule. In order to analyze the model, the distance of the routes was classified according to trip per day as short, medium and long distance, i.e., <50km short, 51-142 medium and above 142km as long distance route and summarize as follows.

Table 4. 11: Summary of daily vehicles and passenger's distribution for short distance routes

Route	Existing scheduled No.veh	Averg No.passen.	No.seats per vehicle	Allowed No.trip
Agaro	49	1644	14	3
Yebu	24	392	14	3
Serbo	22	402	14	3
Seka	37	351	14	3

Table 4. 12: Summary of daily vehicles and passenger's distribution for medium distance routes

Route	Existing scheduled No.veh	Averg No.passen.	No.seats per vehicle	Allowed No.trip
Chida	0	37	24	2
Saja	9	90	14	2
Mole	19	186	24	2
Bilda	0	181	14	2
Limmu	16	422	14	2
Bonga	40	648	15	2
Asendabo	63	640	14	2
Dedo	23	450	24	2
Sokoru	18	119	14	2
Gojeb	0	451	14	2
Beadle	29	437	14	2
Shebe	58	293	14	2

Table 4. 13: Summary of daily vehicles and passenger's distribution for long distance routes

Route	Existing scheduled No.veh	Averg No.passen.	No.seats per vehicle	Allowed No.trip
Teppi	3	97	63	1
Mizan	3	88	63	1
Nekemte	3	80	63	1
Mettu	3	113	63	1
Welkite	74	462	14	1
Tercha	15	230	44	1

Then linear regression model is expressed in the form of, $\mathbf{Y=\alpha+\beta_1 x_1 + \beta_2 X_2 + \beta_3 X_3}$

Where, Y represents number of vehicles should be assigned

X_1 represents number of trips per day, X_2 number of seat an X_3 number of passengers

α and β are constants displayed in above table

Therefore, **Y= 21.487+0.017*number of passengers** was the equation developed for short distance routes according to this paper.

Table 4. 14: Summary of proposed daily vehicles according to developed model for short distance route

Route	Existing scheduled No.veh	Averg No.passen.	No.seats per vehicle	Allowed No.trip	Predicted no. of vehicles
Agaro	49	1644	14	3	49
Yebu	24	392	14	3	28
Serbo	22	402	14	3	28
Seka	37	351	14	3	27

As observed from above table, there should be correction of vehicle assignment along some routes such as Yebu, Serbo and Seka. However, addition of vehicles needed for Yebu and Serbo, but it is clearly seen that vehicle assignment along Seka route were not fair relative to others and equation adjust such variation between the routes.

Using the same procedure and insert the data for the rest table medium and the result seems as follows.

Y=16.363+0.066*number of passenger-0.707*number of seat, equation developed for medium distance routes.

Table 4. 15: Summary of proposed daily vehicles according to developed model for Medium distance route

Route	Existing scheduled No.veh	Averg No.passen.	No.seats per vehicle	Allowed No.trip	Predicted no. of vehicles
Chida	0	37	24	2	2
Saja	9	90	14	2	12
Mole	19	186	24	2	12
Bilda	0	181	14	2	18
Limmu	16	422	14	2	34
Bonga	40	648	15	2	46
Asendabo	63	640	14	2	49
Dedo	23	450	24	2	29
Sokoru	18	119	14	2	14
Gojeb	0	451	14	2	36
Bedele	29	437	14	2	35
Shebe	58	293	14	2	26

As we have seen from table above, adjustment of vehicles assignment along the routes is applied based on equation developed.

For long distance routes also the following equation was developed by using linear regression model.

Y= 42.789-0.632*number of seat, equation developed for long distance routes.

Table 4. 16: Summary of proposed daily vehicles according to developed model for short distance route

Route	Existing scheduled No.veh	Averg No.passen.	No.seats per vehicle	Allowed No.trip	Predicted no. of vehicles
Teppi	3	97	63	1	3
Mizan	3	88	63	1	3
Nekemte	3	80	63	1	3
Welkite	74	462	14	1	34
Mettu	3	113	63	1	3
Tercha	15	230	44	1	15

Based on the above table, adjustment of vehicle assignment along Welkite route is observed based on the equation developed.

Finally, when the above data is combined, it seems as follows.

Table 4.17: Summary of table containing daily operating routes

no.	destination	n. veh.assigend	No.predicted vehicle	Difference
1	Gojeb	0	36	-36
2	Bilda	0	18	-18
3	Chida	0	2	-2
4	Teppi	3	3	0
5	Mizan	3	3	0
6	Nekemte	3	3	0
7	Mettu	3	3	0
8	Saja	9	12	-3
9	Tercha	15	15	0
10	Limmu	16	34	-18
11	Sokoru	18	14	4
12	Mole	19	12	7
13	Serbo	22	28	-6
14	Dedo	23	29	-6
15	Yebu	24	28	-4
16	Bedele	29	35	-6
17	Seka	37	27	10
18	Bonga	40	46	-6
19	Agaro	49	49	0
20	Shebe	58	26	32
21	Asendabo	63	49	14
22	Welkite	74	34	40
	Total	508	506	

4.4.2 Solution to Problems Related to Service Given in Terminal

In order to improve problems identified in the terminal that passengers feel dissatisfied the following recommendation is stated.

a. In order to avoid problems related to shortage of vehicles, terminal can follow the above model to assign sufficient number of vehicles for the routes.
b. To improve problems related to availability of route information, the terminal should mount symbol in front of each routes to indicate vehicles going on that way rather than calling passengers one by one. In addition, the arrangements of vehicles standing should be sequential rather than they stand in the terminal here and there in order to be easily accessible for all and to make passengers use their time instead of wasting their time on

searching the vehicle go to their way. Generally, modifying internal arrangement of the bus terminal as follows will improve mentioned problem. And there should be adequate provision of space within the site, for parking, maneuvering, loading and unloading to fulfil the operational requirements (www.doeni.gov.uk).

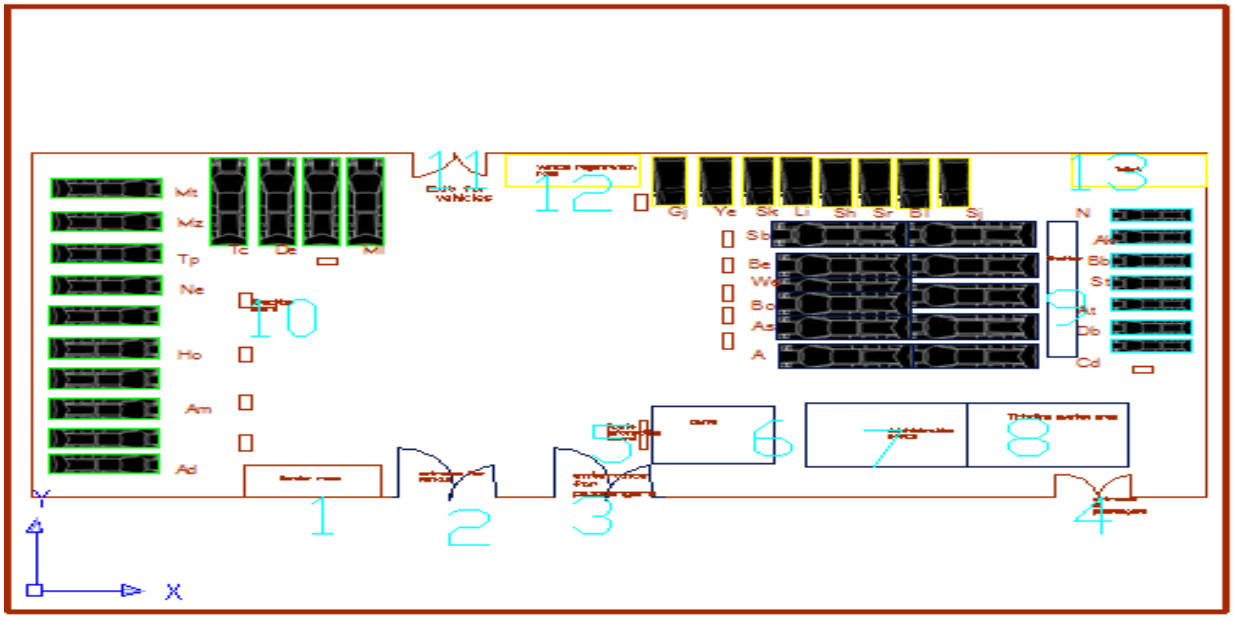

Figure 4.16: Recommended future layout of the area Description; 1- Guarder room

2- Entrance gate for vehicle only 3- Entrance gate for only passengers

4- Entrance gate for only passengers 5- Routes information board

6- Café 7- Administration office

8- Ticketing area 9- Shelter

10- Board indicating vehicles way 11- Exit for vehicles

12- Vehicle registration area 13- Toilet

And also it's better if area for each route in the terminal is identified and mentioned as tried to show in the above layout and here is the key for the abbreviated route above on the plan.

A- Agaro	Bo- Bonga	We- Welkite	Be- Bedele	Sb- Serbo	Gj- Gojeb
Ye- Yebu	Sk- Seka	Li- Limmu	Sh- Shebe	Bl- Bilda	Sj- Saja
Tc- Tercha	De- Dedo	Ml- mole	Mt- Mettu	Mz- Mizan	Tp- Teppi
Ne- Nekemte	N- Nada	Bb- Babu	At- Atinago	Db- Deneba	Cd- Chida

c. To keep passengers secure, bus terminal should have good light specially morning at opening time, the level of overcrowding should be considered while terminal operates and conductor should have made passengers aware to keep themselves from thief, worker of the terminal should have identified from others by wearing uniform.

d. To improve problem related to comfort, adequate seating capacity should be built at bus terminal under prepared shelter in the terminal, so that they can wait for the vehicle and the comfort can be improved.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

This research has assessed transport terminal operation with respect to vehicle assignment and passenger's perception at Jimma bus terminal.

The study was mainly focus on investigating proportionality of vehicle assignment throughout the routes. As the result from the desk study data indicates, there was variation in vehicle assignment to the routes. For instance, average number of passengers travel along Welkite was 462, but vehicles assigned for Welkite from the terminal were 74. In the other hand, average numbers of passenger per day along Gojeb route were 451, but there was no existing number of vehicles in monthly schedule of the terminal. This indicates that as there is no proportional assignment of vehicles throughout the routes. Therefore, from linear regression result the equation developed to get uniform distribution of vehicles, Y=21.487+0.017*No. passenger, for routes categorized under short distance routes, Y=16.363+0.066*No. passen-0.707*N. seat, for medium distance routes and Y=42.789-0.632*No. seats for long distance routes based on this thesis.

On the other hand, to identify problems related to transport service given to passengers and assess their level of satisfaction, the most common issues were responded by passengers. Such risen issues were, based on the availability of sufficient number of vehicles, availability of route information board in the terminal, security in the terminal and comfort of the terminal regarding to availability of seat in the terminal under shelter and cleanliness of the terminal. From the problems identified, respondents were asked about their level of satisfaction and agreement and based on availability of sufficient vehicles, 56.9% of them were satisfied, 15.3% dissatisfied and 27.8% were in between. Regarding to availability of route information board in the area, 18.4% were satisfied, 55.4% were dissatisfied and 26.2 of them were having average level of satisfaction. Based on security of the terminal 41.6% of passengers were satisfied, 32.2 % were dissatisfied and 26.2% of them have average level of satisfaction. Finally, regarding to comfort of terminal, concerning to availability of seat in terminal under shelter 14.4% of passengers were satisfied, 61.6% of them were dissatisfied and 20% of them were averagely satisfied and regarding to cleanliness of the terminal, 13.8%

of them were agreed, and 69.3% of them were disagreed and 16.9% of them were in average with cleanliness of the terminal.

5.2RECOMMENDATIONS

Based on the findings of the study the following recommendations are forwarded to improve mentioned problems in the terminal.

- Uniformity of vehicle distribution was assessed and according to result shown there was variation throughout the route. Therefore, in order to make uniformity on the way of vehicle assignment is better if it is based on interest of passengers and depending on frequently used routes rather than owner's interest. In addition, terminal can follow the result from the regression model.
- Problems related to service given in the terminal for passengers were stated and passengers were not satisfied with most of the service in the area. Therefore, in order to satisfy passengers' interest, there should be internal facilities in the terminal such as seats, light; route information board and daily clean the terminal.
- Terminal management team should prepare comment box for users in the terminal.
- And also it is better if there is included in monthly schedule for those routes such as chida, Gojeb and Bilda. In addition, for routes operated once a week such as Nada, Sentema, Deneba, Babu, Ako and Atnago its better if fixed number of vehicles are included in schedule of the terminal.

Generally, the time for data collection of this thesis was categorized almost in summer season based on the available time and finance for this thesis which is not consider some other season. For example, as Jimma zone is known by cash crop such as Coffee, at that season the traffic flow will increase, and also at a time for maximum flow of student, these will also different from summer season traffic flow. Therefore, at the future its better if sufficient budget and time is prepared for the assessment which is made by considering each season in order to get accurate data.

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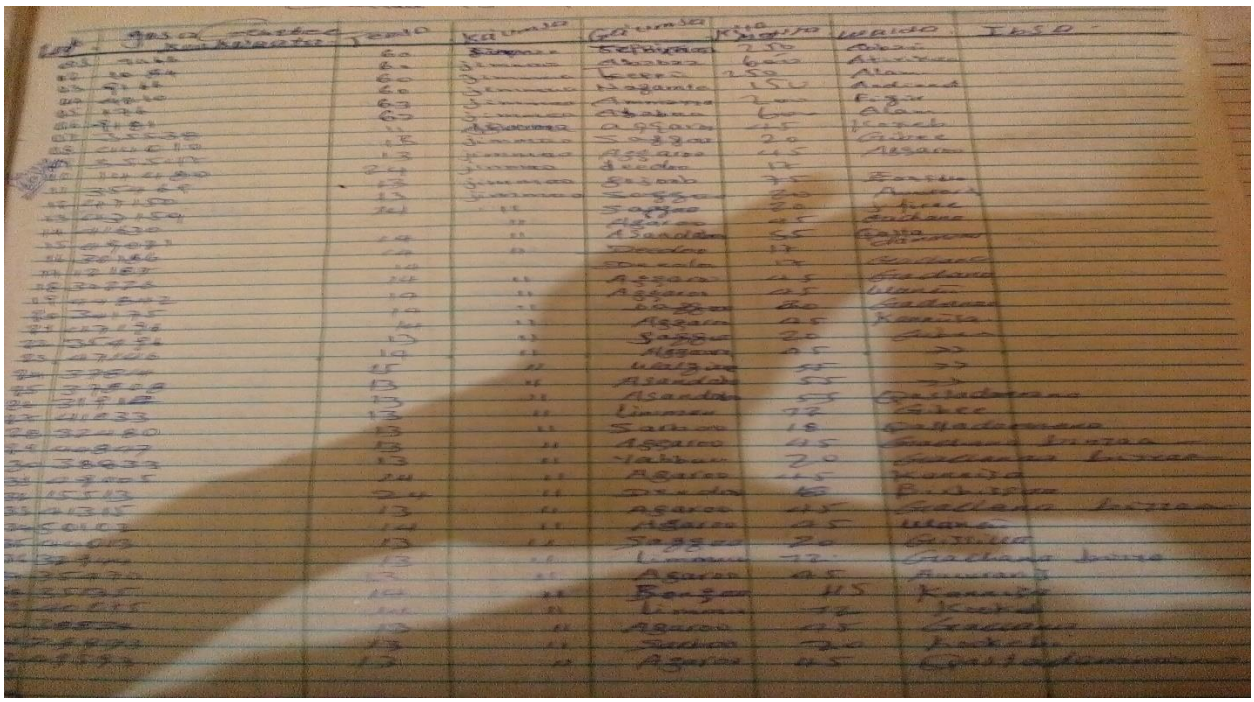
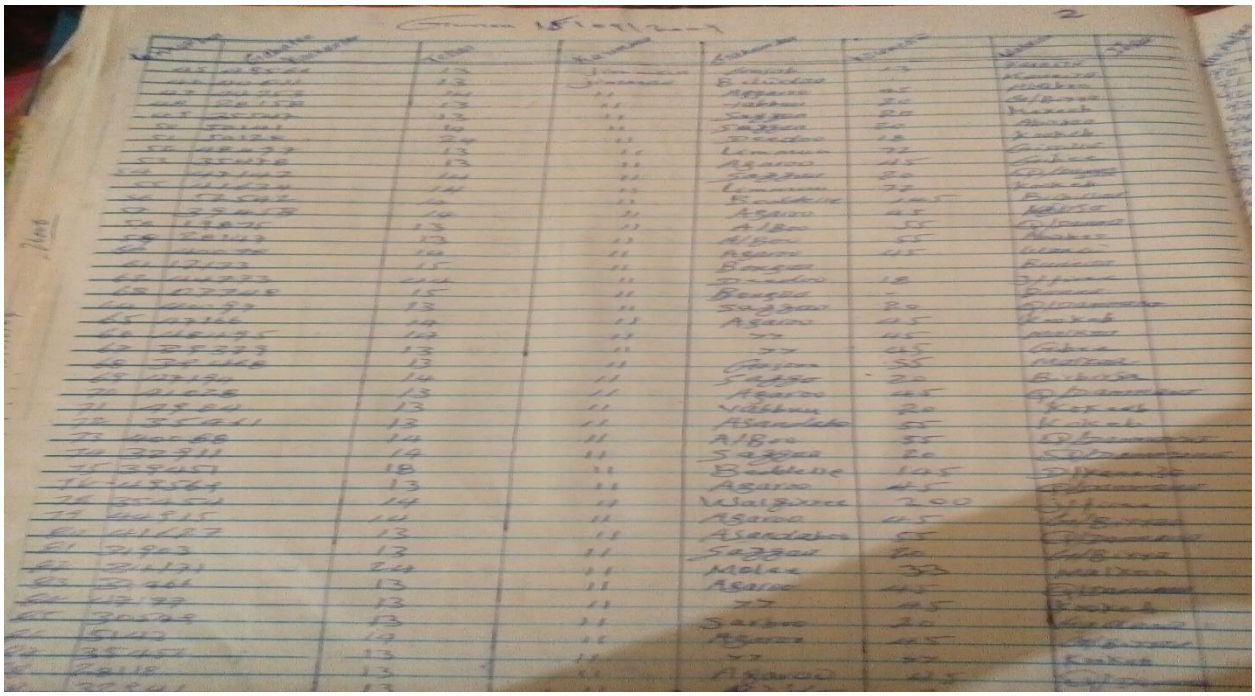
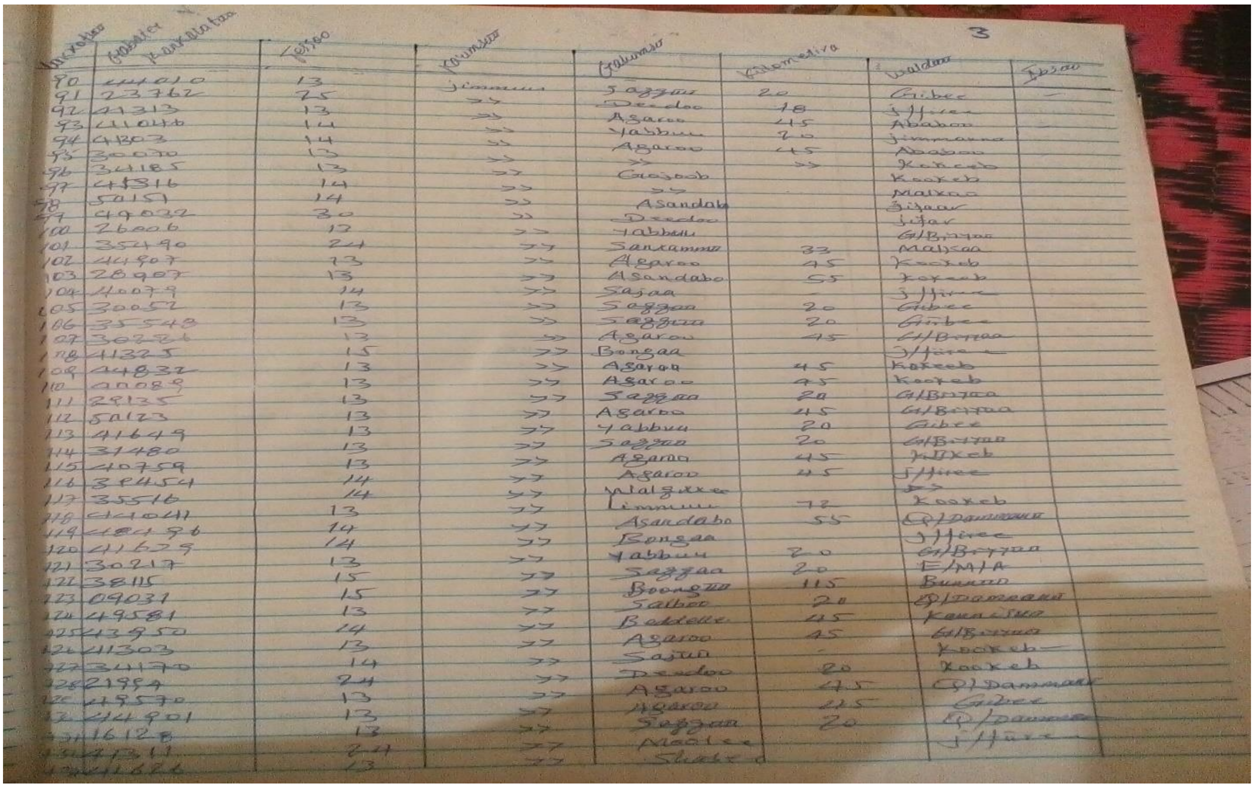
Appendix A

Sample Raw Data of Vehicles from Bus Terminal







3

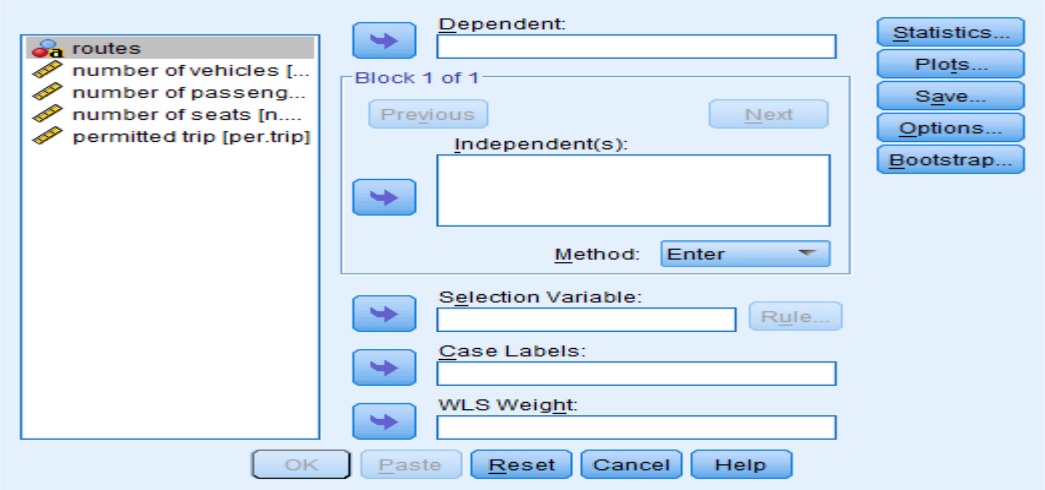
Lakk.	Gabatee Kaarkaataa	Jettoo	Ka'umsa	Galumsa	Kilometira	Waldaa	Ibsaa
90	44010	13	Jimmaa	Saggaa	20	Gibee	—
91	23762	25	>>	Deedoo	18	J/Jiree	—
92	41313	13	>>	Agaroo	45	Ababoo	—
93	41046	14	>>	Yabbuu	20	Jimmarama	
94	41803	14	>>	Agaroo	45	Ababoo	
95	30070	13	>>	>>	>>	Kooxeb	
96	34185	13	>>	Gosoob		Kooxeb	
97	48316	14	>>	>>		Malkaa	
98	50151	14	>>	Asandabo		Jijaar	
99	49032	30	>>	Deedoo		Jifar	
100	26006	13	>>	Yabbuu		G/Biyyaa	
101	35490	24	>>	Sankamma	33	Malkaa	
102	44907	13	>>	Agaroo	45	Kooxeb	
103	28907	13	>>	Asandabo	55	Kooxeb	
104	40079	14	>>	Sajaa	-	J/Jiree	
105	30052	13	>>	Saggaa	20	Gibee	
106	35548	13	>>	Saggaa	20	Gibee	
107	30224	13	>>	Agaroo	45	G/Biyyaa	
108	41325	15	>>	Bongaa		J/Jiree	
109	44832	13	>>	Agaroo	45	Kooxeb	
110	40089	13	>>	Agaroo	45	Kooxeb	
111	29135	13	>>	Saggaa	20	G/Biyyaa	
112	50123	13	>>	Agaroo	45	G/Biyyaa	
113	41649	13	>>	Yabbuu	20	Gibee	
114	31480	13	>>	Saggaa	20	G/Biyyaa	
115	40759	13	>>	Agaroo	45	Kooxeb	
116	38454	14	>>	Agaroo	45	J/Jiree	
117	35516	14	>>	Walgaxxee		>>	
118	44041	13	>>	Limmuu	72	Kooxeb	
119	48496	14	>>	Asandabo	55	Q/Dammaa	
120	41679	14	>>	Bongaa		J/Jiree	
121	30217	13	>>	Yabbuu	20	G/Biyyaa	
122	38115	15	>>	Saggaa	20	E/M/A	
123	09031	15	>>	Boongaa	115	Bunnaa	
124	49581	13	>>	Salboo	20	Q/Dammaa	
125	43950	14	>>	Beddelle	45	Kaanisaa	
126	41303	13	>>	Agaroo	45	G/Biyyaa	
127	34170	14	>>	Sajaa	-	Kooxeb	
128	21994	24	>>	Deedoo	20	Kooxeb	
129	49570	13	>>	Agaroo	45	Q/Dammaa	
130	44901	13	>>	Agaroo	115	Gibee	
131	16128	13	>>	Saggaa	20	Q/Dammaa	
132	47311	24	>>	Mooleé		J/Jiree	
133	41626	13	>>	Shakiso			

4

Lakk.	Gabatee	Jettoo	Ka'umsa	Galumsa	Kilometira	Waldaa	Ibsaa
134	23411	24	Jimmaa	Sankamma	20	Awwaas	
133	30053	13	>>	Salboo	20	J/Jiree	
134	34157	13	>>	Agaroo	45	Q/Dammaa	
135	49557	24	>>	Deedoo	18	Malkaa	
136	38987	14	>>	Saggaa	20	Biyyaa	
137	33598	13	>>	Agaroo	45	Q/Dammaa	
138	30155	13	>>	Limmuu	72	Q/Dammaa	
139	35974	18	>>	Bedellee	145	Dammax	
140	37202	13	>>	Agaroo	45	Kooxeb	
141	44038	14	>>	>>	>>	Malkaa	
142	38814	15	>>	Sajaa	20	Ejersaa	
143	29120	13	>>	Asandabo	55	Gibee	
144	44031	14	>>	Asandabo	55	Kooxeb	
145	35299	13	>>	>>	>>	G/Biyyaa	
146	43153	14	>>	Asandabo	55	Q/Dammaa	
147	37462	13	>>	Yabbuu	20	30 11	
148	35496	13	>>	Agaroo	45	Malkaa	
149	37844	14	>>	>>	>>	Ababoo	
150	44764	13	>>	Limmuu	72	Q/Dammaa	
151	22325	24	>>	Deedoo	20	Malkaa	
152	43174	14	>>	Boongaa	115	J/Jiree	
153	41045	13	>>	Agaroo	45	Gellaa	
154	49553	13	>>	>>	>>	J/Jiree	
155	50148	14	>>	Asandabo	55	Kooxeb	
156	31912	13	>>	>>	>>	Q/Dammaa	
157	31456	13	>>	>>	>>	Kooxeb	
158	41305	14	>>	Saggaa	20	Kaaa Jaa	
159	08040	15	>>	Boongaa	115	Bunnaa	
160	34199	13	>>	Agaroo	45	G/Biyyaa	
161	08668	24	>>	Deedoo	20	Gusaa	
162	37529	13	>>	Deedoo	20	Kooxeb	
163	39472	13	>>	Gosoomb	55	>>	
164	44028	13	>>	Agaroo	45	Q/Dammaa	
165	36900	13	>>	Bongaa	115	Gibee	
166	47192	24	>>	Moolee	33	Jijaar	
167	48562	14	>>	Sokorruu	100	>>	
168	27855	14	>>	Beddelle	145	[illegible]	
169	50144	14	>>	Asandabo	55	G/Biyyaa	
170	44783	14	>>	>>	>>	[illegible]	
171	37468	13	>>	Salboo	20	Q/Dammaa	
172	38801	13	>>	Asandabo	55	Kooxeb	
173	47194	14	>>	Saggaa	20	[illegible]	
174	48453	14	>>	Waltiziima	200		

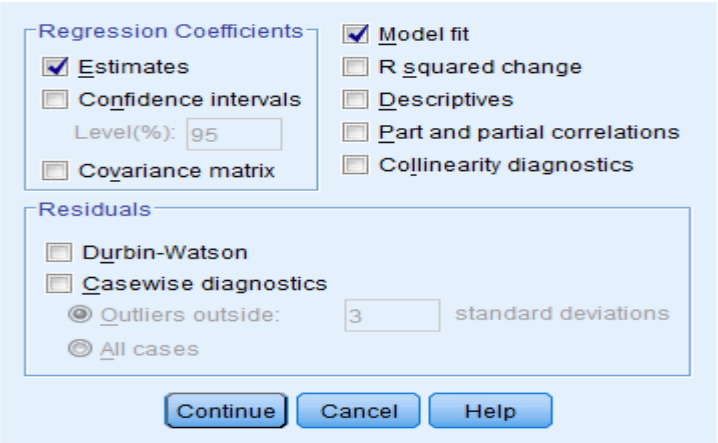
Appendix B

Process for developing model for vehicles assignments



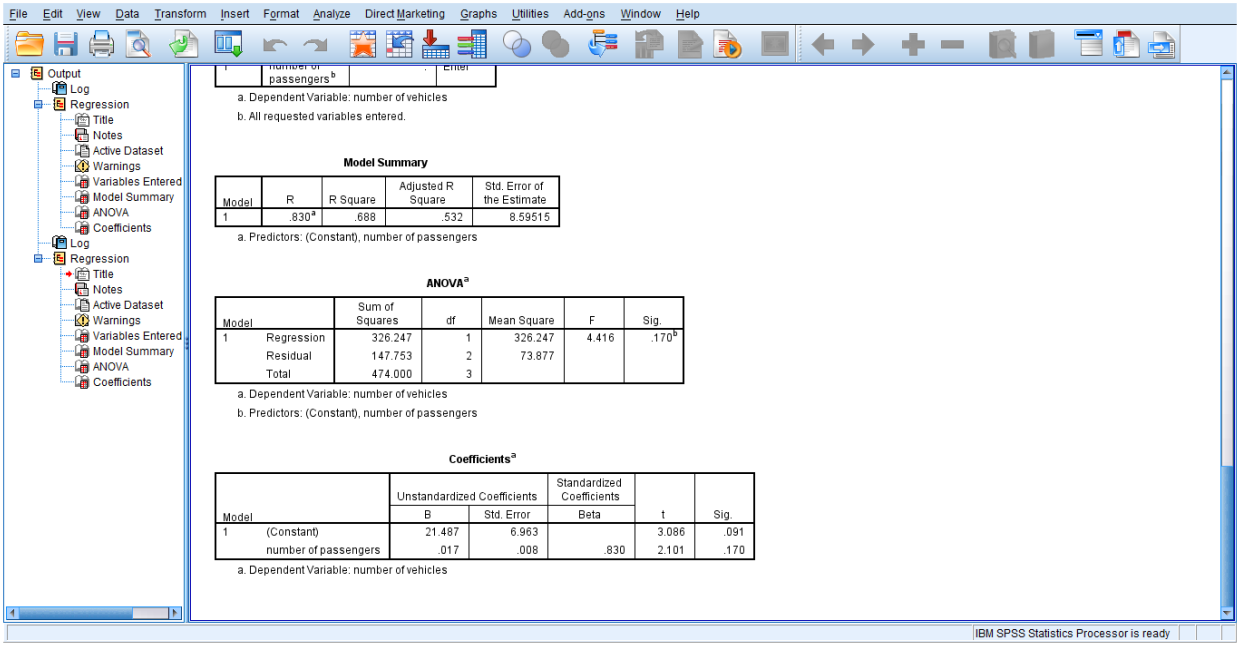
Screenshot from software.

Then insert number of vehicles as dependent variables and number of trip, number of passengers and number of seats as independent variables in the above dialog box and click on statistics to display the following.



Step in the software to get model.

Finally, after click on model fit and display, click on continue then ok to display the result as follows according to tables above, respectively from short to long distance.



a. Dependent Variable: number of vehicles

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.830[a]	.688	.532	8.59515

a. Predictors: (Constant), number of passengers

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	326.247	1	326.247	4.416	.170[b]
	Residual	147.753	2	73.877		
	Total	474.000	3			

a. Dependent Variable: number of vehicles

b. Predictors: (Constant), number of passengers

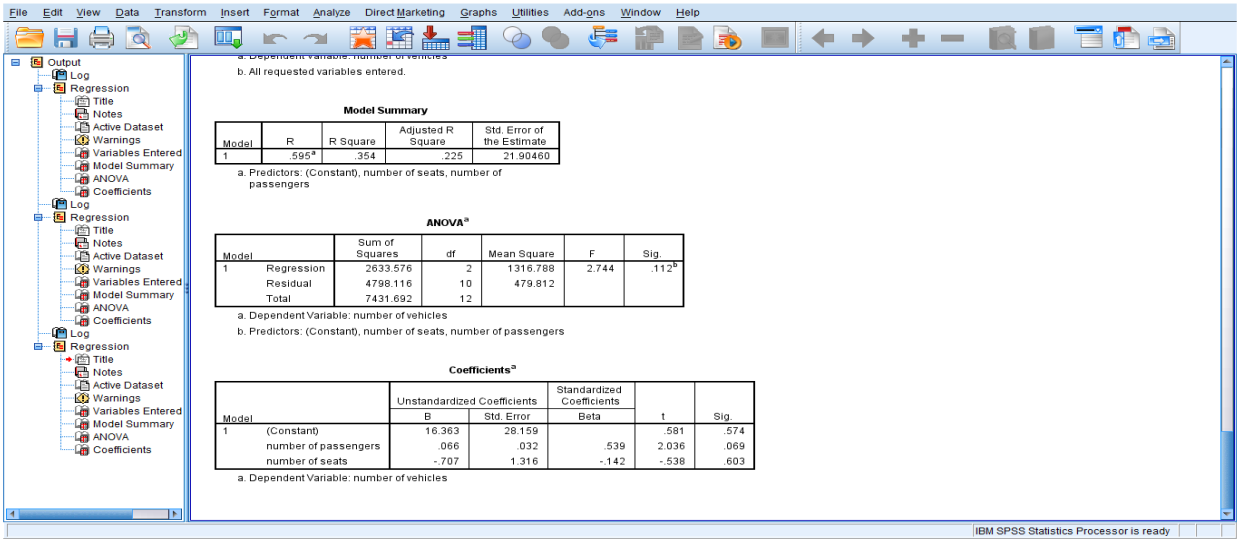
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	21.487	6.963		3.086	.091
	number of passengers	.017	.008	.830	2.101	.170

a. Dependent Variable: number of vehicles

IBM SPSS Statistics Processor is ready

Result including values of coefficients for short distance routes



b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.595[a]	.354	.225	21.90460

a. Predictors: (Constant), number of seats, number of passengers

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2633.576	2	1316.788	2.744	.112[b]
	Residual	4798.116	10	479.812		
	Total	7431.692	12			

a. Dependent Variable: number of vehicles

b. Predictors: (Constant), number of seats, number of passengers

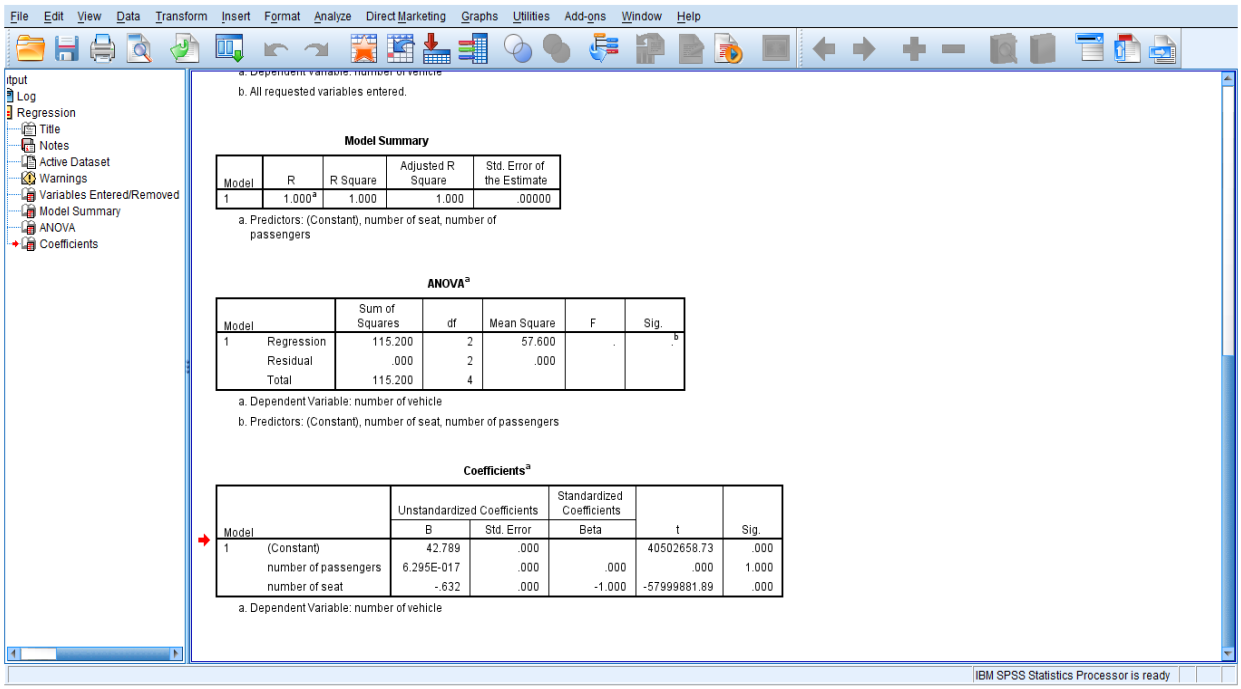
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	16.363	28.159		.581	.574
	number of passengers	.066	.032	.539	2.036	.069
	number of seats	-.707	1.316	-.142	-.538	.603

a. Dependent Variable: number of vehicles

IBM SPSS Statistics Processor is ready

Result including values of coefficients for medium distance routes



Result including values of coefficients for long distance routes

Appendix C

Questionnaire

Passengers' and Road User's Perception can be gathered through structured questionnaire as follows:

I. General

a) Interview Date _____

b) Interviewee Status:

Address _____ Age ____Sex _____Educational Status_____

II. Interview Questions

Please answer the following questions to your convenient perception:

1. How often do you use this terminal for your movement purposes?

A) Frequently B) Sometimes C) Rarely D) Not before

2. Which route do you often use?

3. What is the purpose of your journey on this route?

A) Trade B) warehouse C) education D) governmental work

4. What is your level of satisfaction concerning to availability of sufficient number of vehicle going to your way?

1, very satisfied 2, satisfied 3, average 4, dissatisfied 5, very dissatisfied

5. What is your level of satisfaction concerning to availability of route information mounted in the terminal?

1, very satisfied 2, satisfied 3, average 4, dissatisfied 5, very dissatisfied

6. What is your level of satisfaction based on security in the terminal?

1, very satisfied 2, satisfied 3, average 4, dissatisfied 5, very dissatisfied

7. What is your level of satisfaction based on comfort in the terminal concerning to availability of seats?

1, very satisfied 2, satisfied 3, average 4, dissatisfied 5, very dissatisfied

8. What is your level of satisfaction based on comfort in the terminal concerning to cleanliness?

1, very satisfied 2, satisfied 3, average 4, dissatisfied 5, very dissatisfied

A Questionnaire for Managing Team

I. General

a) Interview Date _____

b) Interviewee Status:

Address _____ Age ____Sex _____Educational Status_____

Your role in terminal……

II. Interview Questions

1. What are the problems usually occur in the terminal?
2. Which routes need high number of vehicle assignment than other respective route? How many numbers of vehicles are assigned per day?
3. Do you think the efficiency of vehicles in the terminal is as expected?

A, yes B, no

4. If your answer in number 3 is No what are the factors that will affect the efficiency of vehicles?
5. Is there any route information or indicating sign that will help passengers in the terminal?

A, yes B, No

6. If your answer above is No, how can passengers easily get which vehicles go to their route?
7. Is there any speed limit sign for vehicles to slow down their speed in the terminal?

A. yes B. No

8. If your answer to above is No, have you ever seen accident occurrence in the terminal because speed of vehicles derived in the terminal?
9. Do you think driver behavior in the terminal could affect efficiency of vehicles?
10. Do you think that configuration of vehicles in the terminal is easily accessible for passengers?
11. Do think that terminal is safe and secure for passenger?

A. yes B. No

12. If your answer is No, for above what do you recommend in order to make it safe and secure?

Questionnaire for drivers

I. General

a) Interview Date _____

b) Interviewee Status:

Address _____ Age ____Sex _____Educational Status_____

II. Interview Questions

1. How often do you drive on this route?

A) Frequently B) Sometimes C) Rarely D) Not before

2. Who is responsible for assigning vehicle in terminal if there is high traffic flow on your assigned route?

3. What type of problem did you observe in the terminal concerning assignment?

4. What would you recommend to solve the problem observed?