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Evaluation Of Transportation Performance Of City Transport in Tegal City

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Abstract- The problem of public transportation service in Tegal City is not yet optimal performance of urban transport service and border transportation caused by route of circular route so that public transportation service user will going in the opposite direction of difficulty obtaining public transportation. And not optimal network route performance caused by several route routes that overlap with other routes so that minimize Load Factor The proposed structuring of urban transport network and border in Tegal City 8 routes (2 urban transport routes and 6 border transport routes) to 14 routes consisting of 9 urban transport routes, namely A1, A2, A3, A4, A5, A6, A7, A8, A9 and 5 border routes, Tegal - Slawi, Tegal - Banjaran, Tegal - Pasar Bawang, Tegal - Kemantran and Tegal - Jatibarang .

Keywords**:** *public transportation, circular route, opposite direction, overlap*

1. Preface

Tegal City is also very strategic because it is located in T-junction of Purwokerto - Tegal - Jakarta and Semarang - Tegal - Jakarta. While the administrative boundaries of Tegal City are as follows, North side with Java Sea, South side with Tegal regency, west side with Brebes Regency East with Tegal Regency.

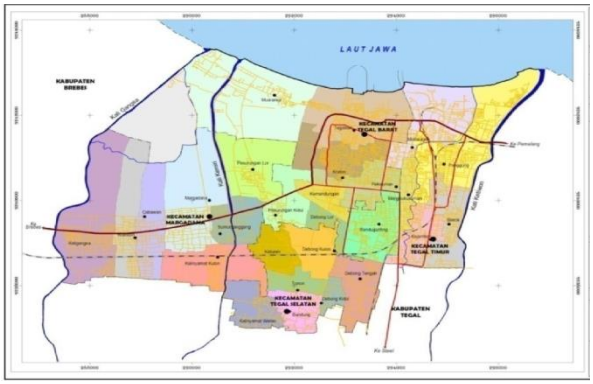


Figure 1. Tegal City Borders

Tegal City has an uneven distribution of the population. Tegal Timur sub-district has the most population that reaches about 31,36%. This is due to several factors, among

others, because the district of East Tegal is the center of government, the center of the economy and the center of education. For more details can be seen in the following table:

Table 1 Area, Population of each District and Population Density in Tegal City 2017

No	Districts	Area	Population	Population Density Of Each District
1	Tegal Selatan	6,43	58.857	8.925
2	Tegal Timur	6,36	76.840	11.725
3	Tegal Barat	15,13	63.447	4.136
4	Margadana	11,76	45.854	3.878
		39,68	244.998	28.664

Source: Central Bureau of Statistics Tegal City Year 2017

2. Literature Review

2.1 Transport

Understanding of transportation according to Law number 22 of 2009 on traffic and road transport Article 1 paragraph 3 is the movement of people and / or goods from one place to another by using vehicles in the road traffic space.

2.2 Public transport

Public transport may be defined as the movement of persons and / or goods from one place to another by means of motor vehicles provided for use by the public at a direct or indirect fee.

2.3 Public transport routes

According to Government Regulation No. 74 of 2014, article 1, paragraph 8, Trayek is defined as a general passage of vehicles for the service of passenger cars or buses with fixed-origin and fixed travel destinations, fixed trajectories and types of fixed and scheduled or unscheduled vehicles . While the route network is a collection of trajectory-a route that becomes a unity of people transportation service network (Purwantoro, 2005). Route network setup and pattern depends on:

a. Percentage of areas served by the public transport system.
b. The number of required lane turns in the passenger movement from origin to destination.
c. Setting the frequency and schedule of vehicle operation
d. Terminal location.

Table 2. Indicators of Performance Standard of Public Transport Service

Nilai	1	2	3	4	5	6	7	8	9	10
1	>1	>1	<5	>15	>12	<13	<4	<82	>30	05-18
2	0,8-1	0,7-1	5-10	10-15	6-12	13-15	4-6	82-100	20-30	05-20
3	<0,8	<0,7	>10	<10	<6	>15	>6	>100	<20	05-22

Source: Directorate General of Land Transportation Indonesia

Information :
Value 1 = for service standards with less criteria
Value 2 = for service standards with medium criteria
Value 3 = for service standards with good criteria

Column 1 = Average load factor during peak hours
Column 2 = Average load factor not during peak hours
Column 3 = Average travel speed (Km / h)
Column 4 = Average headway (Minutes)

Column 5 = Average travel time (minutes)
Column 6 = Service time (hours)
Column 7 = Frequency (vehicle / hour)
Column 8 = Number of vehicles in operation (%)
Column 9 = Average waiting time for passengers (minutes)
Column 10 = Beginning and end of service time (Hours)

2.4 Vehicle Operating Costs (VOC)

Vehicle Operational Cost (VOC) includes expenses incurred by the transport entrepreneur every day, month and even year for vehicle maintenance and operational expenses. These costs include both direct and indirect costs.

3. Research Methods

In releasing the performance of public transport refers to the guidelines used by the Directorate General of Land Transportation. The parameters to be analyzed are:

3.1 *Load Factor on Hours Busy*

Load factor during peak hours is the comparison between sold capacity and capacity available for travel at peak hours expressed in percent.

The load factor calculation is:

$$Lf = \frac{Pnp}{C} \times 100\% \quad (1)$$

Information : Lf = Load Factor
Pnp = Number of passengers transported
C = Vehicle capacity

3.2 *Load Busy Outside Hour factor*

Load factor during peak hours is the comparison between the capacity sold and the capacity available for travel not during peak hours expressed in percent.

3.3 Travel Speed

Travel Speed is the ratio of the length of the route to travel with the required travel time expressed in km / h. The calculation of the speed of travel is

$$V = 60 \times \frac{L}{T} \text{ Km / h} \quad (2)$$

Description: V = speed of travel (Km / h)
L = length of route (Km)
T = Vehicle capacity (minutes)

3.4 Headway (time between)

Headway (time between) is the time interval between one vehicle with another vehicle sequentially behind it on a route. Headway calculation is:

$$H = \frac{60 \text{ minutes}}{\text{Frequency}} \text{ minutes} \quad (4)$$

Description: V = speed of travel (Km / h)
L = length of route (Km)
T = Vehicle capacity (minutes)

3.5 Travel Time

Travel Time is the time required to travel 1 kilometer long stretch in minutes / kilometers. Calculated based on survey results in public transport (on bus).

3.6 Service Time

Service Time is the amount of time effective of public transport service (in hours) outside of rest time, known based on survey results.

3.7 Frequency of Service

Frequency of service is the number of vehicles that operate for a certain time. The required service frequency is determined by the most busy time request, with the following calculation formula:

$$F = \frac{Pnp}{C} \text{ vehicle / hour (5)}$$

Description :
- F = Frequency
- Pnp = Number of passengers each hour
- C = Vehicle capacity

3.8 Number of vehicles in operation (%)

The number of vehicles that operate is the percentage of the number of vehicles operating with the number of vehicles according to permits, known based on survey results.

3.9 Passenger waiting time (minutes)

Passenger waiting time is the time required by the passengers from the stop to get the freight, known based on survey results.

3.10 Beginning and end of service time

The beginning and end of service time is the time the public transport starts operating until the time to end its operation, known based on survey results.

3.11 Vehicle Operating Costs (VOC) Analysis

Based on the cost grouping, the cost structure of transportation services is as follows:

a. Direct cost

1) Depreciation of productive vehicles
2) Productive vehicle capital interest
3) The crew of the bus (driver and conductor)
   - Salary / wages
   - Operational allowance (official money)
   - Social visits
4) Fuel Oil (BBM)
5) Tires
6) Small Service
7) Great Service
8) Examination (Overhaul)
9) Oil Addition
10) Parts and body
11) Wash the bus
12) Terminal Retribution

13) vehicle registration / vehicle tax
14) Kir
15) Insurance
    - Vehicle Insurance
    - Insurance bus crew

b. Indirect Costs

1) Employee costs other than vehicle crew
    a) salary / wages
    b) overtime pay
    c) social benefits
        - health care visit
        - clothing
        - accident insurance
2) Management costs
    a) Depreciation of office buildings
    b) Depreciation of pools and workshops
    c) Depreciation of inventory / office equipment
    d) Depreciation of workshop facilities
    e) Office administration fee
    f) Office maintenance expenses
    g) Maintenance costs pool and workshop
    h) Electricity and water costs
    i) Telephone and telegram charges
    j) Official travel expenses other than vehicle crew
    k) Company tax
    l) Route permit
    m) Business license
    n) Marketing costs
    o) Others

3.12 User transport analysis

Judging from the work of the public users of the city tegal divided into 3 major parts of employees, Private / traders, and students. For the analysis of the use of transportation is diantarannya Accessibility service, waiting time, travel time, rates, security, and comfort.

4. Data and Analysis

4.1. Load Factor

The load factor data is obtained through both static and dynamic load factor surveys. The recapitulation of the results of the load factor survey is as follows:

Table 3. Recapitulation of Survey Results Load Factor Route A1

Time	Capacity	passenger	Lf %
06.00 - 07.00	12	6	50%
07.00 - 08.00	12	5	42%
08.00 - 09.00	12	3	25%
09.00 - 10.00	12	1	8%
10.00 - 11.00	12	1	8%
11.00 - 12.00	12	1	8%
12.00 - 13.00	12	4	33%

Time	Capacity	passenger	Lf %
13.00 - 14.00	12	5	42%
14.00 - 15.00	12	3	25%
15.00 - 16.00	12	3	25%
16.00 - 17.00			
17.00 - 18.00			
Average Peak hour	12	5	42%
Average outside the Peak Hour	12	2	17%
Average	12	3	27%

Source: Analysis Result, 2017

Table 4. Recapitulation of Survey Results Load Factor Route A2

Time	Capacity	passenger	Lf %
06.00 - 07.00	12	5	42%
07.00 - 08.00	12	6	50%
08.00 - 09.00	12	2	17%
09.00 - 10.00	12	1	8%
10.00 - 11.00	12	1	8%
11.00 - 12.00	12	1	8%
12.00 - 13.00	12	4	33%
13.00 - 14.00	12	4	33%
14.00 - 15.00	12	3	25%
15.00 - 16.00	12	3	25%
16.00 - 17.00			
17.00 - 18.00			
Average Peak hour	12	5	40%
Average outside the Peak Hour	12	2	15%
Average	12	3	25%

Source: Analysis Result, 2017

Table 5. Recapitulation of Load Factor Survey Results of Tegal-Slawi Route

Time	Capacity	passenger	Lf %
06.00 - 07.00	12	6	50%
07.00 - 08.00	12	5	42%
08.00 - 09.00	12	1	8%
09.00 - 10.00	12	1	8%
10.00 - 11.00	12	2	17%
11.00 - 12.00	12	2	17%
12.00 - 13.00	12	4	33%
13.00 - 14.00	12	5	42%
14.00 - 15.00	12	2	17%
15.00 - 16.00	12	2	17%
16.00 - 17.00	12	5	42%
17.00 - 18.00	12	1	8%
Average Peak hour	12	5	42%
Average outside the Peak Hour	12	2	13%
Average	12	3	25%

Source: Analysis Result, 2017

Table 6. Recapitulation of Load Factor Survey Results Tegal -Banjaran Route

Time	Capacity	passenger	Lf %
06.00 - 07.00	12	7	58%
07.00 - 08.00	12	6	50%

Time	Capacity	passenger	Lf %
08.00 - 09.00	12	2	17%
09.00 - 10.00	12	1	8%
10.00 - 11.00	12	2	17%
11.00 - 12.00	12	3	25%
12.00 - 13.00	12	5	42%
13.00 - 14.00	12	6	50%
14.00 - 15.00	12	3	25%
15.00 - 16.00	12	2	17%
16.00 - 17.00	12	4	33%
17.00 - 18.00	12	3	25%
Average Peak hour	12	6	47%
Average outside the Peak Hour	12	2	19%
Average	12	4	31%

Source: Analysis Result, 2017

Table 7. Recapitulation of Load Factor Survey Results of Tegal - Kemantran Route

Time	Capacity	passenger	Lf %
06.00 - 07.00	12	6	50%
07.00 - 08.00	12	5	42%
08.00 - 09.00	12	2	17%
09.00 - 10.00	12	1	8%
10.00 - 11.00	12	4	33%
11.00 - 12.00	12	1	8%
12.00 - 13.00	12	5	42%
13.00 - 14.00	12	6	50%
14.00 - 15.00	12	1	8%
15.00 - 16.00	12	1	8%
16.00 - 17.00	12	6	50%
17.00 - 18.00			
Average Peak hour	12	6	47%
Average outside the Peak Hour	12	2	14%
Average	12	3	29%

Source: Analysis Result, 2017

Table 8. Recapitulation of Load Factor Survey Results of Tegal - Dukuh Turi Route

Time	Capacity	passenger	Lf %
06.00 - 07.00	12	6	50%
07.00 - 08.00	12	6	50%
08.00 - 09.00	12	1	8%
09.00 - 10.00	12	2	17%
10.00 - 11.00	12	2	17%
11.00 - 12.00	12	1	8%
12.00 - 13.00	12	6	50%
13.00 - 14.00	12	5	42%
14.00 - 15.00	12	3	25%
15.00 - 16.00	12	2	17%
16.00 - 17.00	12	5	42%
17.00 - 18.00	12	2	17%
Average Peak hour	12	6	47%
Average outside the Peak Hour	12	2	15%
Average	12	3	28%

Source: Analysis Result, 2017

Table 9. Recapitulation of Load Factor Survey Results Tegal - Pasar Bawang Route

Time	Capacity	passenger	Lf %
06.00 - 07.00	12	5	42%
07.00 - 08.00	12	4	33%
08.00 - 09.00			
09.00 - 10.00			
10.00 - 11.00			
11.00 - 12.00	12	1	8%
12.00 - 13.00	12	5	42%
13.00 - 14.00	12	3	25%
14.00 - 15.00	12	1	8%
15.00 - 16.00			
16.00 - 17.00			
17.00 - 18.00			
Average Peak hour	12	4	35%
Average outside the Peak Hour	12	1	8%
Average	12	3	26%

Source: Analysis Result, 2017

Table 10. Recapitulation of Load Factor Survey Results Tegal – Jatibarang Route

Time	Capacity	passenger	Lf %
06.00 - 07.00	12	7	58%
07.00 - 08.00	12	2	17%
08.00 - 09.00			
09.00 - 10.00	12	2	17%
10.00 - 11.00			
11.00 - 12.00			
12.00 - 13.00	12	5	42%
13.00 - 14.00			
14.00 - 15.00	12	2	17%
15.00 - 16.00			
16.00 - 17.00	12	4	33%
17.00 - 18.00			
Average Peak hour	12	5	44%
Average outside the Peak Hour	12	2	17%
Average	12	3	25%

Source: Analysis Result, 2017

4.2. Travel Speed

The travel speed data is obtained through the Moving Car Observer survey.

Table 11. Travel Speed Data

No	Route	Length Route (KM)	Travel Time (Minute)	Speed (KM / Hour)
1	A1	17	92	11
2	A2	16	95	10
3	Tegal-Slawi	20	52	23
4	Tegal-Banjaran	13	45	17
5	Tegal-DukuhTuri	13	65	12
6	Tegal-Ps.Bawang	15	53	17
7	Tegal-Kemantran	15	40	23
8	Tegal-Jatibarang	21	35	36

Source: Analysis Result, 2017

Headway (time between)

Headway data (intermediate time) is obtained through static surveys on passenger bags at each route or terminal.

Table 12. Headway Recapitulation (minutes)

Time	A1	A2	Slawi	Banjaran	Kemantran	Ps.Bawang	Dukuh Turi	Jatibarang
06.00 - 07.00	30	10	3	5	20	60	20	60
07.00 - 08.00	60	15	3	12	30		20	
08.00 - 09.00	60	30	5	7	30		60	
09.00 - 10.00	60	20	8	20	20	60	60	60
10.00 - 11.00	60	15	8	12	30		30	
11.00 - 12.00	60	30	10	30	20		30	
12.00 - 13.00	30	20	4	10	20		60	60
13.00 - 14.00	30	15	5	20	30	60	30	
14.00 - 15.00	60	60	15	30	60		30	
15.00 - 16.00	60	60	30	30	60		60	60
16.00 - 17.00			10	60	60		30	
17.00 - 18.00			60	60			60	

Source: Analysis Result, 2017

Table 13. Headway Recapitulation (minutes)

No.	Rute	Headway Average
1	A1	51
2	A2	28
3	Tegal - Slawi	13
4	Tegal - Banjaran	25
5	Tegal - Kemantran	35
6	Tegal - Pasar Bawang	60
7	Tegal - Dukuh Turi	41
8	Tegal - Jatibarang	60
Rata-rata		39

4.3. Service Time

Service time data is obtained through interview survey to operator / driver.

Table 14. Service Time Data

No	Route	Service Time	Total (hour)
1	A1	05:30-16:00	10.5
2	A2	05:30-16:00	10.5
3	Tegal-Slawi	05:30-04:59	23.5
4	Tegal-Banjaran	05:30-17:30	11.5
5	Tegal-DukuhTuri	05:30-17:30	11.5
6	Tegal-Ps.Bawang	05:30-16:00	10.5
7	Tegal-Kemantran	05:30-17:30	11.5
8	Tegal-Jatibarang	05:30-15:30	9.5

Source: Analysis Result, 2017

4.4. Frequency

Frequency data is obtained through static surveys on passenger bags at each route or terminal.

Table 15. Recapitulation of Frequency of Each Route (vehicle / hour)

Time	A1	A2	Slawi	Banjaran	Kemantran	Ps.Bawang	Dukuh Turi	Jatibarang
06.00 - 07.00	2	6	18	11	3	1	3	1
07.00 - 08.00	1	4	22	5	2		3	
08.00 - 09.00	1	2	12	9	2		1	
09.00 - 10.00	1	3	8	3	3	1	1	1
10.00 - 11.00	1	4	8	5	2		2	
11.00 - 12.00	1	2	6	2	3		2	
12.00 - 13.00	2	3	14	6	3		1	1
13.00 - 14.00	2	4	12	3	2	1	2	
14.00 - 15.00	1	1	4	2	1		2	
15.00 - 16.00	1	1	2	2	1		1	1
16.00 - 17.00			6	1	1		2	
17.00 - 18.00			1	1			1	

Source: Analysis Result, 2017

Table 16. Average Frequency (Vehicle / hour)

No.	Route	Frequency Average
1	A1	1
2	A2	3
3	Tegal - Slawi	9
4	Tegal - Banjaran	4
5	Tegal - Kemantran	2
6	Tegal - Pasar Bawang	1
7	Tegal - Dukuh Turi	2
8	Tegal - Jatibarang	1
Rata-rata		3

Source: Analysis Result, 2017

4.5. Number of vehicles in operation

The data on the number of vehicles in operation is obtained through interview survey to the operator / driver.

Table 17. Operational Vehicle Analysis

No	Route	Vehicle	Real	%
1	A1	22	5	23
2	A2	25	15	60
3	Tegal-Slawi	26	20	77
4	Tegal-Banjaran	77	22	29
5	Tegal-DukuhTuri	13	4	31
6	Tegal-Ps.Bawang	9	3	33
7	Tegal-Kemantran	15	5	33
8	Tegal-Jatibarang	7	2	29

Source: survey results 2017

4.6. Passenger waiting time

Passenger waiting time data is obtained through a passenger interview survey in a vehicle or at a stop.

Table 18. Data on Passenger Waiting Time

No	Route	Wait Time (Minutes)
1	A1	35
2	A2	25
3	Tegal-Slawi	5
4	Tegal-Banjaran	20
5	Tegal-DukuhTuri	25
6	Tegal-Ps.Bawang	65
7	Tegal-Kemantran	22
8	Tegal-Jatibarang	65

Source: Analysis Result, 2017

4.7. Performance of Urban and Border Transport Service

Table 19. Performance of Urban and Border Transport Service in Tegal City

Route	LFs	LFts	KP	H	WP	F	KB	WTP
A1	42	17	11	51	10.5	1	5	35
A2	40	15	10	28	10.5	3	15	25
Tegal-Slawi	42	13	23	13	23.5	9	20	5
Tegal-Banjaran	47	19	17	25	11.5	4	22	20
Tegal-DukuhTuri	47	14	12	41	11.5	2	4	25
Tegal-Pasar Bawang	35	8	17	60	10.5	1	3	65
Tegal-Kemantran	47	15	23	35	11.5	2	5	22
Tegal-Jatibarang	44	17	36	60	9.5	1	2	65

Source: Analysis Result, 2017

Descripton:
LFs : Load Factor Hours Busy
LFts : Load Factor outside Hours Busy
KP : Travel Speed
H : Headway
WP : Service Time
F : Frequency
KB : Vehicle Operating
WTP : Passenger Waiting Time

4.8. Assessment Analysis of Public Transport Service

From the results of public transport performance analysis that has been discussed previously, then the data analysis results are then made analysis of public transport service standards. The results of the analysis are presented in the following table.

Table 20. Assessment of Standard of Public Transport Service

Route	LFs	LFts	KP	H	WP	F	KB	WTP	Total value
A1	1	1	3	1	1	1	1	1	10
A2	1	1	3	1	1	1	1	2	11
Tegal-Slawi	1	1	3	1	3	3	1	3	16
Tegal-Banjaran	1	1	3	1	1	2	1	2	12
Tegal-DukuhTuri	1	1	3	1	1	1	1	2	11
Tegal-Pasar Bawang	1	1	3	1	1	1	1	1	10
Tegal-Kemantran	1	1	3	1	1	2	1	2	12
Tegal-Jatibarang	1	1	3	1	1	1	1	1	10

Descripton:
LFs : Load Factor Hours Busy
LFts : Load Factor outside Hours Busy
KP : Travel Speed
H : Headway
WP : Service Time
F : Frequency
KB : Vehicle Operating
WTP : Passenger Waiting Time

From the analysis result of the assessment of public transport service standards in the above table it is known that there are 3 routes that get the smallest value (value 10) are:

a. 1. Route A1
b. 2. Tegal-Market of Onion Trek and
c. 3. Trajectory Tegal-Jatibarang

The three routes of the 8 service indicators only get the full value in the 3rd column, ie the travel speed column, whereas in other standards it only gets a low value. In the second sequence with a value of 11, obtained by route A2 and route Tegal-Dukuh Turi by getting the value of full travel speed (3) and travel time to get the value 2. While the order to -3 with value 12 in get by route Tegal-Banjaran and Tegal-Kemantran with the composition of the frequency value 2, trip speed 3 and passenger waiting time 2. The highest scores were directed by the Tegal-Slawi route with a value of 16, with full value composition in 4 service categories and less value in 4 service categories.

However, in the provisions of the Directorate General of Land Transportation, Ministry of Transportation value of services is divided into 3 categories, namely:

a. Total Value 18-24 good category
b. Total Value 12-17,99 medium category;
c. Total Value <12 categories is not optimal

From the assessment of public transport service standards in Tegal city can be grouped as follows:

1. Medium category : Tegal-Slawi Route
2. Category not optimal : A1 Route; A2 Route; Tegal Banjaran Route; Tegal-Dukuh Turi Route; Tegal-Pasar Bawang Route; Tegal-Kemantran Route and Tegal-Jatibarang Route.

4.9. Condition of Existing Tariff

The condition of urban and border transport tariffs in Tegal City is very varied because it is influenced by several factors, among others:
- Passenger, public or student status
- Fuel prices that have increased or decreased in a relatively quick time

Based on the survey results, the average tariff rate for each route is as shown in the table below:

Table 21. Tariff of urban and border transport in Tegal City

NO	Route	Route Segment	The ratings	
			General	Students
1.	A1	Terminal - Tegalsari	Rp. 4.000	Rp. 3.000,-
		Tegalsari – Ps Martoloyo	Rp. 4.000	Rp. 3.000,-
		Martoloyo - Kejambon	Rp. 4.000	Rp. 3.000,-
		Kejambon - Kalinyamat	Rp. 4.000	Rp. 3.000,-
		Kalinyamat - Terminal	Rp. 4.000	Rp. 3.000,-
2	A2	Terminal – Pasific	Rp. 4.000	Rp. 3.000,-
		Pasific - Kejambon	Rp. 4.000	Rp. 3.000,-

NO	Route	Route Segment	The ratings	
			General	Students
		Kejambon – Ps. Martoloyo	Rp. 4.000	Rp. 3.000,-
		Ps. Martoloyo - Pasific	Rp. 4.000	Rp. 3.000,-
		Pasific - Terminal	Rp. 4.000	Rp. 3.000,-
3	Tegal - Banjaran	Terminal – Ps. Pagi	Rp. 4.000	Rp. 3.000,-
		Ps. Pagi - Karanganyar	Rp. 4.000	Rp. 3.000,-
		Karanganyar - Banjaran	Rp. 3.000	Rp. 2.000,-
4	Tegal - Slawi	Terminal - Pasific	Rp. 4.000	Rp. 3.000,-
		Pasiific - Stasiun	Rp. 4.000	Rp. 3.000,-
		Stasiun - Karanganyar	Rp. 4.000	Rp. 3.000,-
		Karanganyar - Banjaran	Rp. 3.000	Rp. 2.000,-
		Banjaran - Slawi	Rp. 3.000	Rp. 2.000,-
5	Tegal - Dukuhturi	Terminal - Dukuhturi	Rp. 8.000	Rp. 6.000,-
		Dukuhturi - Kejambon	Rp. 4.000	Rp. 3.000,-
		Kejambon – Pasar Pagi	Rp. 4.000	Rp. 3.000,-
		Pasar Pagi - Pasific	Rp. 4.000	Rp. 3.000,-
		Pasific - Terminal	Rp. 4.000	Rp. 3.000,-
6	Tegal – Pasar Bawang	Termnal – Pasar Bawang	Rp. 8.000	Rp. 6.000,-
		Pasar Bawang - Terminal	Rp. 8.000	Rp. 6.000,-
7	Tegal - Kemantran	Teminal – Pasific	Rp. 4.000	Rp. 3.000,-
		Pasific – Pasar Pagi	Rp. 4.000	Rp. 3.000,-
		Pasar Pagi - Mejasem	Rp. 6.000	Rp. 4.000,-
		Mejasem - Kemantran	Rp. 6.000	Rp. 4.000,-
8	Tegal - Jatibarang	Terminal - Jatibarang	Rp. 8.000	Rp. 6.000,-
		Jatibarang - Terminal	Rp. 8.000	Rp. 6.000,-

Source: survey results 2017

4.10. Planned Route of Urban and Border Transport Route in Tegal City

Table 22. Planned Route of Urban and Border Transport Routes in Tegal City

NO	Code	Route	Description
1	A1	Terminal Tegal – Jl. Mataram – Jl. Brawijaya – Jl. Blanak – Jl. Hang Tuah – Jl. Bawal – Jl. Lumba-Lumba – Jl. Sepat – Jl. Wader – Jl. Hang Tuah – Jl. Letjen Suprapto – Jl. DI. Panjaitan – Jl. A.Yani (Terminal Pasar Pagi) – Jl. Veteran – Jl. Proklamasi – Jl. S. Parman – Jl. Blanak – Jl. Brawijaya – Jl. Mataram – Terminal Tegal.	Terminal to the north past Polytechnic Campus, TPI, SMA 2, Pasar Cinde, Tegalsari Village, Supermarket, Morning Market, Post Office, Housing
2	A2	Terminal Tegal – Jl. Dr. Cipto Mangunkusumo – Jl. Kol. Sugiono – Jl. Dewi Sartika – Jl. Gatot Subroto (Keturen) – Jl. KS. Tubun – Jl. Merpati – Jl. Sri Gunting – Jl. AR. Hakim – Jl. Kartini – Jl. KH. Ahmad Dahlan – Alun-Alun – Jl. A. Yani (Terminal Pasar Pagi) – Jl. Waringin – Jl. HOS. Cokroaminoto – Jl. P. Diponegoro – Jl. AR. Hakim – Jl. Sri Gunting – Jl. Merpati – Jl. KS. Tubun – Jl. Gatot Subroto (Keturen) – Terminal Tegal.	Potential: Terminal, Akper City Government, Randugunting Market, Yogya Mall, Educational Area Kartini, Tegal Town Hall, Morning Market, Housing
3	A3	Terminal Tegal – Jl. Ki Hajar Dewantara – Jl. Cut Nya Dhien – Jl. Teuku Umar – Jl. KS. Tubun – Jl. Sultan Agung – Jl. AR. Hakim – Jl. P. Diponegoro – Jl. A. Yani (Terminal Pasar Pagi)	Moving Routes Tegal-Dukuhturi Potential: Tegal Terminal, Bandung Market, Tire, Randugunting Market, Kardinah Hospital,

NO	Code	Route	Description
			Yogya Mall, Morning Market, Housing
4	A4	Terminal Tegal – Jl. Dr. Wahidin Sudirohusodo – Jl. Kol. Sugiono – Jl. Jenderal Sudirman – Jl. P. Diponegoro – Jl. Kartini – Jl.Semeru – Terminal Stasiun Tegal – Jl. Pancasila – Alun-Alun - Jl. P. Diponegoro – Jl. Jenderal Sudirman – Jl. Kol. Sugiono - Jl. Dr. Wahidin Sudirohusodo - Terminal Tegal	Potential: Terminal Tegal, Rita Mal, Yogya Mal, Station, Town Hall Tegal, Housing
5	A5	Terminal Tegal – Jl. Gatot Subroto (Keturen) – Jl. Hasanudin – Jl. Teuku Cik Ditiro - Jl. Ki Hajar Dewantara – Jl. Agus Salim – Pasar Krandon – Kelurahan Kaligangsa – Kampus 2 PKTJ Margadana – Terminal Tegal.	Potential: Terminal Tegal, Bandung Market, Krandon Market, Kaligangsa Health Center, Housing of civil servants.
6	A6	Jl. A. Yani (Terminal Pasar Pagi) – Jl. Veteran – Jl. Proklamasi – Jl. Slamet Riyadi – Jl. Yos Sudarso – Jl. Irian (Pondok Martoloyo) – Jl. Halmahera – Jl. Serayu – Jl. Panggung Timur - Jl. Slamet Riyadi – Jl. Veteran – Jl. A. Yani (Terminal Pasar Pagi)	Potential: Morning Market, Post Office, BPD Jateng, PLN, Housing, UPS Campus Tegal
7	A7	Terminal Tegal – Jl. Mataram – Jl. Jalingkut – Jl. Sawo Barat – Jl. Sawo Timur – Jl. Kapten Ismail – Jl. Dr. Sutoomo – Jl. Gajahmada - Jl. HOS. Cokroaminoto – Jl. KH. Mukhlas – Jl. Pancasila - Jl. KH. Mukhlas – Jl. HOS. Cokroaminoto – Jl. Dr. Sutoomo – Jl. Kapten Ismail – Jl. Asem Tiga – Jl. Rambutan – Jl. Sipelem - Jl. Jalingkut – Jl. Mataram – Terminal Tegal	Potential: Tegal Terminal, Tegal Polytechnic, Tegal Barat Health Center, Cinde Market, Education Area, Housing, Station, Town Hall
8	A8	Jl. A. Yani (Terminal Pasar Pagi) – Jl. DI. Panjaitan – Jl. Letjen Suprapto – Jl. Kapten Ismail – Jl. Kapten Sudibyo - Jl. Gatot Subroto (Keturen) – Jl. Sibandaran - Jl. Teuku Cik Ditiro - Jl. Hasanudin I - Jl. Gatot Subroto (Keturen) – Jl. Kapten Sudibyo - Jl. Kapten Ismail – Jl. Letjen Suprapto – Jl. DI. Panjaitan – Jl. A. Yani (Terminal Pasar Pagi)	Potential: Terminal Tegal, Morning Market, Supermarkets, Housing, Education, Pacific Mall, RSI, Pasar Bandung
9	A9	Jl. A. Yani (Terminal Pasar Pagi) – Jl. Dr. Setiabudi – Jl. Serayu – Jl. Perintis Kemerdekaan – Jl. Arjuna – Jl. Sumbodro – Jl. Werkudoro – Jl. KS. Tubun - Jl. Kapten Sudibyo – Jl. Kompol Suprapto - Jl. Dr. Wahidin Sudirohusodo - Terminal Tegal	Potential: Tegal Terminal, Ps Pagi, Ps Anyar, Ps Langon, Kardinah Hospital, RSI, Rita Mall, Housing, Education
10	Tegal – Slawi	Dari Tegal : Terminal Stasiun Tegal – Jl. Semeru – Jl. Menteri Supeno – Jl. Cempaka – Jl. AR. Hakim – Jl. Sultan Agung – Slawi (Jl. Tegal – Purwokerto) Dari Slawi : Slawi (Jl. Tegal – Purwokerto) - Jl. Sultan Agung – Jl. AR. Hakim – Jl. Kartini – Jl. Tentara Pelajar – Jl. Pancasila - Terminal Stasiun Tegal	Potential in Tegal City: RSUD Kardinah, Educational Area, Station
11	Tegal – Banjaran	Dari Tegal : Jl. A. Yani (Terminal Pasar Pagi) – Jl. P.	Potential in Tegal City: RSUD Kardinah, Yogya

NO	Code	Route	Description
		Diponegoro – Jl. AR. Hakim – Jl. Sultan Agung – Banjaran. Dari Banjaran : Banjaran - Jl. Sultan Agung – Jl. AR. Hakim – Jl. P. Diponegoro – Jl. A. Yani (Terminal Pasar Pagi)	Mal, Pasar Pagi
12	Tegal – Pasar Bawang	Terminal Tegal – Jl. Dr. Cipto Mangunkusumo – Jl. Ki Hajar Dewantara – Jembatan Kembar Kupu – Dukuhturi – Singkil – Pasar Bawang	Potential in Tegal City: Market of Sumur Panggang, Kelurahan Sumur Panggang
13	Tegal – Kemantran	Dari Tegal : Jl. A. Yani (Terminal Pasar Pagi) – Jl. Dr. Setiabudi – Jl. Kol. Sudiarto – Jl. Semeru - Jl. Arjuna – Jl. Perintis Kemerdekaan – Jl. Hanoman – Kemantran. Dari Kemantran : Kemantran - Jl. Hanoman – Jl. Perintis Kemerdekaan – Jl. Arjuna – Jl. Semeru - Jl. Kol. Sudiarto – Jl. Dr. Setiabudi – Jl. A. Yani (Terminal Pasar Pagi)	Potential in Tegal City: PKTJ, Station, Morning Market
14	Tegal - Jatibarang	Dari Tegal : Terminal Tegal – Jl. Dr. Cipto Mangunkusumo – Pasar Krandon – Jl. Hasanudin (Cabawan) – Jatibarang Dari Jatibarang : Jatibarang - Jl. Hasanudin (Cabawan) – Jl. Agus Salim - Jl. Dr. Cipto Mangunkusumo – Terminal Tegal	Potential in Tegal City: Tegal Terminal, Pasar Sumur Panggang

Source: Analysis Result, 2017

4.11. Transport Needs

The number of fleets required if the network structuring is done as the following table:

Table 23. Number of Transportation Required

NO	Route	P	RTT	LT	H	Number of shuttles N = RTT+LT/H
1	A1	9,8	29	30	6	10
2	A2	10,2	41	30	6	12
3	A3	10,8	43	30	6	12
4	A4	10	30	30	6	10
5	A5	9,2	28	30	6	10
6	A6	9	27	30	6	10
7	A7	10	40	30	6	12
8	A8	10,4	42	30	6	12
9	A9	10,6	42	30	6	12
10	Tegal - Slawi	15	60	60	6	20
11	Tegal - Banjaran	13	60	60	6	20
12	Tegal - Pasar Bawang	15	50	60	8	14
13	Tegal - Kemantran	13	60	60	6	20
14	Tegal - Jatibarang	21	97	60	8	20
Jumlah						194

Source: Analysis Result, 2017

Description
P = Route length (km)
RTT = Run time (PP) time (minutes)
LT = Layover time (minutes)
H = Headway (min)

Based on the results of the analysis as shown above, it is known that the number of fleets required is 194 vehicles which means the same as the number of fleets that exist today. So in the structuring of the route network there is no addition or reduction of the number of fleets.

4.12. Vehicle Operating Costs

Based on the results of the analysis of vehicle operating costs, the amount of vehicle operating costs for each route and to know as the following table:

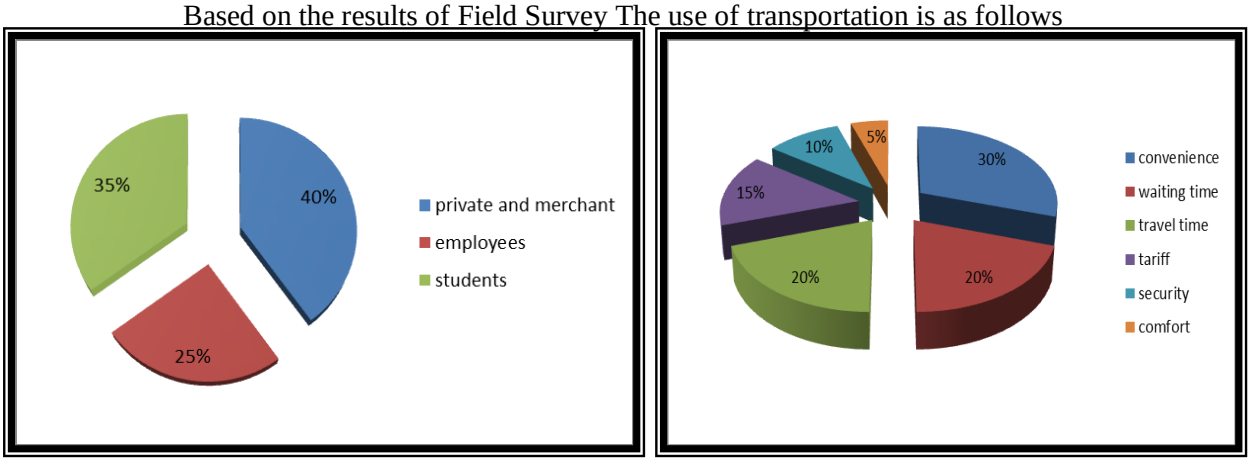
Table 24. Vehicle Operating Costs

No.	Route	Distance (Km)	Average Lf	Vehicle Operating Costs every passenger / km	Appropriate Lf
1	A1	9,8	50%	Rp 741	Rp 1.482
2	A2	10,2	50%	Rp 741	Rp 1.482
3	A3	10,8	50%	Rp 741	Rp 1.482
4	A4	10	50%	Rp 741	Rp 1.482
5	A5	9,2	50%	Rp 741	Rp 1.482
6	A6	9	50%	Rp 741	Rp 1.482
7	A7	10	50%	Rp 741	Rp 1.482
8	A8	10,4	50%	Rp 741	Rp 1.482
9	A9	10,6	50%	Rp 741	Rp 1.482
10	Tegal - Slawi	15	50%	Rp 524	Rp 1.048
11	Tegal - Banjaran	13	50%	Rp 524	Rp 1.048
12	Tegal - Pasar Bawang	15	50%	Rp 524	Rp 1.048
13	Tegal - Kemantran	13	50%	Rp 524	Rp 1.048
14	Tegal - Jatibarang	21	50%	Rp 524	Rp 1.048

Source: Analysis Result, 2017

4.13. Transport analysis

Based on the results of Field Survey The use of transportation is as follows



Source: Analysis Result, 2017

Figure 2. Pie chart of user transport composition and priority of passengers

4.14. Route network performance plan

Route network structuring is planned to be:

Table 25. Route Network Performance Plan

Trayek	Kend	Lf peak	Lf off	KP	H	WP	F	KB	WTP
A1	10	70	30	20	6	12	10	10	6
A2	12	70	30	15	6	12	10	12	6
A3	12	70	30	15	6	12	10	12	6
A4	10	70	30	20	6	12	10	10	6
A5	10	70	30	20	6	12	10	10	6
A6	10	70	30	20	6	12	10	10	6
A7	12	70	30	15	6	12	10	12	6
A8	12	70	30	15	6	12	10	12	6
A9	12	70	30	15	6	12	10	12	6
Tegal - Slawi	20	70	30	15	6	12	10	20	6
Tegal - Banjaran	20	70	30	13	6	12	10	20	6
Tegal - Pasar Bawang	14	70	30	18	8	12	10	14	8
Tegal - Kemantran	20	70	30	13	6	12	10	20	6
Tegal - Jatibarang	20	70	30	13	8	12	10	20	8
Jumlah	194								

Source: Analysis Result, 2017

Description:
LFs : Busy Hour Factor Load (%)
LFts : Load Factor outside Hours (%)
KP : Travel Speed (km / h)
H : Headway (minutes)
WP : Service Time (hours)
F : Frequency (kend / jam)
KB : Vehicle Operating (kend)
WTP : Passenger Time (minutes)

To find out how big the level of service performance plan needs to be done assessment. Assessment of the service performance plan is divided into 3 criteria, namely:

- good criterion if have total value 18 - 24
- medium criterion if have total value 12 - 17,99
- criteria less if the total value <12

Assessment of the service performance plan is as follows:

Table 36. Assessment of Network Performance Plans

Trayek	Lf peak	Lf off	KP	H	WP	F	KB	WTP	Total
A1	2	3	3	3	2	3	2	3	21
A2	2	3	3	3	2	3	2	3	21
A3	2	3	3	3	2	3	2	3	21
A4	2	3	3	3	2	3	2	3	21
A5	2	3	3	3	2	3	2	3	21
A6	2	3	3	3	2	3	2	3	21

Trayek	Lf peak	Lf off	KP	H	WP	F	KB	WTP	Total
A7	2	3	3	3	2	3	2	3	21
A8	2	3	3	3	2	3	2	3	21
A9	2	3	3	3	2	3	2	3	21
Tegal - Slawi	2	3	3	3	2	3	2	3	21
Tegal - Banjaran	2	3	3	3	2	3	2	3	21
Tegal - Pasar Bawang	2	3	3	3	2	3	2	3	21
Tegal - Kemantran	2	3	3	3	2	3	2	3	21
Tegal - Jatibarang	2	3	3	3	2	3	2	3	21
Jumlah	194								

Source: Analysis Result, 2017

Description:
LFs : Busy Hour Factor Load (%)
LFts : Load Factor outside Hours (%)
KP : Travel Speed (km / h)
H : Headway (minutes)
WP : Service Time (hours)
F : Frequency (kend / jam)
KB : Vehicle Operating (kend)
WTP : Passenger Time (minutes)

Based on the assessment results as in table 30 it is known that all planned routes are predicted to have good service performance with a total of 21 (good) value.

5. Conclusions and Suggestions

5.1. Conclusion

Based on the results of the analysis then in conclude

1) The problem of public transportation service in Tegal City is not yet optimal performance of urban transport service and border transportation caused by route of circular route so that public transportation service user will go in the opposite direction of difficulty obtaining public transportation. And not optimal network route performance caused by some route route that overlap with other route so that minimize Load Factor.
2) Based on the results of the analysis to improve the performance of public transport services needs to be done structuring the route network thoroughly.
3) The proposed structuring of urban transport network and border routes in Tegal City 8 routes (2 urban transport routes and 6 border transport routes) to 14 routes consists of 9 urban transport routes ie A1, A2, A3, A4, A5, A6, A7 , A8, A9 and 5 border transit routes, namely Tegal - Slawi, Tegal - Banjaran, Tegal - Pasar Bawang, Tegal - Kemantran and Tegal – Jatibarang Routes. .
4) With the structuring of all routes that are predicted to improve the performance of public transport services in the city of Tegal.
5) In the implementation of structuring route network needs to be done planning and socialization stages:
   a. Exposure to the community
   b. Coordination with related agencies
   c. Study the transport node
   d. Public hearing / consignment
   e. Determination and experiment
   f. Route network implementation

6) The means used to fill the route network that has been arranged refers to the Regulation of the Minister of Transportation concerning Minimum Service Standards of Transport of People with Public Motor Vehicles In Route, consisting of:
   a. Safety equipment
   b. Health facility
   c. Emergency response information

5.2. Suggestion

In structuring the route network should not increase the number of fleets, but only divert several fleets into the new planned route.

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Bibliography

1993, Government Regulation No. 41 of 1993 on Road Transport, Directorate General of Land Transportation, Jakarta

_____, 2002, Decree of the Director General of Land Transportation Number SK / 687 / AJ.206 / DRJD / 2002, Directorate General of Land Transportation.

, 2003, Decree of the Minister of Transportation No. KM 35 Year 2003 on the Implementation of Public Transport on Public Roads, Directorate General of Land Transportation, Jakarta.

, 2009, Law of the Republic of Indonesia Number 22 Year 2009 on Road Traffic and Transportation, Directorate General of Land Transportation, Jakarta

Blunden and Black, 1984; ASCE, 1986 in the book Transportation Engineering by C. Jotin Khistydan B. Kent Lall.

Giannopoulus, G.A., 1989, Bus Planning and Operations in Urban Areas: A practical Guide, Prentice-Hall, Inc., New Jersey.

Tamin Z, Ofyar, 2000, Transport Planning and Modeling, ITB, Bandung.

Tegal City PKL Team, 2012, General Report of City Field Work Practice Tegal Force XXXI, High School of Land Transportation, Bekasi.