Initiative 4: Improvement and Extension of Chartered Services

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Abbreviations and Acronyms

Abbreviations	Full Form
AC Bus	Air Conditioned Bus
BMTC	Bengaluru Metropolitan Transport Corporation
CPKM	Cost Per Kilometre
CSTEP	Center for Study of Science, Technology and Policy
EPKM	Earning Per Kilometre
INR	Indian Rupee
IT Industry	Information Technology Industry
Km	Kilometre(s)
KSRTC	Karnataka State Road Transport Corporation
Non AC Bus	Non Air-Conditioned Bus
OC	Operating Cost

Executive Summary

Bengaluru, the capital of Karnataka state, is one of the fastest growing metropolitan cities in India. With population growth, rapid urbanisation and development of the IT industry, different sectors of the city experienced a significant demand for urban infrastructure. Public transportation was one such crucial sector requiring infrastructure upgradation.

In order to cater to this growing transportation demand, BMTC introduced chartered/dedicated bus services in both AC and non-AC variants catering to corporate clients, educational institutions and government organisations in Bengaluru.

However, in the recent past (2015), with the entry of app-based cab services and competition from private bus operators[1], BMTC started losing some of its existing chartered/dedicated customers. In this context, Government of Karnataka has engaged the Center for Study of Science, Technology and Policy (CSTEP), as a technical research institution, to assess the feasibility of improving operational efficiency of these services.

This study proposes a model for estimation of the rate per km and pass rate structure of chartered and dedicated bus services, based on route length and varying average profit per bus per day. The proposed model recommends dead kilometres[2] to be charged for chartered bus services and also proposed a monthly pass rate structure for dedicated bus services aiming to attract potential new clients and retain existing clients. This study will also determine the additional bus fleet required to reach break-even profit with respect to the current profit levels from these services. It also helps in comparing these services with the normal bus services under different load factors to generate these profit margins.

This study also considers the existing clients' experiences with BMTC chartered/dedicated services. In addition to existing clients, it identifies challenges that may prevent potential clients from opting for BMTC chartered/dedicated bus services. For this assessment, key personnel of existing as well as potential new companies were interviewed. The feedback from existing and potential clients is incorporated in the report.

[1] Companies have recently started hiring private buses for chartered services.

[2] Dead kilometres represent the distance covered by the vehicle without carrying any passengers. For a trip, this includes the distance from the depot to the first passenger pick up location and the distance from the final drop location to the depot.

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1. Introduction

BMTC introduced chartered/dedicated bus services in 2006, with both AC and Non AC vehicle (BMTC 2013). Chartered bus services cater to corporates, educational institutions and government organisations on a per km basis. Companies/organisations hire BMTC buses to provide transport to their employees/students. For this service, BMTC charges for the total kilometres on each route per day. Dedicated bus services offer a monthly pass-based model for corporate customers. Currently, BMTC operates 432 chartered bus services for 65 clients with an annual revenue of INR 32.8 crore. The chartered bus services' revenue for the period 2014-2017 has seen a decrease of 13.8%. BMTC operates dedicated bus services for 16 clients with 367 buses, generating an annual revenue of INR 61.3 crore. This service has seen an increase of 3.3% in last four years. The total annual revenue generated from both these services in 2017 is INR 94.1 crore which is approx. 5% of the gross revenue generated by BMTC.

In the recent past, with the entry of private bus operators and app-based cab services/bus aggregators, BMTC has started losing some of its existing chartered/dedicated customers. The aim of this study is to assess the feasibility of improving the operational efficiency of these services to retain existing customers and attract new customers.

2. Problem Statement

To assess the extent to which BMTC can revise the existing dead kilometre model to retain its existing customers and increase customer base

Operating chartered/dedicated bus services for major firms in Bengaluru provides a business opportunity to BMTC to improve profitability of the organisation. As a business strategy, the pricing of these chartered/dedicated bus services has to be higher than the normal bus services for regular passengers in Bengaluru[3]. Currently, profit-generation centres on charging dead kilometres to these firms and the price is either charged as cost/km (chartered services) or monthly pass system (dedicated services). However, the current rate structure potentially limits the customers and thereby, the revenue. The research question here is what rate structure is optimal for increasing revenue for these services.

3. Objectives and Issues for Evaluation

Objective:

To propose a model to increase revenue from chartered/dedicated bus services.

Scope:

- Target Population: Existing and potential clients of chartered/dedicated bus services - corporates
- Geographical Coverage: Existing and upcoming Information Technology corridors.

4. Evaluation Design

4.1. Information Sources

Primary Data: Primary data for this study included interviews with key personnel from existing and potential customers for chartered/dedicated bus services. For existing customers, the line of enquiry focussed on current experiences related to chartered/dedicated bus services, criteria for engaging with BMTC (e.g. age of buses, clean buses), potential for additional bus demand and pre-requisites on part of BMTC (e.g. insurance, fitness certificate).

[3] Chartered/Dedicated buses are bus rental services which BMTC offers to clients. The bus operational routes are as per the client request during specific hours.

For potential customers, the line of enquiry focussed on identifying mobility patterns of their employees, criteria for engaging with BMTC and potential fleet requirement. During the study, four clients were interviewed for dedicated services and one, for chartered services.

Secondary Data: For the purposes of this study, secondary data included a complete client list of chartered/dedicated bus services and the number of buses used by the companies. In addition, financial data for chartered bus services – specifically, route data and the corresponding rate structure, as well as financial performance for the past five years – was obtained from BMTC. Data was also obtained on proposed measures to increase revenue from these services.

5. Evaluation Methodology

In this study, primary interviews were conducted with key personnel of existing and potential chartered/dedicated bus clients. Based on the secondary data collected, a model was proposed to recommend fare/km for chartered bus services and monthly pass rate structure for dedicated bus services. The details of the steps followed in the methodology have been discussed in this section. Figure 1 presents the methodology for the proposed model.

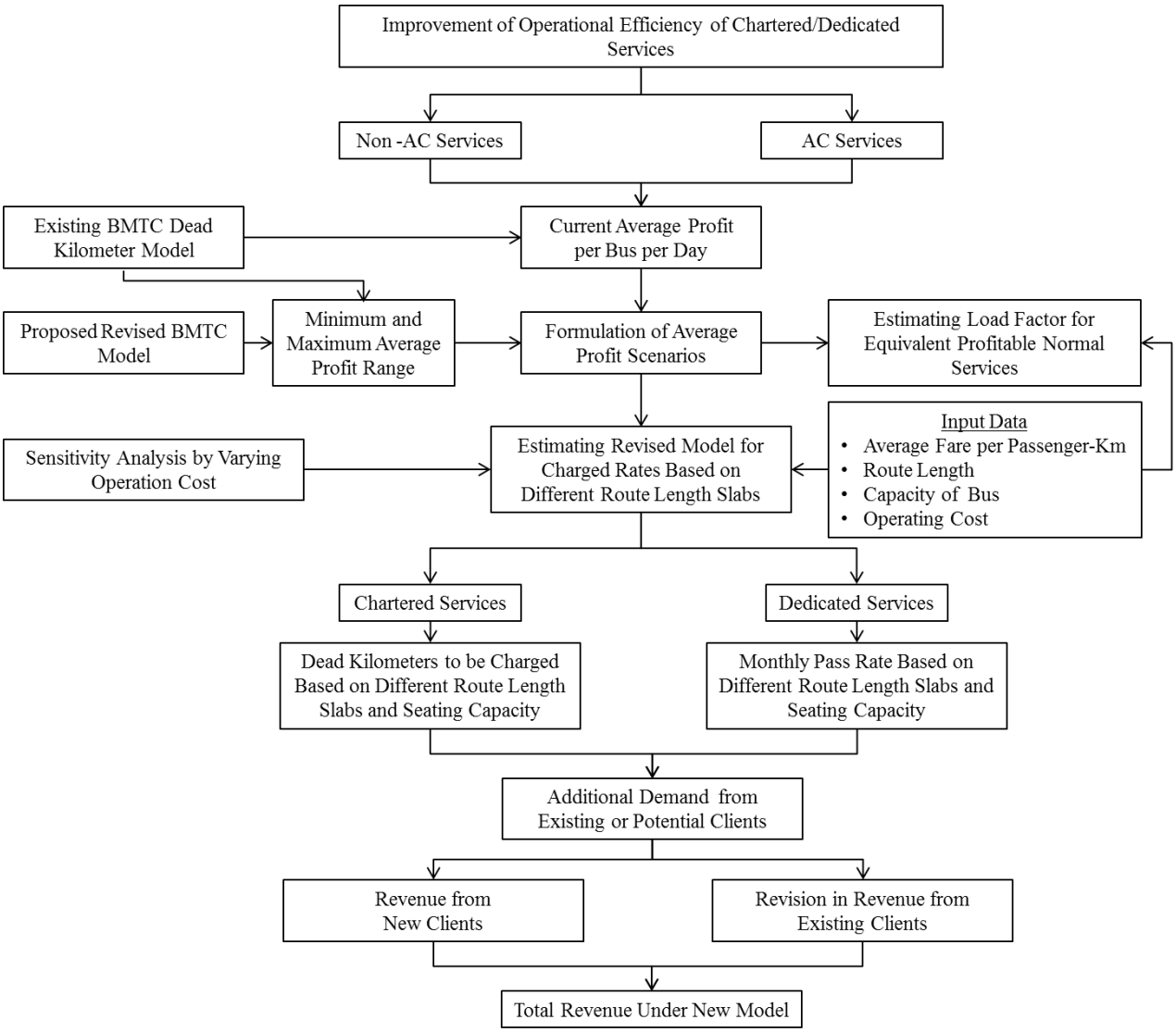

Figure 1: Methodology for the proposed model

The methodology aims to formulate a model to obtain dead kilometres to be charged for chartered services and monthly pass rate for dedicated services for a fixed average profit per bus per day[4]. The average profit per bus per day is equated to the profit function of normal services, to determine the required load factor. By comparing equivalent profitable normal services with the chartered/dedicated profit functions, the dead kilometres/monthly pass to be charged are determined for different route length slabs, as shown in Figure 2. Only the peak hour timeframe was considered as a majority of these services will be provided during peak hours. This study can, however, be extended to non-peak timeframes as well.

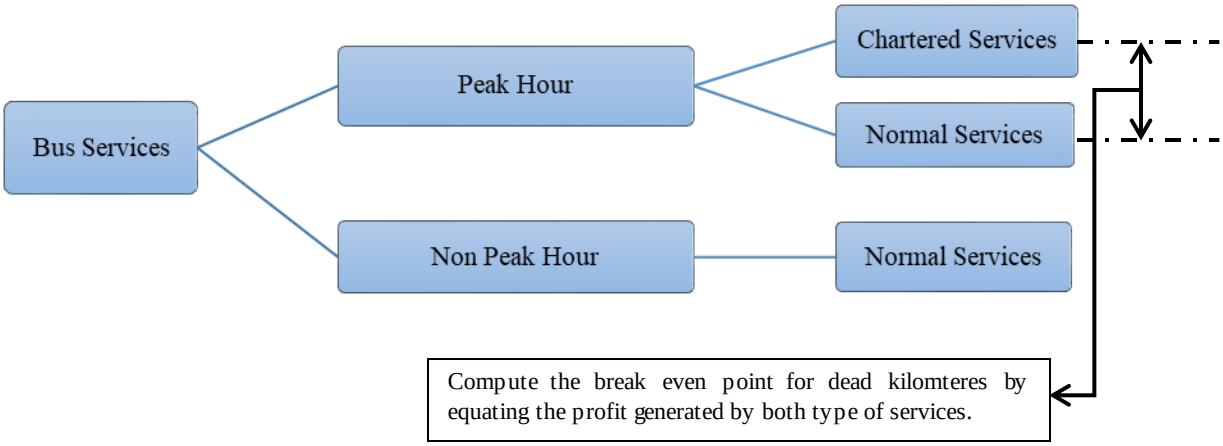

Figure 2: Computing dead kilometres by comparing normal and chartered services

To generate profit, normal bus services need to run during peak hours (8 am to 10 am) and have high load factors[5]. However, chartered/dedicated bus services can be profitable with a load factor of one (as they charge for dead kilometres. The break-even point for dead kilometres charged is the point where the intended average profit from normal bus services at these load factors (which generate profit) becomes equal to the profit from chartered/dedicated services. Any additional dead kilometre charged from this point will lead to higher profit compared to running a normal service.

Equations are provided below to compute the break-even dead kilometres. Scenarios are provided to showcase the additional profit generated by these services by charging higher dead kilometres from the break-even point. After dropping passengers off at their firms, these

[4] Per day indicates one round trip, i.e. from the origin to the destination and back (up and down trip).
[5] Load factor refers to the capacity utilisation of the bus service. It represents the ratio of number of passenger carried to the seating capacity of the bus.

services operate as normal bus services (resumed normal bus services) on pre-decided routes. For this analysis, the comparison should only be between the normal bus services operated during peak hour and chartered/dedicated bus services. For the analysis, the profit generated by these resumed normal bus services and normal bus services is assumed to be same. Similarly, dedicated bus monthly pass rates were estimated by equating the intended average profit per bus per day with the profit equation of the dedicated bus service.

To illustrate this, consider the figure below (Figure 3), representing an origin and destination route where these services are being planned. Assume BMTC could either run a normal bus service or a chartered/dedicated bus service between these points.

The following parameters are considered in the equations below:

f - Average fare per passenger-km (INR/pass-km)

l - Route Length (comprising initial dead kilometres) (km)

C_b - Capacity of the bus (pass/bus)

LF - Load Factor

CS - Cost charged to the clients (INR/km)

OC - Operating Cost per km (INR/km)

D_{op}- Number of days operated in a month

x – Break-even dead kilometres charged per day (km)

MP - Monthly Pass Rate (INR)

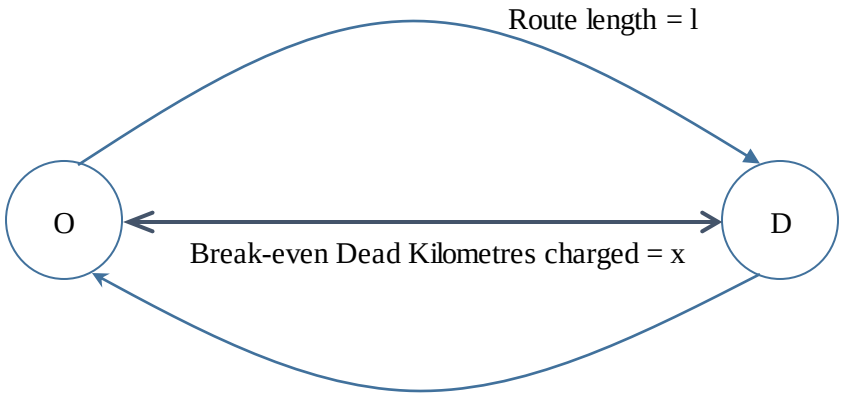

Figure 3: Origin and destination route

The profit generated by running a normal bus service between O and D for one bus per day for two trips, π_{norm} , is calculated as:

$$\pi_{norm} = 2 * f * l * C_b * LF - 2 * OC * l \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

The profit generated by running a chartered bus service between O and D for one bus per day for two trips, π_{chart}, is calculated as:

$$\pi_{chart} = CS * (2l + x) - 2 * OC * l \quad \text{.................................. (2)}$$

The break-even point for dead kilometres can be computed by equating the two equations.

$$\pi_{norm} = \pi_{chart}$$

$$\pi_{norm} = CS * (2l + x) - 2 * OC * l \quad \text{................................. (3)}$$

Therefore, break-even dead kilometres, x, is given below:

$$x = \frac{\pi_{norm} + 2*OC*l - 2*CS*l}{CS} \quad \text{....................................... (4)}$$

Similarly, monthly pass rates for the dedicated bus services can be calculated by using the equation given below:

$$\pi_{norm} * D_{op} = MP * C_b - D_{op} * OC * 2l \quad \text{.............................. (5)}$$

$$MP = \frac{\pi_{norm} * D_{op} + D_{op} * OC * 2l}{C_b} \quad \text{.................................... (6)}$$

Using these models, the number of dead kilometres to be charged was computed for chartered bus services. Similarly the monthly pass rate for the dedicated bus services was computed, and is discussed in the next section. Using the same formula, slab rates were proposed for the chartered/dedicated bus services.

6. Data Collection and Analysis

6.1. Data Analysis

Using data (BMTC 2018) of the existing and potential clients, average profit margin per bus per day was computed based on the existing dead kilometre model and the proposed revised model by BMTC. This profit margin was used in this analysis to create different scenarios and thereby determine the slab rates based on route lengths by varying the intended average profit per bus per day. This also helped to determine the additional bus demand required to break-even in profit. Using these average profit margins, equivalent load factor required in normal bus services to generate these profit margins was calculated.

The data used in this analysis is provided in the Table 1 below. Average fare per passenger-km for both ordinary[6] and AC buses was calculated using the existing route data during peak hours that was provided by BMTC. This study assumed that the charged cost/km was equal to the operating cost/km, thereby ensuring that any dead km charged would result in profit.

The days of operation for the calculation of monthly pass rates was assumed to be 22 days. A sensitivity analysis was carried in this study to estimate the dead kilometres, by varying the operational cost. In this analysis the charged cost was considered to be constant. At the first level the operating cost was increased by INR 3/km whereas in the second level, the operating cost was increased by INR 8/km. The calculations of this table are provided in the Annexure I.

Table 1: Input data used in analysis

Variables	Ordinary Buses		AC Buses	
	42 Seats	50 Seats	35 Seats	42 Seats
Average Fare per Passenger-km (INR/pass-km)	0.87	0.87	1.7	1.7
Operating Cost (INR/km)	48	52	76	80
Charge Cost (INR/km)	48	52	76	80
Days of Operation in a Month	22	22	22	22
Sensitivity Analysis Operating Cost (INR/km)[7]	51 and 56	55 and 60	79 and 84	83 and 88

The existing dead kilometre charging model of BMTC and also the proposed revised charging model of BMTC were considered to compute the maximum and minimum average profit per bus per day. Currently, BMTC charges the client certain dead kilometres in order to make profit for the chartered services, whereas monthly pass rates are fixed based on the route lengths. In the revised model by BMTC, to generate profit, a certain margin is fixed over cost per kilometre (CPKM) which varies with route length[8]. This formed the basis for our average profit margin for different scenarios.

Table 2 shows the average profit margin per bus per day (for both Ordinary and AC services), both from the existing BMTC model and from the revised proposed model by BMTC. The calculations are provided in the Annexure II.

[6] In this report, the terms ordinary and non AC bus are used interchangeably.
[7] Explained in the Sensitivity Analysis section
[8] Refer to Annexure II

Table 2: Average profit margins per bus per day

Models	Average Profit Margin - Ordinary Buses (INR/day)		Average Profit Margin - AC Buses (INR/day)[9]
	Dedicated	Chartered	
Existing model (BAU)	1,305 (~ 1,500)	1,130 (~1,500[10])	1,717 (~1,750)
Revised model by BMTC	471 (~500)	471 (~500)	724 (~750)

The average approximated profit margin from the existing model comes out to be INR 1,500 per bus per day. This profit margin might be on the higher side (resulting in higher prices than private bus operators), thereby restricting the likelihood of attracting potential clients for these services. On the other hand, the revised model by BMTC generates an average profit margin of INR 500 per bus per day. The price changes brought about by this model are likely to expand the customer base; however, the additional bus demand requirement at these profit margins might exceed the available fleet for chartered/dedicated services (approximately 800 buses). Therefore, there is a need to analyse feasible profit margins within this range (INR 500-1500). Using the average profit margins given in the table above, different scenarios have been formulated as shown in Table 3.

Table 3: Scenarios based on average profit margin per bus per day

Scenarios	Average Profit Margin-Ordinary Buses (INR/day)	Average Profit Margin-AC Buses (INR/day)
Scenario 1	500	750
Scenario 2	750	1,000
Scenario 3	1,000	1,250
Scenario 4	1,250	1,500

To gauge these average profit margins from the normal services perspective, the average load factors were calculated using Equation (1). The respective load factors were calculated for all the scenarios, and are shown in Table 4.

[9] Disaggregated data on dedicated and chartered AC services was not available.
[10] Considered high profit margin of INR 1,500 in line with the dedicated bus services.

Table 4: Load factors for different scenarios

Scenarios	Load Factors - Ordinary Buses		Load Factors - AC buses	
	42 Seats	50 Seats	35 Seats	42 Seats
Scenario 1	1.58	1.42	1.52	1.33
Scenario 2	1.71	1.53	1.61	1.4
Scenario 3	1.85	1.64	1.69	1.46
Scenario 4	1.98	1.75	1.77	1.53

The table above highlights the load factors required throughout the route length to maintain the average profit margin per bus per day for the different scenarios. Maintaining these high load factors for profitability might not be realistic for a majority of the normal bus routes. From the data provided by BMTC[11], schedule C buses[12] constitute around 78% of the total fleet. This provides an opportunity to convert a few of these buses into chartered/dedicated bus services during the peak hour, to generate higher profit. A pre-determined slab rate for each scenario provides higher flexibility to BMTC when negotiating contracts for chartered services with potential clients. The calculations for these load factors are given in Annexure III.

Consequently, for each scenario, the average profit margin per bus per day was fixed to determine:

- Minimum dead kilometres to be charged for chartered services
- Monthly pass rate for dedicated bus services, based on different route length intervals[13]

For each scenario, the two-way route lengths are divided into four intervals: '< 25 km', '25-50 km', '50-75 km', and '75-100 km'. Slab rates, corresponding to each interval in terms of dead kilometres to be charged, were calculated using Equation (4) for chartered bus services, and using Equation (6) for monthly pass for dedicated bus services.

Tables 5 and 6 show the slab rates for chartered and dedicated bus services respectively, by equating π_{norm} to the average profit levels in the formulated scenarios. Here, profit from normal bus service for the equivalent load factor will be different for the route length slab. The average across all the route length intervals will be equal to intended average profit per bus per day in the respective scenario. For the chartered bus services, the dead kilometres value was computed to generate the intended average profit per bus per day.

[11] Internal notes from BMTC
[12] Schedule C buses – Buses for which the cost per kilometre (CPKM) is greater than earning per kilometre (EPKM)
[13] Route lengths were one of the criteria considered for determining the slab rates in the revised BMTC model.

In Table 5, two different seating capacities have been considered for both ordinary (42 and 50 seats) and AC buses (35 and 42 seats). The route lengths form the basis of the differential charging of dead kilometres. The dead kilometres value was rounded off to an appropriate value to have consistency in the rate chart. There is no significant difference in the charged dead kilometres for different capacities as the difference in the number of seats is not that high.

The dead kilometres to be charged increases with increase in the route length, thus ensuring that the average profit margin per bus per day is maintained. For example, in Scenario 2 for ordinary buses, the intended average profit is around INR 750 per bus per day; the dead kilometre charged for a 25-50 km route length to generate this profit for a 50 seat bus is 12 km. With increase in the intended profit margin in the scenarios, the charged dead kilometres increase. For the case mentioned above, the dead kilometres to be charged in Scenario 3 increases to 15 km. These proposed slab rates give BMTC a flexible platform to negotiate on the rates with the clients. Sample calculations are provided in Annexure IV.

Table 5: Proposed slab rates for chartered bus services

Scenarios	Route Length Two-way (km)	Dead Km Charged Per Day (km) - Ordinary Buses		Dead Km Charged Per Day (km) - AC Buses	
		42 Seats	50 Seats	35 Seats	42 Seats
Scenario 1	< 25	5.00	5.00	5.00	5.00
	25-50	10.00	10.00	10.00	10.00
	50-75	15.00	13.00	13.00	13.00
	75-100	20.00	18.00	18.00	18.00
Scenario 2	< 25	7.00	7.00	5.00	5.00
	25-50	13.00	12.00	10.00	10.00
	50-75	20.00	20.00	18.00	17.00
	75-100	28.00	25.00	25.00	23.00
Scenario 3	< 25	10.00	8.00	7.00	7.00
	25-50	18.00	15.00	15.00	13.00
	50-75	28.00	25.00	22.00	20.00
	75-100	38.00	35.00	30.00	28.00
Scenario 4	< 25	10.00	10.00	8.00	8.00
	25-50	20.00	20.00	15.00	15.00
	50-75	33.00	30.00	25.00	25.00
	75-100	45.00	42.00	35.00	35.00

Similarly, for dedicated bus services two different capacities were considered for both the ordinary (42 and 50 seats) and AC bus (35 and 42 seats) services, as shown in Table 6. The pass rates were determined on the basis of the two way route length. It was observed that the pass rates were higher for smaller capacity buses for the same route length, and increases with

route length. As the intended average profit per bus per day increases, the pass rate increases. For example in Scenario 2 for ordinary buses, the intended average profit to make is around INR 750 per bus per day; the monthly pass rate for this comes out to be INR 1,150. The current monthly pass rates by BMTC are calculated by dividing the route lengths into different intervals, which includes the dead kilometres.

This proposed model uses only the operational route length to determine the monthly pass rate, which considers the intended average profit per bus per day. Also, there are only two length slabs[14] for AC buses in the current BMTC charge sheet. This is likely to deter passengers traveling shorter routes from choosing these services, thereby reducing the demand. This model proposes rates for dedicated AC bus services under four route lengths. CSTEP proposes that the monthly pass rates be charged as per the route length intervals, which may encourage additional demand for these services.

Table 6: Proposed slab rates for dedicated bus services[15]

Scenarios	Route Length Two- way (km)	Monthly Pass (INR) - Ordinary Buses		Monthly Pass (INR) - AC Buses	
		42 Seats	50 Seats	35 Seats	42 Seats
Scenario 1	< 25	1,050	1,050	2,250	2,250
	25-50	1,200	1,050	2,250	2,250
	50-75	1,950	1,750	3,600	3,150
	75-100	2,600	2,350	4,900	4,300
Scenario 2	< 25	1,050	1,050	2,250	2,250
	25-50	1,250	1,150	2,300	2,250
	50-75	2,100	1,900	3,800	3,300
	75-100	2,900	2,550	5,200	4,500
Scenario 3	< 25	1,050	1,050	2,250	2,250
	25-50	1,350	1,200	2,450	2,250
	50-75	2,250	2,000	4,000	3,450
	75-100	3,100	2,750	5,450	4,700
Scenario 4	< 25	1,050	1,050	2,250	2,250
	25-50	1,450	1,300	2,550	2,250
	50-75	2,400	2,150	4,200	3,650
	75-100	3,250	2,900	5,700	4,950

[14] Two length slabs (AC buses) – Route length up to 120 km and route length from 120 to 160 km

[15] Monthly pass rate from the proposed CSTEP model for several scenarios comes out to be lesser than the monthly pass rate charged by BMTC. Therefore minimum monthly pass rate is kept as INR 1,050 for ordinary and INR 2,250 for AC services as per BMTC monthly pass rates (https://www.mybmtc.com/en/monthly_pass). Same is reflected in Table 6, 8 and 10.

6.2. Sensitivity Analysis

With increasing fuel prices [16] (Good Returns 2018) and staff wages, the operating cost is likely to go higher in the near future. This section indicates changes in slab rates by taking into account increased operating costs. The CPKM data for previous years (2012-13 to 2017-18) was considered in order to estimate the average annual increase in operating cost. From this data, for the operational cost, a minimum increase of INR 3/km and a maximum increase of INR 8/km was considered (BMTC 2017). In this analysis, only operational cost is varied and charged cost is considered constant. For instance, for an ordinary 50-seat bus the charged cost considered is INR 52/km and the operating cost considered is INR 55/km and INR 60/km. The differential in operating and charged cost needs to be accounted in the dead kilometres charged in order to maintain the same level of intended average profit per bus per day.

Tables 7 and 8 show the slab rates for chartered and dedicated bus services respectively, for operational cost increases of INR 3/km and INR 8/km. Under Scenario 2 for an ordinary bus (50 seats & route length 25-50 km), the dead kilometres to be charged is 12 km (Table 5) for an operational cost of INR 52/km, and 15km (Table 7) for an operational cost of INR 55/km.

Table 7: Proposed slab rates for chartered bus services (OC increase - INR 3/km)

Scenarios	Route Length Two-way (km)	Dead km Charged Per Day (km) - Ordinary Buses		Dead km Charged Per Day (km) - AC Buses	
		42 Seats	50 Seats	35 Seats	42 Seats
Scenario 1	< 25	7.00	5.00	5.00	5.00
	25-50	12.00	10.00	10.00	10.00
	50-75	18.00	17.00	15.00	15.00
	75-100	25.00	23.00	22.00	20.00
Scenario 2	< 25	10.00	8.00	7.00	7.00
	25-50	15.00	15.00	13.00	12.00
	50-75	25.00	23.00	20.00	20.00
	75-100	35.00	32.00	28.00	28.00
Scenario 3	< 25	10.00	10.00	8.00	8.00
	25-50	20.00	18.00	15.00	15.00
	50-75	30.00	30.00	25.00	23.00
	75-100	43.00	40.00	33.00	32.00
Scenario 4	< 25	12.00	10.00	10.00	10.00
	25-50	23.00	22.00	18.00	17.00
	50-75	38.00	35.00	28.00	28.00
	75-100	52.00	48.00	40.00	38.00

[16] Diesel price in Bengaluru: June 2017 – INR ~57.50/litre and June 2018 – INR ~68.90/litre

Similarly, for dedicated bus services the revised rates have been calculated and shown in Table 8 below. With the increase in operating cost, the monthly pass rate increases as well. Under Scenario 2, the monthly pass rate for an ordinary bus (42 seats & route length 25-50km) is INR 1,250 for an operational cost of INR 52/km (Table 6) and INR 1,350 for an operational cost of INR 55/km (Table 9).

This analysis provides these services with the flexibility to modify their rates in the event of increased operational costs.

Table 8: Proposed slab rates for dedicated bus services (OC increase - INR 3/Km)

Scenarios	Route Length Two-way (Km)	Monthly Pass (INR)- Ordinary Buses		Monthly Pass (INR)- AC Buses	
		42 Seats	50 Seats	35 Seats	42 Seats
Scenario 1	< 25	1,050	1,050	2,250	2,250
	25-50	1,250	1,100	2,250	2,250
	50-75	2,050	1,800	3,700	3,250
	75-100	2,800	2,450	5,050	4,400
Scenario 2	< 25	1,050	1,050	2,250	2,250
	25-50	1,350	1,200	2,400	2,250
	50-75	2,250	1,950	3,950	3,450
	75-100	3,000	2,650	5,350	4,700
Scenario 3	< 25	1,050	1,050	2,250	2,250
	25-50	1,450	1,250	2,500	2,250
	50-75	2,350	2,100	4,100	3,600
	75-100	3,200	2,850	5,600	4,850
Scenario 4	< 25	1,050	1,050	2,250	2,250
	25-50	1,500	1,350	2,600	2,300
	50-75	2,500	2,250	4,300	3,750
	75-100	3,400	3,050	5,850	5,150

Tables 9 and 10 show the proposed slab rates for chartered and dedicated bus services respectively, for the second level of increase in operating cost (i.e. an increase of INR 8/km). Trends similar to the previous example are observed in this instance as well.

Table 9: Proposed slab rates for chartered bus services (OC increase - INR 8/Km)

Scenarios	Route Length Two-way (km)	Dead km Charged Per Day (km) - Ordinary Buses		Dead km Charged Per Day (km) - AC Buses	
		42 Seats	50 Seats	35 Seats	42 Seats
Scenario 1	< 25	10.00	10.00	8.00	7.00
	25-50	15.00	15.00	13.00	12.00
	50-75	25.00	25.00	20.00	20.00
	75-100	35.00	32.00	28.00	28.00
Scenario 2	< 25	10.00	10.00	10.00	8.00
	25-50	20.00	18.00	15.00	15.00
	50-75	30.00	30.00	25.00	25.00
	75-100	43.00	40.00	33.00	32.00
Scenario 3	< 25	13.00	12.00	10.00	10.00
	25-50	23.00	22.00	18.00	18.00
	50-75	40.00	35.00	28.00	28.00
	75-100	52.00	48.00	40.00	38.00
Scenario 4	< 25	15.00	15.00	10.00	10.00
	25-50	27.00	25.00	20.00	20.00
	50-75	45.00	40.00	32.00	30.00
	75-100	60.00	55.00	45.00	42.00

Table 10: Proposed slab rates for dedicated bus services (OC increase - INR 8/Km)

Scenarios	Route Length Two-way (km)	Monthly Pass (INR) - Ordinary Buses		Monthly Pass (INR) - AC Buses	
		42 Seats	50 Seats	35 Seats	42 Seats
Scenario 1	< 25	1,050	1,050	2,250	2,250
	25-50	1,350	1,200	2,400	2,250
	50-75	2,200	1,950	3,950	3,400
	75-100	2,950	2,650	5,350	4,650
Scenario 2	< 25	1,050	1,050	2,250	2,250
	25-50	1,450	1,250	2,500	2,250
	50-75	2,350	2,100	4,100	3,600
	75-100	3,200	2,850	5,600	4,850
Scenario 3	< 25	1,050	1,050	2,250	2,250
	25-50	1,550	1,350	2,600	2,250
	50-75	2,500	2,250	4,300	3,700
	75-100	3,400	3,000	5,850	5,050
Scenario 4	< 25	1,050	1,050	2,250	2,250
	25-50	1,600	1,450	2,750	2,350
	50-75	2,700	2,350	4,500	3,900
	75-100	3,650	3,200	6,100	5,300

For example for an ordinary chartered bus service with 42 seats capacity – Scenario 3, when the operating cost increases by INR 3/km and INR 8/km against the actual operating cost, the variation in the dead kilometres with respect to route length is shown in the Figure 4.

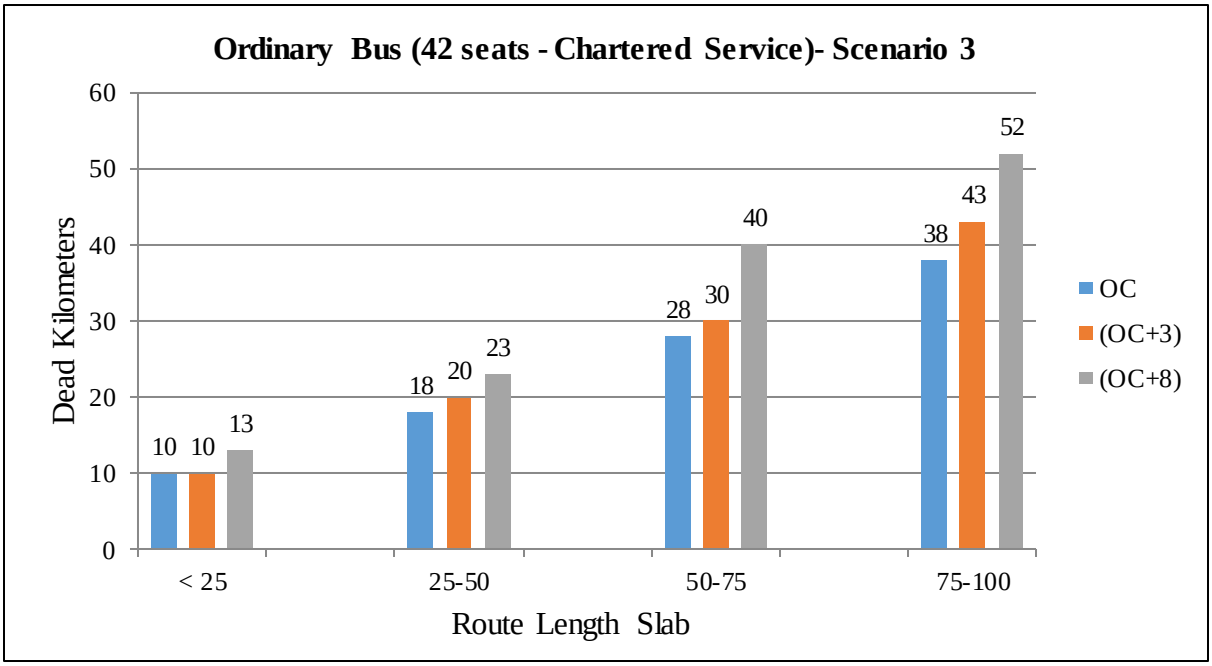

Figure 4: Dead km for Ordinary Bus (42 seats – Chartered) - Scenario 3

For example for an ordinary dedicated bus service with 42 seats capacity – Scenario 3, when the operating cost increases by INR 3/km and INR 8/km against the actual operating cost, the variation in the monthly pass rates with respect to route length is shown in the Figure 5.

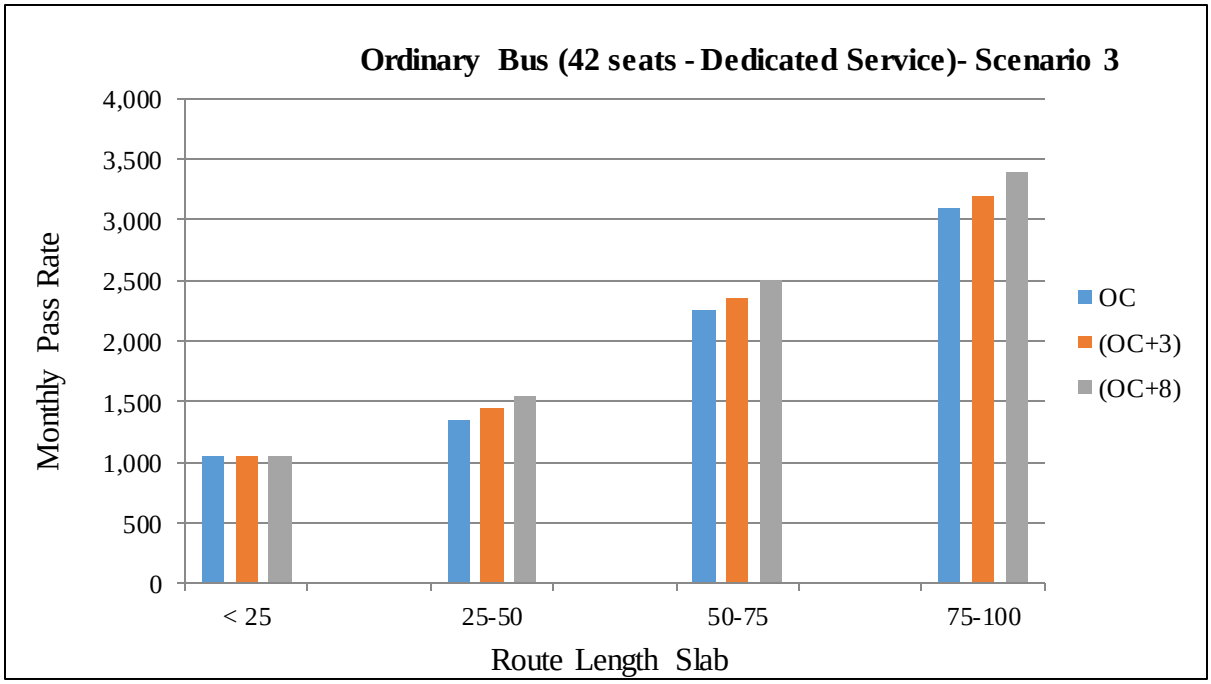

Figure 5: Monthly pass for Ordinary Bus (42 seats - Dedicated) - Scenario 3

6.3. Additional Bus Demand Required

With the aim of attracting new potential clients and generate demand for these services, BMTC has proposed a revised model. According to this revised model, the average profit of INR 1,500 per bus per day from the current dead kilometre model is reduced to INR 500. With the reduction in the profit margin per bus per day, in order to maintain the same profit as in the existing dead kilometre model, BMTC will need to generate additional demand for these services at those revised pricing. Tables 11 and 12 provides the net profit per day per bus in each scenario for different percentages of spare bus fleet utilisation.

According to data provided by BMTC, 800 buses are currently in use for the chartered and dedicated bus services, out of which 600 are ordinary and 200 are AC buses. BMTC has approximately 800 buses to spare for these services[17]. The estimation of the additional bus fleet demand took into account 600 buses for ordinary and 200 buses for AC services. The difference between the intended average profits per bus per day in the new scenario and the existing scenario was used to compute the net profit in the respective scenarios. The calculation is shown in Annexure V.

Table 11: Net profit per day for additional bus demand of ordinary services

Scenarios	Net Profit Per Day (INR) – Ordinary Bus				
	Average Profit Per Bus Per Day	Percentage of Spare Bus Fleet Used			
		100	75	50	25
Scenario 1	INR 500	(-) 3,00,000	(-) 3,75000	(-) 4,50,000	(-) 5,25,000
Scenario 2	INR 750	0	(-) 1,12,500	(-) 2,25,000	(-) 3,37,500
Scenario 3	INR 1,000	3,00,000	1,50,000	0	(-) 1,50,000
Scenario 4	INR 1,250	6,00,000	4,12,500	2,25,000	37,500

Table 11 shows the net profit per day for additional ordinary bus demand. For example, in Scenario 3, if 100% of the spare bus fleet were used (i.e. 600 ordinary buses) the daily net profit for the ordinary services would be INR 3,00,000. On the other hand, these services would financially break even if 50% of the spare bus fleet were used in the same scenario.

[17] Internal notes by BMTC

Similarly for AC bus services, it was observed that for Scenario 2, the break-even profit point occurred when 75% of the spare bus fleet was used. For Scenario 4, even if 25% of the spare bus fleet were used, the daily net profit for the ordinary services would be INR 37,500.

Table 12: Net profit per day for additional demand of AC services

Scenarios	Net Profit per Day – AC Services				
	Average Profit Per Bus Per Day	Percentage of Spare Bus Fleet Used			
		100	75	50	25
Scenario 1	INR 750	(-) 50,000	(-) 87,500	(-) 1,25,000	(-) 1,62,500
Scenario 2	INR 1,000	50,000	0	(-) 50000	(-) 100,000
Scenario 3	INR 1,250	1,50,000	87,500	25,000	(-) 37,500
Scenario 4	INR 1,500	2,50,000	1,75,000	1,00,000	25,000

This analysis will help BMTC negotiate pricing with their clients keeping the additional demand in perspective. BMTC could negotiate for a certain level of commitment in terms of buses to be deployed with a particular client at the proposed rates.

7. Findings and Discussion

A few key findings from the study are detailed below:

- The average approximated profit margin from the existing model comes out to be INR 1,500 per day per bus. This profit margin might be on the higher side, thereby restricting the likelihood of attracting potential clients for these services.
- The revised model by BMTC generates average profit margin of INR 500 per day per bus. This model will likely enhance customer base but the additional bus demand requirement at these profit margins might exceed the available fleet.
- It was observed in the additional bus demand section, for Scenario 1 (both ordinary and AC bus services), even at 100% of spare fleet utilisation, the net profit turns out to be negative. This indicates that at low profit margin (INR 500), the additional spare fleet is not sufficient to achieve profit compared to the existing scenario.
- Having a good spectrum of route length intervals ensures that the passengers travelling on shorter route lengths do not pay high prices. Hence, it can be a way to tap into the latent demand that may exist for shorter corridors.
- These proposed slab rates for various scenarios can provide BMTC a platform to negotiate on the pricing of the services and even have an additional demand perspective for the proposed prices.

However interviews have also revealed that there are multiple issues which need to be addressed by BMTC. These include:

- The need for a customer-centric approach
- The need for providing competitive rates on a per/km or pass cost, which BMTC is currently unable to do
- The need for providing new buses, which do not have frequent break-downs and are well maintained
- The need for contract negotiations including providing insurance/indemnity to corporate employees travelling on BMTC buses (this is provided by private transport operators)

8. Conclusion and Recommendations

The current financial model for chartered/dedicated bus services that focuses on making profits through dead kilometres has restricted the number of corporate customers. The revised BMTC model that focusses on generating minimum profit margin needs additional services to be operated, to generate a profit margin equivalent to the existing dead kilometre model. Both the models are not viable in the long run, with the increasing operating cost per km. In the context of varying operating cost, CSTEP proposed a model based on route length to estimate the dead kilometres to be charged and monthly pass for chartered services and dedicated bus services. If BMTC wishes to increase the customer base, it needs to adopt an alternative model which would reduce the number of dead kilometres and move towards a multi-slab fare model.

CSTEP's analysis shows that such a model would allow for customers travelling varying distances to be charged differentially. This could potentially increase the number of customers. Such a model also offers BMTC different profit slabs per bus per trip ensuring that these operations remain profitable. Finally, it offers BMTC and existing/potential customers an opportunity to negotiate the fare per km/monthly pass rate, and for the corresponding number of buses to be deployed.

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Annexure I

Calculation for Average Fare per Passenger-km

Ordinary Bus Services

Example:

Route No 258 CC[18] - (Nelamangala to Kempegowda bus station); Route length = 23 km

Peak time revenue (INR) = 24,034

Peak time ridership = 1,493

Average fare per passenger-km = Revenue/ridership/route length

= 24,034/1,493/23

=0.69 ~ 0.7 INR/ passenger-km

AC Bus Services

Example:

Route V-500CA[19] - (Banashankari to ITPL); Route length - 26 km

Total revenue (INR) per day- 8,58,789

Total ridership per day – 20,318

Average fare per passenger-km = Revenue/ridership/route length

= 8,58,789/20,318/26

= 1.62 ~ 1.7 INR/passenger-km

[18] Based on ETM data shared by BMTC for route no. 258CC (May 2017)
[19] Based on ETM data shared by BMTC for route no. V-500CA (Jan 2017)

Annexure II

Calculation for Average Profit Margins: Ordinary Services

Existing Model

Based on Data from Potential Client:

Total operating km (point to point- two side) – 2,633 km

Charged km (including dead km) – 4,950 km

Percentage of operating km - 53% ~ 50%

Based on Data from Existing Client:

Total km operated - 2,259

Total km charged per day - 4,519 km

Total number of bus operated - 56

Revenue per day (R) - INR 1,93,309

Profit per day (INR) = (R- OC*Dop) = 75,815

Profit per day per bus (INR) = 75,815/56 = 1,353 ~ INR 1,500

Based on Overall Dedicated Bus Service Data from BMTC:

Km charged per day - 14,900 km

Km operated per day - 7,450 km

Revenue per day - INR 5,81,908.50

Profit per day - INR 1,94,508.50

Profit per day per bus - INR 1,305 ~ 1,500

Based on Overall Chartered Bus Service Data from BMTC:

Km charged per day - 23,989.5 km

Km operated per day - 11,994.75 km

Revenue per day - INR 9,16,357.35

Profit per day - INR 2,92,630.35

Profit per day per bus - INR 1,129 ~ 1,500

Revised Model by BMTC

Route Length (km)	Peak-time Revenue	Profit (INR/day)
30	1.25*CPKM	390 (1.25 *CPKM - CPKM)
31-40	1.22*CPKM	400.4 (1.22 *CPKM - CPKM)
41-50	1.20*CPKM	468 (1.20 *CPKM - CPKM)
51-60	1.18*CPKM	514.8 (1.18 *CPKM - CPKM)
>61	1.16*CPKM	582.4 (1.16 *CPKM - CPKM)
Average		471.12 ~ 500

Calculation for Average Profit Margins: AC Services

Existing Model

Assumption: Percentage km operated per day is taken as 50% (same as ordinary services)

Based on Overall Dedicated Service Data from BMTC

Km charged per day - 26,280 km

Km operated per day - 13,140 km

Revenue per day - INR 14,27,234

Profit per day - INR 3,76,034

Profit per day per bus - INR 1,717 ~ 1,750

Revised Model by BMTC

Route Length (km)	Peak-time Revenue	Profit (INR/day)
30	1.25*CPKM	600 (1.25 *CPKM - CPKM)
31-40	1.22*CPKM	616 (1.22 *CPKM - CPKM)
41-50	1.20*CPKM	720 (1.20 *CPKM - CPKM)
51-60	1.18*CPKM	792 (1.18 *CPKM - CPKM)
>61	1.16*CPKM	896 (1.16 *CPKM - CPKM)
Average		724.8 ~ 750

Annexure III

Load Factor Calculation:

The load factors are calculated from Equation (1):

$$\pi_{norm} = 2 * f * l * C_b * LF - 2 * OC * l$$

For an average profit of INR 500:

$$\text{LF} = \frac{\pi_{norm} + 2 * OC * l}{2 * f * l * C_b}$$

π_{norm} - INR 500

OC - INR 48

l - Average route length (25 km)

f - 0.87

C_b - 42

$$\text{LF} = \frac{500 + 2 * 48 * 25}{2 * 0.87 * 25 * 42}$$

$$= 1.58$$

Annexure IV

Slab Rates for Chartered Services

Dead kilometres calculated using Equation (4):

$$x = \frac{\pi_{norm} + 2 * OC * l - 2 * CS * l}{CS}$$

For a route length range of 25- 50 km:

Average profit = INR 375.25

OC = INR 48

CS = INR 48

$$x = \frac{375.25 + 2 * 48 * 38 - 2 * 48 * 38}{48}$$

= 7.72 ~ 10 km

Slab rates for Dedicated Services

Monthly pass calculated using Equation (6):

$$MP = \frac{\pi_{norm} * D_{op} + D_{op} * OC * 2l}{C_b}$$

For a route length range of 25- 50 km:

Average profit = INR 375.25

OC = INR 48

C_b = 42

Dop = 22

$$MP = \frac{375.25 * 22 + 22 * 48 * 38}{42}$$

= INR 1,153 ~ 1,200

Annexure V

Calculation for Additional Demand

Maximum profit/bus/day = INR 1,500

Existing number of bus = 600

Profit/day = INR 9, 00,000

Additional buses available = 600 (ordinary)

For INR 500 profit: 100% utilisation of additional buses

Net profit per day (INR) = (600+600)*500 - 9, 00,000= -3,00,000 (which indicates a loss of INR 3,00,000)