

IMPROVING THE BUS ROUTE EFFICIENCY OF MBCET

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Abstract — Poor route planning may result in poor route coverage, an excessive requirement for interchange between routes, and irregular frequencies. While dealing with efficiency of college transportation operation, it can encompass many things, including vehicle fuel economy and productivity of technicians. Certainly efficient routing starts with planning. Performance of a bus system is affected by several criteria, such as increased in the number of buses, number of bus stops, and number of passengers, and changes along roadways and in land uses. Therefore, the various issues causing inefficient operation of bus services needs to be identified and also appropriate techniques/measures should be formulated to resolve these issues. Plans must be kept under regular review, and revised as necessary.

Index Terms — Route planning, route coverage, efficiency, vehicle fuel economy.

I. INTRODUCTION

Transport demand in most cities has increased significantly, due to increase in population as a result of both natural increase and migration from rural areas and smaller towns. Fast growth of population has trigger a greater need for well-organized public transport service to carry many passengers through overcrowded and congested urban areas. The problem of scheduling and routing college buses deals with the important question of how to transport students to and from college in the safest, most economical and most convenient manner. The scheduling and routing activities are often controversial because the problem must deal with multiple objectives. Although the vehicle routing in general has dealt with many objectives, the most relevant in the context of routing and scheduling of college buses are to minimize the transportation cost and to minimize the transportation time.

There are a million ways to get from one point to another point .But when it comes to optimizing the bus routes, efficiency is what matters most. When we talk about efficiency in a college transportation operation, it can encompass many things, including vehicle fuel economy and productivity of technicians. But if we really want efficiency, the discussion must focus on routing specifically, the policies that shape college bus routes and the processes put in place to evaluate

those routes as routing is the key element for finding good solutions. Transportation system should have proper routes with proper timing and with maximum capacity utilization for its effective use. Every system faces its own defects and limitations in every aspects, bus routing and scheduling are to be given primary importance while focusing on its safest use. Efficiency is another major factor that is considered, efficiency starts with planning and for planning data are required.

Existing bus route of MBCET is not efficient to cover all the important routes, so the objective of this project is to create a transportation system which help in stop allocation and to identify the safest routes. From the survey conducted in MBCET campus our team were able to identify the defects in existing system, which provide necessary information for rerouting to satisfy the present and future demands and also to make its effective use[2].

II. ISSUES OF BUS TRANSPORTATION IN MBCET

Some of the important issues for inefficient performance of bus transportation system in college as identified for this study are as follows:

- Overcrowding due to inadequate system
- Inefficient & uneconomic bus routes
- Irrational location of bus stop
- Higher overall operational cost

Objectives for designing daily operations of a public transportation system should encompass both angles of service and economic efficiency. Thus the practical goals for the project is to overcome all the shortcomings of the present system as stated before, and can be briefly summarized as follows:

- User benefit maximization
- Operator cost minimization
- Capacity maximization

Therefore, the various issues causing inefficient operation of bus services needs to be identified and also appropriate measures should be formulated to resolve these issues.

III. METHOD OF CONSTRUCTION OF EFFICIENT BUS ROUTES

Achieving efficiency improvements in bus transport systems is not always easy. This is a practical solution for planners which help explore the essential elements, steps and milestones to improve bus transport system efficiency. It considers proven practices and examples from planning to implementation, monitoring and evaluation. It also identifies key questions to ask when devising, implementing and evaluating transport system efficiency.

A. Data Collection

The questionnaire survey was conducted among the 1st 2nd 3rd and 4th year students of various streams of B.Tech programme for the analysis of the existing college transportation system.

DEPARTMENT OF CIVIL ENGINEERING
MAR BASELIOS COLLEGE OF ENGINEERING & TECHNOLOGY
 THIRUVANANTHAPURAM

TRANSPORTATION SURVEY

This survey is conducted as part of the final year project of SS students of Department of Civil Engineering for the analysis of our college transportation system. Please fill in the details correctly

Name : _____
 Branch : _____ Batch : _____
 Semester: _____ Roll No: _____

Location of home/place of stay: _____

ARRIVAL TO COLLEGE (FN)

1. How do you arrive at college ?

(A) Day scholars:

a. College bus

b. Auto / Bicycle / 2-wheeler / Walking / Public transport

c. Parents drop at

i) college

ii) boarding point

iii) main gate

d. Arrive at TVM via bus or train

i) If Yes, specify arrival point: _____

ii) Mode of reaching college from arrival point :
 Auto Public transport Private vehicle College bus

(2) Hostler :

a. Name and place of Hostel: _____

b. How do you arrive at college ?
 Walking 2-wheeler Auto Public transport

2. If you arrive at main gate, how do you reach college from main gate?
 Walking 2-wheeler Auto 4-wheeler

DEPARTURE FROM COLLEGE (AN)

3. Return journey to place of stay:

a. Same as that of arrival

b. If not, specify: _____

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Figure 1: Questionnaire Page 1

IF YOU AVAIL COLLEGE BUS FACILITY

4. Route & Route No: _____

5. Boarding point: _____

6. How do you reach your boarding point from your home/place of stay

Walk Bicycle

Auto 2-Wheeler

Bus 4-Wheeler

7. Do more than one college bus arrive at / pass by your boarding point?
 Yes No

8. Is there any college bus boarding points within 0.5 km radius from your boarding point (If Yes, specify): _____

REASONS FOR NOT AVAILING COLLEGE BUS

9. Please mark the factors that decrease your willingness to choose college bus

1. Overcrowding 4. Non-availability of information regarding

2. Late arrival of bus cancellation, breakdown etc

3. Non availability of nearby boarding points 5. Seat availability

6. Non-flexible bus timings (during University exams, etc.)

OTHER INFORMATION

10. Do you experience any traffic congestion on your way to and from the college ?
 If Yes, a. Morning - specify locations: _____
 b. Evening - specify locations: _____

11. Any suggestions to improve the college transportation system: _____

12. Are you willing to come by college bus if your opinions are considered ?
 Yes No

Signature _____

- Always wear helmets while driving 2-wheelers and buckle seatbelts while driving 4-wheelers
- Avoid rash & reckless driving, over speeding and overtaking through left side
- Make sure you have a valid & authentic driving license while driving
- Always obey all traffic rules on road and have a safe journey

(Page 2 of 2)

Figure 2: Questionnaire Page 2

B. Response percentage

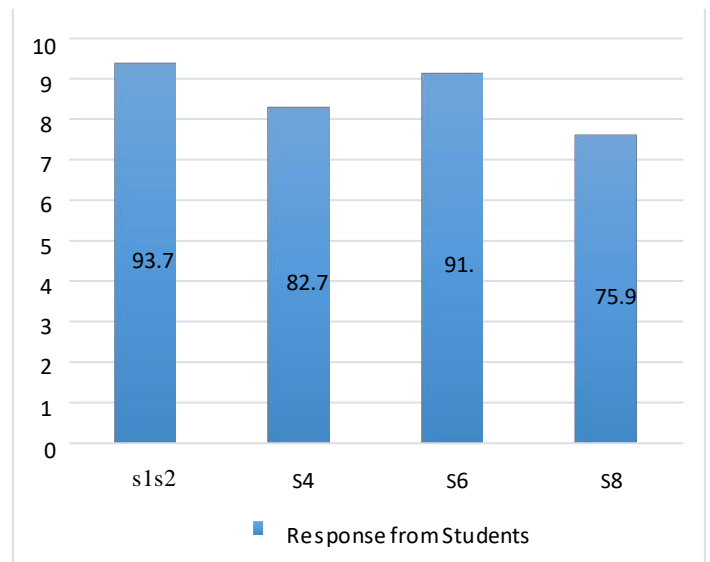


Figure 3: Response from Students in percentage

C. Mode of Arrival

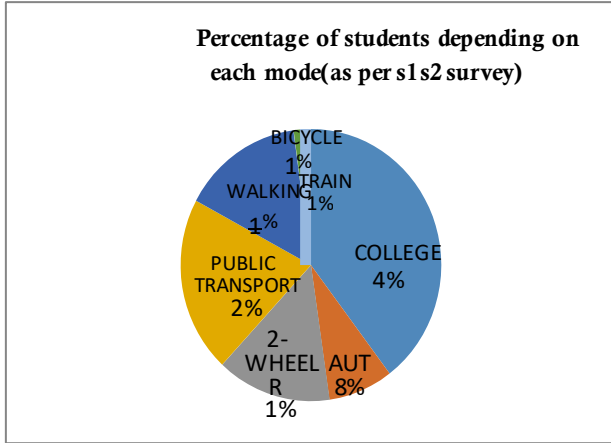


Figure 4: Pie diagram showing mode of arrival of students (as per s1s2 survey)

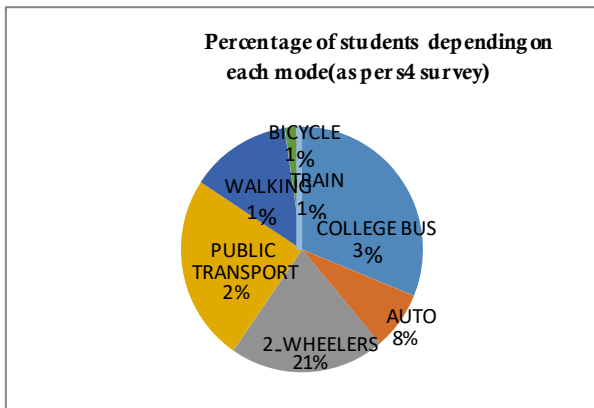


Figure 5: Pie diagram showing mode of arrival of students (as per s4 survey)

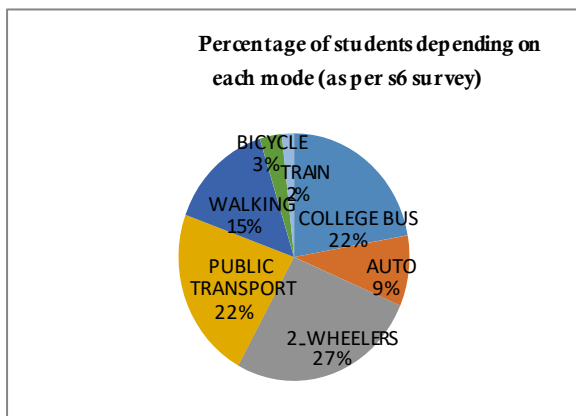


Figure 6: Pie diagram showing mode of arrival of students (as per s6 survey)

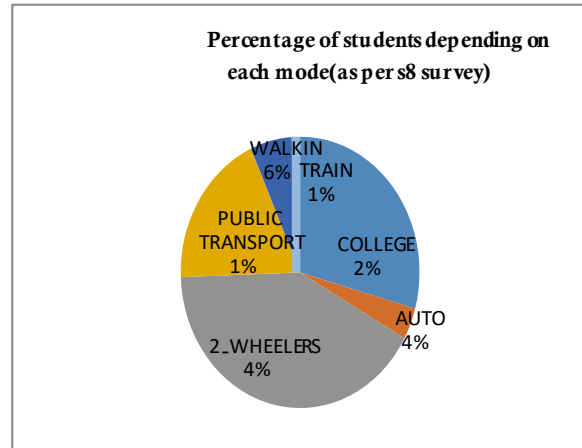


Table 1: College Bus Demand and Student Willingness from various locations

| Location of Student | College Bus Demand | Willingness |
|---------------------|--------------------|-------------|
| Chavadimukku | 3 | 1 |
| Kariyavattom | 4 | 2 |
| Kazhakootam | 16 | 4 |
| Kesavadasapuram | 2 | 4 |
| Kulathoor | 1 | 1 |
| Mannathala | | 6 |
| Pongumoodu | 6 | 3 |
| Pothencode | 3 | 2 |
| Sreekariyam | 19 | 10 |
| Ulloor | 5 | 1 |
| Chempazhanthy | | 1 |
| Kallampally | 1 | |
| Gandhipuram | 1 | 1 |
| Ambalamukku | 3 | 7 |
| Kudappanakunnu | | 1 |
| Muttada | | 2 |
| Nettayom | 1 | 1 |
| Peroorkada | 12 | 11 |
| Peyad | 3 | 3 |
| Vattiyoorkavu | 12 | 8 |
| Vazhayila | | 2 |

D. Suggestions for New System

The suggestions provided by the students for the improvement of the bus route system are represented in Table 2.

Table 2: Suggestions for New System

| Suggestions | Taken into Consideration |
|------------------------------------|--------------------------|
| Need more bus | YES |
| Need of boarding point at Attingal | NO |
| Extend the reach of college bus | YES |
| Increase the boarding point | YES |
| Increase the seating capacity | NO |
| Route via KIMS | YES |
| Bus route via Kaimanam | YES |
| Bus route via Venjarumoodu | NO |
| Bus route via Kochuvelli | YES |
| Bus route via Nedumangad | NO |
| Improve the seat quality | NO |
| Decrease crowd | YES |
| Sarvodaya bus should be reduced | NO |
| Bus route via Valiathura | YES |

E. Current Bus Route Network



Figure 8: Combined Current Bus Route Network

F. Study Area

The locations of the students were obtained from the survey analysis results and were listed out. Keeping the college as central point, from the locations of the students, the farthest locations were identified and the boundary of the study area was fixed based on these locations. To ensure safety to public health, economy and utility it is necessary to check, analyse and treat the raw available water to safe and permissible limits before utilising it. In order to ensure that the available water source of the slum is suitable for drinking purposes, following experiments were performed.



Figure 9: Study Area

G. Zoning

1. The survey results were analysed and the locations of the students of the college were identified and listed.
2. The farthest locations of students from the college are identified.
3. The locations were then plotted on the study area using Google Earth.
4. The exact location of the college was marked and keeping it as the central point the locations of the students were classified into 8 distinct zones.



Figure 10: Zoning

H. ROUTING AND SCHEDULING

1. The Origins of Students currently availing college bus & those who are willing to avail college bus were plotted in the study area using Google Earth
2. The farthest points that the college bus can reach within the time limit are identified
3. First set of trial routes were prepared by providing routes through the feasible farthest points of origin interconnecting intermediate points of origin
4. The total distance and time taken for completing the route was determined using Google Maps and the feasible routes were selected
5. The Total Number of Students from each point including current college bus demand and willingness was tabulated
6. A second set of trial routes were prepared either by re-routing the routes from the first set. The routes were prepared such that the total number of students boarding the bus from a single route was limited between 60 to 70
7. Boarding points for students were allocated to each route
8. The final set of routes were prepared by optimizing the routes from the second trial

I. Proposed Routes



Figure 11: Route 1



Figure 12: Route 2



Figure 13: Route 3

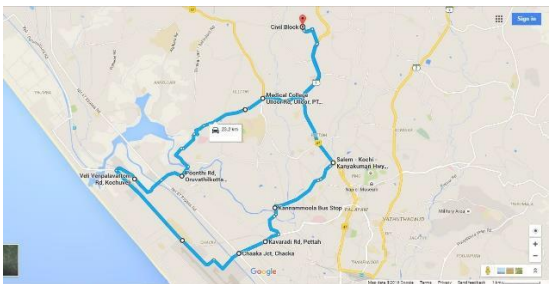


Figure 14: Route 4

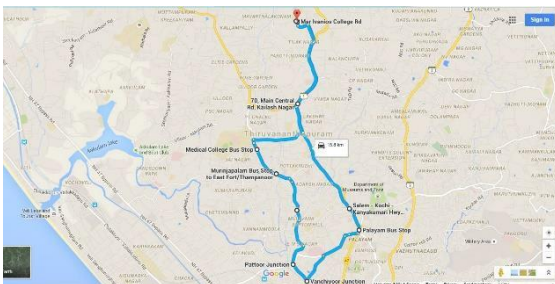


Figure 15: Route 5

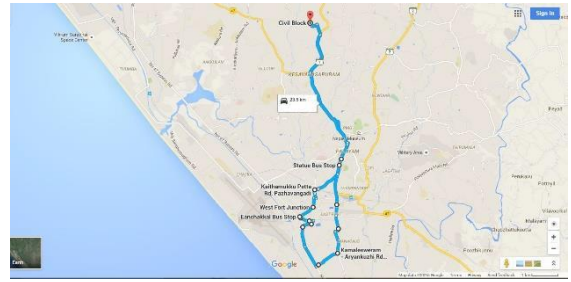


Figure 16: Route 6



Figure 17: Route 7



Figure 18: Route 8



Figure 19: Route 9



Figure 20: Route 10

IV. ESTIMATION

Table 3: Estimation (1)

| CHARACTERISTICS | EXISTING ROUTES (2014-15) | PROPOSED ROUTES |
|--|-------------------------------|--------------------------------|
| 1.SALARY (4 buses owned by the college) | | |
| a)Drivers: Rs.7500(monthly) | 7500*4 *12 months =Rs.360000 | 7500*4 *12 months =Rs.360000 |
| b)Cleaner (ata: Rs.750 (monthly) | 750*4*12 months =Rs.36000 | 750*4*12 months =Rs.36000 |
| c)Extra wages | Rs.12550 | |
| d)Annars | Rs.5400 | |
| 2. DIESEL AND FUEL CHARGES | | |
| Number of buses | 9 | 10 |
| Approx. running distance in km (2 trips) | 546.6 (for 9 buses) | 463.4 (for 10 buses) |
| Daily diesel consumption(assuming average mileage of bus as 40mpL) | 137 | 115.85 |
| Average cost of diesel(per litre) | 52.46 | 50.44 |
| Number of working days in a year | 170 | 170 |
| TOTAL COST | 137*52.46*170= Rs.12, 21,793. | 115.85*50.44*170=Rs.9, 93,390. |
| Diesel charges for MICET buses(4 Nos.) | Rs.6,48,000 (Office data) | |

Table 4: Estimation (2)

| CHARACTERISTICS | EXISTING ROUTE (2014-15) | PREPARED ROUTE |
|--|--------------------------|----------------|
| 3.REPAIR & MAINTAINANCE(4 buses owned by the college) | | |
| Spares | Rs. 1, 40,515 | |
| Tyre rethreading (Rs.4000 for normal Nylon tyres and Rs.5000 for radial tyres) | | |
| Workshop charges | Rs.85, 067 | |
| Extra expenses | Rs.20, 850 | |
| 4.INSURANCE PREMIUM(4 buses owned by the college) | | |
| | Rs.1, 57,256 | |
| 5.ROAD TAX(4 buses owned by the college) | | |
| | Rs.69,616 | |
| 6.HIRE CHARGES | | |
| | Rs.5,73,793 (5 buses) | |

5. COMPARISON OF PROPOSED AND CURRENT BUS ROUTE SYSTEMS

Table 5: Comparison of Proposed and Current Bus Route Systems

| Characteristics | Existing routes | Recommend ed route |
|---|------------------------|--------------------|
| No of buses used | 9 | 10 |
| No of buses hired | 5 | 6 |
| Approximate running distance(km) in an year | 1,00,000 km | 80,000 km |
| Approximate distance travelled in one day (km) | 546.6 km | 463.4 km |
| Amount of diesel required in one year (approx.) litres for the 4 buses owned by the college | 23290 L | 19695 L |
| Approximate hire charges | Rs. 5,73,793 (2014-15) | Rs. 6,88,556(new) |
| Total No: of Students availing college bus facility | 370 | 606 |
| Total No: of Locations covered | 71 | 90 |

V. CONCLUSION

After Plotting & comparing the details of the current & the proposed bus route networks, it was found that the proposed bus route network is better than the current network. Even though the number of buses used has increased by one due to addition of the 10th route, the approximate total running distance of the buses for a year has been reduced by 20,000 km (463.4 km/day). Moreover, the reach of college bus has been extended to locations like Vedivechankovil, Mukkolakkal, Nettayam-Mukkola, Vazhayila, Kochuveli, etc. An additional 19 locations has been incorporated in the proposed route network. The Proposed Bus Route Network was designed to provide the college bus facility to additional 236 students apart from the 370 students availing the college bus facility of the current system. Thus taking into consideration, the advantages of the proposed network, it can be concluded that the Proposed Routing is efficient than the existing network.

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