DESIGN OF EFFECTIVE PUBLIC TRANSPORT SYSTEMS IN CHENNAI: A STUDY OF PUBLIC PERCEPTION

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ABSTRACT

A growing concern for public transit is its inability to shift passenger's mode from private to public transport. In order to overcome this problem, a more developed feeder bus network and matched schedules will play important roles. The present paper aims to review some of the studies performed on Feeder Bus Network Design and Scheduling Problem (FNDSP) based on three distinctive parts of the FNDSP setup, namely, problem description, problem characteristics, and solution approaches. The problems consist of different Sub problems including data preparation, feeder bus network design, route generation, and feeder bus scheduling. Subsequently, descriptive analysis and classification of previous works are presented to highlight the main characteristics and solution methods. Finally, some of the issues and trends for future research are identified. This research is targeted at dealing with the FNDSP to exhibit strategic and tactical goals and also contributes to the unification of the field which might be a useful complement to the few existing reviews.

KEY WORDS: *Urbanization, Bus Network, transport.*

INTRODUCTION

An important addressing issues of sustainability allows societies to meet their present needs without compromising the environment for future generations. This policy proposal will address the promotion of public transportation systems as a means for sustainable development. A more sustainable approach to transportation will lead to less environmental damage before it occurs rather than as a reaction to the damage that results from vehicle emissions . There are two important aspects of environmental damage: the first is CO2 emissions that cause climate change and the second is other emissions that contribute to air pollution and subsequent health effects. These two problems are exacerbated by the increasing trend for private vehicles. The trend calls for more vehicles on the road which means more vehicle emissions and thus more 1 deleterious environmental effects. If public transportation is used more frequently, this can serve as a way to reduce the number of vehicles on the road and subsequently reduce emissions.

Present Urban Transport Problems
• Urbanization in India: 31% in 2017 to 50% in 2030.
• Increasing dependence on private transport.

Solution
• Making public transport attractive to commuters.

• Increasing catchment area of mass transit stations.
•Providing feeder service.

LITERATURE REVIEW

From the overall review of literature related to the transit network planning process, the following observations are made.

i. Though the transport sector has a major impact on the society and emerged as one of the important service 40 providers, the literature shows that not enough research has been carried out.
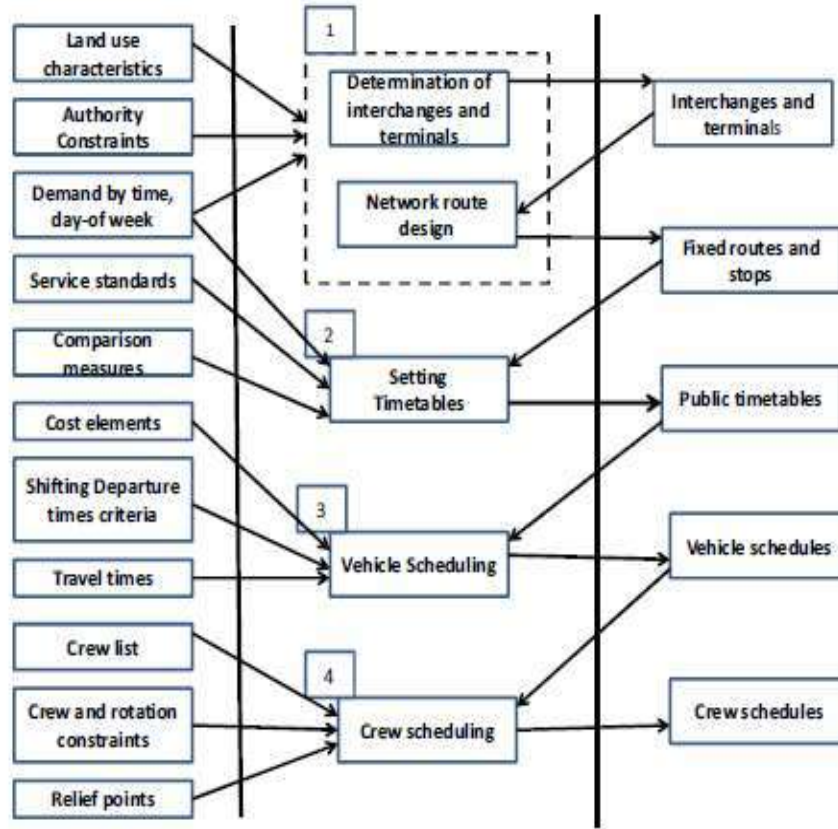
ii. The models using Integer / mixed integer programming, Genetic Algorithms, simulation and other heuristics, AHP and DEA, have been employed for network design and evaluation of routes and depots. Not many studies are reported in India on the study of bus routes and depots.

iii. Many researchers have considered average passenger demand and average travel time in their studies on determining headway/frequency. This average demand and travel time refers to the route and not between the stages (stops). Only a very few researchers have considered the stochastic nature of these data. However, studies with variable passenger demand at the stages (stops), alighting of passengers at the stages and variable travel time between the stages are not reported in literature.

iv. Only a very few researchers have undertaken research in bus transport system in India. In Indian metropolitan cities, the roads are narrow and usually congested with heavy traffic of

heterogeneous vehicles. Under these conditions, determining the headway considering stochastic data is a challenging task. Thus, there is enough scope for undertaking research in the transport sector in general and in India in particular.

SCOPE OF RESEARCH

In this research, some important issues related to the bus transit system of a metropolitan city have been undertaken. It is well known that making more productive use of resources is an important issue of any transport system. Though all the components of the transit planning process are important, some of them have more impact on the operational economy and customer satisfaction. Bearing this in mind and the current status of research, the scope of the research is limited to the following elements of the bus transit system.

1. Depot evaluation
2. Route evaluation
3. Determination of headway and timetabling

The study includes the development of models and their application to real cases.

EXPERIMENTAL METHOD

The basic functions of network route design are as follows:

1) Identification of the location of the origins and destinations (terminus).
2) Establishing relationship between those origins and destinations with transit stages.
3) Identification of transit service schedules, vehicle locations and transfer points.
4) Identification of optimal paths. Apart from network route design, it is necessary to evaluate the performance of the routes as well as the depots periodically in order to monitor their performance and take corrective action if required. The literature related to some of the aspects of the basic functions has been reviewed and presented in the following sections.

NETWORK DESIGN AND ROUTE EVALUATION

The general network design problem is to determine the basic route design, adding new links or expanding the old ones in the existing network. The network design problem of urban transportation consists of minimizing some objective function, subject to the equilibrium constraint such as minimization of overall time or cost measures. In several countries / cities, the public transport is run by transport corporations funded by the government. As such in designing the transport network, apart from economic measures, the public interest is very important. Route evaluation should be an ongoing process so that corrective measures, if any, required to improve the quality of service and reduce operating costs can be taken. The information from route evaluation may also lead to possible network route re-design. The literature related to network design and route evaluation is presented in this section. Ceder and Wilson (1986) described the bus network design problem, summarized the different approaches that had been proposed for its solution and proposed a new approach incorporating some of the positive aspects of prior work. The proposed approach is intended to be easier to implement and less demanding in terms of both data requirements and analytical sophistication than previous methods. An algorithm is presented that can be used to design new bus routes taking into account both passenger and operator interests; however, this algorithm focuses on only a single component of the overall bus operations planning process. Bookbinder and Desilets (1992) proposed transfer optimization in a transit network to minimize the overall inconvenience to passengers.

HEADWAY / FREQUENCY

The basic issue in the planning of urban public transport is the determination of headways or inter-dispatch times (time between successive departures). Headway depends on frequency of buses operating in a route. During each session i.e. distinct time-period whose demand characteristics are constant, the following trade off must be considered. Dispatching too many vehicles on a route causes high operating costs, while too few vehicles may result in unsatisfactory levels of service. An appropriate policy on headways will help to balance resources between lines (routes) in peak-demand hours and will influence the total number of buses acquired by a transit company. Previous practice in industry usually bases the planning of headways upon satisfying service criteria on a "most-congested segment". This approach reduces the problem from that of studying a route to that of a single segment (stop), but thereby fails to account for other important information about the line's characteristics.

MODELLING FEEDER NETWORK IN KOYAMBEDU TO MEENAMBAKKAM

Classified into three parts:

1. Demand modelling
2. Network modelling
3. Impact model (User and Operator)

Assumptions:

1. The feeder bus service is modeled from 8am to 10pm only.
2. The effect of Intermediate Public Transport on feeder services is not considered
3. Commuters have no information on departure times of feeder bus.
4. Operating speed of feeder bus and auto-rickshaw in the network are assumed to be 15 Kmph and 20 kmph respectively.

NETWORK MODELLING

Steps involved:

1. Incorporation of network map and marking Points of Interest
2. Creation of zones
3. Creating new transport system (feeder & auto)
4. Creating stop locations for feeder bus
5. Creating feeder line route
6. Creating connectors
7. Creating vehicle journeys

DATA COLLECTION

Primary Data :
• Passenger interview surveys
• Arrival and dispersal pattern
• Ingress and egress time, distance, cost and mode
• Willingness to use and pay for feeder service

Secondary Data:
• Total patronage
• Road network
• BEST bus network
• Location of other mass transit station
• Feeder bus characteristics
• Operating cost data

DESIGN ELEMENT

1.Objective function: Minimize user's and operator's cost
2.Demand Pattern: Many-to-one
3.Decision variables: Journey time and cost coverage
4.Constraints:
• 0.8 < Load factor < 1.2
• Total capacity of bus ≤ 30
• Stop spacing and connector ≤ 500m
• 5mins. ≤ Headways ≤ 10mins.
5.Network approach with simulation solution

SELECTION OF STUDY AREA

Based on following criteria:
1. Total patronage at each metro station
2. Land use pattern
3. Presence of bus stops or bus depots
4. Location of metro station
5. Type of IPT's serving around metro station
6. Inter-station distance

PUBLIC TRANSPORT: USER MODEL

Three types of assignment procedures:
1. Transport system based assignment
2. Headway based assignment
3. Timetable based assignment

PUBLIC TRANSPORT: OPERATOR MODEL

Steps involved:
1. Calculation of public transport assignment
2. Creating operator, vehicles and allocating vehicle journeys
3. Creating fare mode
4. Defining cost model
5. Calculation of line blocking procedure
6. Calculation of operating indicators

TIME INTERVAL	% OF PEOPLE
5:30 am – 8:00 am	7%
8:00 am – 11:00 am	23%
11:00 am – 5:00 pm	31%
5:00 pm - 8:00 pm	27%
8:00 pm – 11:30 pm	12%

TEMPORAL DISTRIBUTION OF DEMAND ON ALANTHUR, PALLAVANTHANGAL AND ASARGHANA.
PRIMARY SURVEY

Train commuters have requested the Metropolitan Transport Corporation (MTC) to ply feeder buses to ferry commuters from Nanganallur, St. Thomas Mount, Ullagaram, Puzhuthivakkam and Madipakkam to the Alandur Metro Railway Station through the Southern Sector Inner Ring Road.

"The Southern Sector Inner Ring Road, which is an arterial thoroughfare, which connects to Grand Southern Trunk Road and Velachery Main Road lacks sufficient bus services , especially to Ullagaram, Puzhuthivakkam and Madipakkam. People either go to St. Thomas Mount railway station, Velachery MRTS Station or Guindy bus stop to reach that various other parts of the city,"

From Puzhuthivakkam (Ullagaram) bus terminus, MTC operates 51P to High Court, M270 to Ambattur Industrial Estate and S554A to Sriperumbudur via Asar Ghana and Guindy.

Less frequency

" The bus services operated on these routes lack frequency. Except for B51 (East Tambaram – Saidapet), there is no direct service connecting Southern Sector Inner Ring Road and Alandur Metro Station,

"If feeder services aren't introduced, CMRL, like MRTS, is less likely to be utilised properly". A few residents have also sought the introduction of the feeder services to Chitlapakkam.

"The feeder services should be introduced from St. Thomas Mount, Pallavaram, Chromepet, Airport and Tambaram," L. Sundararaman, a resident of Muthulakshmi Nagar,

Official sources at MTC say more than 30 feeder services connecting the Metro Rail stations and the areas in the vicinity are plying from 2013. Also, there are many bus services plying between the Koyambedu and Alandur stations.

The Traffic and Transportation Forum, Chennai, has requested the Chennai Metro Rail Limited to ply feeder services at its stations on the lines of Delhi Metro Rail (DMRL), once the Koyambedu - Alandur elevated stretch, and Line 1 Washermanpet to Chennai International Airport, Line 1 extension WIMCO Nagar to Washermanpet, and Line 2 Chennai Central to St. Thomas Mount, become operational.

The first stretch of the Chennai Metro Rail, covering an elevated distance of 11 km between Koyambedu and Alandur, is expected to go operational soon.

"In New Delhi, the DMRL feeder buses are a big help to commuters, whose offices and residences are located along the six red, yellow, blue, green, violet, and airport express (orange) lines.

"The distance to be covered by the CMRL feeder buses can be within a radius of four to five km," .

It is learnt that the CMRL has requested the Metropolitan Transport Corporation to ply small buses as feeder services once its stations become operational.

At present, the MTC operates 100 mini buses on interior roads and localities, and a few arterial roads, including the Grand Southern Trunk Road.

"The Southern Sector Inner Ring Road does not have proper road connectivity.

"Feeder services in and around areas on the stretch will prove to be a relief for several commuters who have to go either to St. Thomas Mount or Velachery MRTS Stations.

"The number of buses can be increased depending upon the response of public,"

"Apart from feeder services, authorised share-autorickshaws can be allowed, benefiting commuters. During rush hour, feeder bus services should be increased"

"The feeder services can be operated through the underpass of Kathipara grade separator to St. Thomas Mount, the underpass can also be utilised for parking of feeder vehicles.

"Many of us will take the Metro to reach offices, schools and colleges and so the feeder bus services are essential.

RESULT AND DISCUSSION

Train commuters have requested the Metropolitan Transport Corporation (MTC) to ply feeder buses to ferry commuters from pallavanthangal, St. Thomas Mount, and Alandhur want to the feeder bus service in Metro Railway Station.
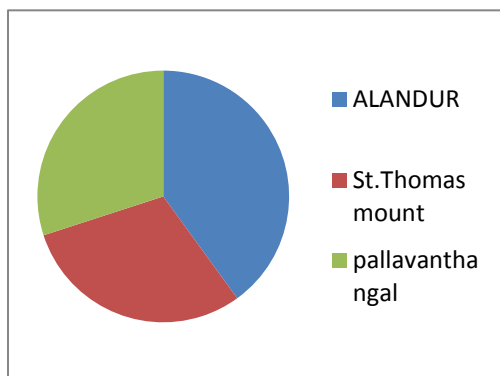
From the survey 40% people needs feeder in Alandur.
30% in St.Thomas mount.
And 30% in Pallavanthangal.

CONCLUSION

- From the result we get the conclusion that we can offer feeder services in the following area
- ALANDUR, St,THOMAS MOUNT, and PALLAVANTHANGAL.

- In pallavanthangal we can offer both metro station and feeder services.

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