

“Bus stop rationalisation using GIS”

Mr. G. Saravanan

III Semester, M.E. Urban Engineering
Division of Urban Systems Development
Anna University, Chennai – 600 025

Mr. S. Suresh Immanuel

I Semester, M.E. Highway & Transport Management
Division of Urban Systems Development
Anna University, Chennai – 600 025

1. INTRODUCTION

Rationalization is a process of making something seem consistent with or based on certain reasons, criteria and scientific study. It also means systematic organisation. Rationalisation of bus stops means re-organizing the existing bus stops in a given route based on certain criteria like passenger density (no of passengers who will board and alight the buses in a particular bus stop), land use pattern in and around the bus stop, the inter-bus stop distance etc. Since the bus stops would have been installed before many years, the then density of the passengers and land use pattern would have undergone a drastic change and the bus stops would not commensurate with these changes. Hence there is an increasing need for the bus stops to be rationalized.

The route taken for the study is the “Saidapet – Thiruvanmiyur Stretch” in Chennai city, the fourth largest city in India. Geographical Information System (GIS) has been used in this study for rationalizing the existing bus stops for the study route. Since GIS has got the added advantage of better visual representation and easy analysis, GIS and in particular Arc View software has been used for the study.

2. NEED FOR THE STUDY

Chennai is the fourth largest Metropolitan City in India. Development has taken place at a faster pace. A lot of conversion and intensification of land use has also taken place. Totally nine fly-overs were completed in the last two years. The existing bus stops were constructed long back about five to ten years ago taking into consideration the various criteria like land use, accessibility to passengers and passenger density, which would have prevailed then. The bus stops are not rationalized periodically. Some bus stops are under utilized and some others are over utilized. Since there is a need to provide an equal and optimal accessibility to the users, the bus stops should be reviewed and relocated if found necessary and hence a study on the same is necessitated.

As a case study, Saidapet to Thiruvanmiyur route is taken. There is a lot of change in land use in and around the study route and the intensification of the land use has also gone up. For instance in Adayar a portion of land near to the canal has been converted from institutional to commercial place and two miniflyovers have been built along the study route, one in Adayar intersection and another in Ganthimandabam. These factors vouches for chosing Saidapet – Thiruvanmiyur route as the study route.

3. OBJECTIVE

The objectives of the paper are,

- To describe the concept of bus stop rationalization and criteria behind the same.
- To apply Geographical Information System for analyzing and to draw inferences and findings.

Based on the findings, if warranted, the bus stops in the study route will be proposed for relocation and a proposal for installing new bus stops can also be arrived at.

4. GEOGRAPHICAL INFORMATION SYSTEM (GIS)

Geographical Information System is a computer based information system used to digitally represent and analyse the geographic details present on the earth surface and the events (non-spatial attributes linked to the geography under study) that are taking place on it. The meaning to represent digitally is to convert analog (smooth line) into a digital form.

“Every object present on the earth can be geo-referenced”, is the fundamental key of associating any database to GIS. Here, term ‘database, is a collection of information about themes and their relationships to each other, and ‘geo-referencing’ refers to the location of a layer or coverage in space defined by the coordinate referencing system.

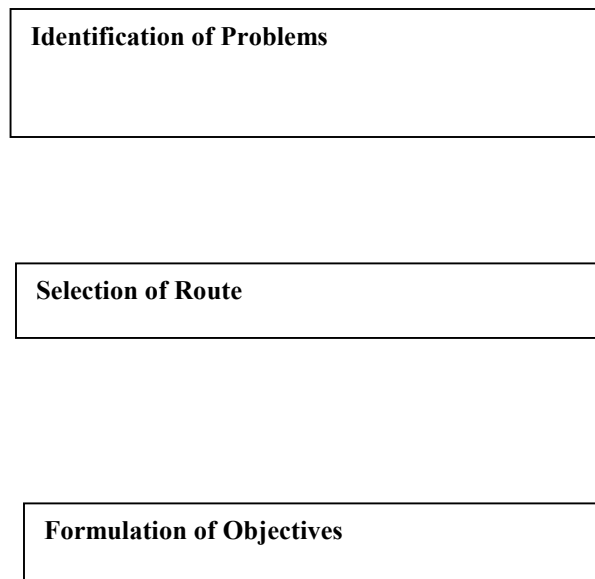
Geographical Information Systems are used to perform a number of fundamental spacial analysis operations. Such operations can use any number of analytical processes. However all spacial analysis utilizes the topological overlay, buffer generation, feature extraction, feature merging, join and relate. Overlaying technique is the one used for the study.

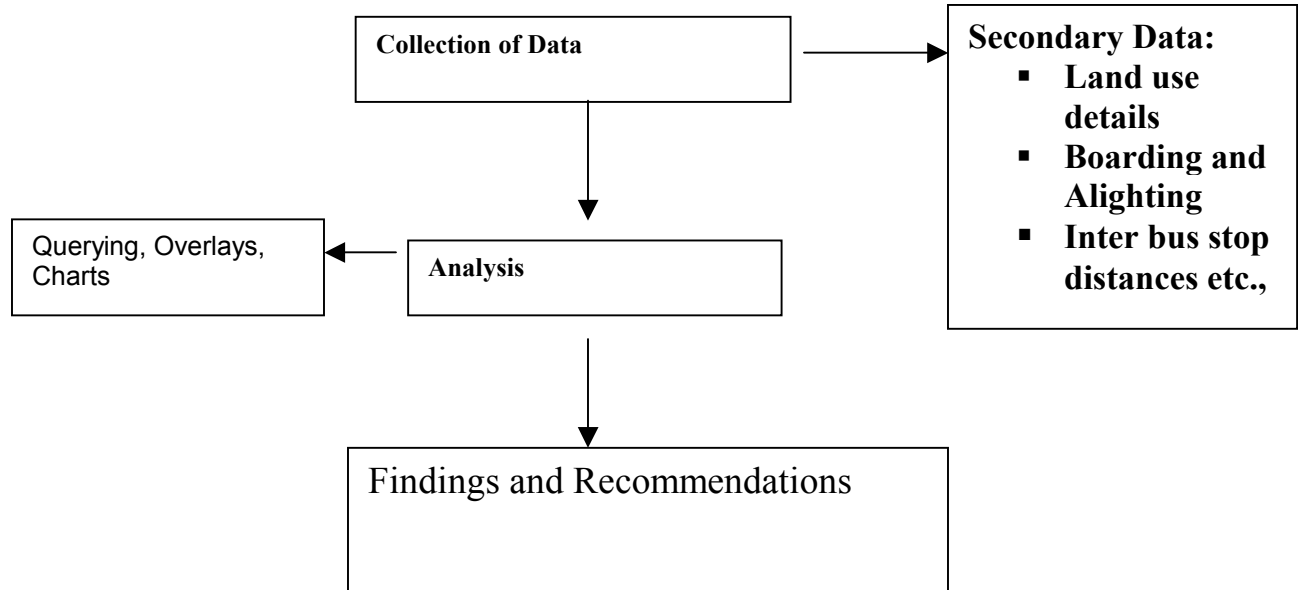
Overlaying Technique

Overlaying Technique is one in which each layers containing separate themes and all or any of the layers can be super-imposed on one another as the case may be and can be analysed. All kind of operations like union, intersection, merging etc., can be made use of for analysis purpose.

5. METHODOLOGY

The following flow chart gives a brief description of the methodology carried out in the study.





6. COLLECTION OF DATA

All the data required for the study namely the name of the bus-stops, location, passenger density of the bus-stops, the land use details in and around the bus-stops, the inter bus stop distance were taken as secondary data from the mini-project done by the Under Graduate students (BE Civil) of Anna University.

Land Use Pattern:

Land-use is a function of transport and vice versa. Since both are mutually dependent on one another, it is important to study how the land use developments influence the trip or traffic generation characteristics along the study route. As such, the general land use distribution and the concentration of activity centers at a distance of 750 meters from the road along the selected route have been taken into consideration.

Passenger Density:

It corresponds to the number of passengers boarding and alighting at each bus stop along the selected route for a duration of one hour.

Inter-Bus Stop Distance:

The distance between two consecutive bus stops is one of factors that has to be taken into consideration for rationalization of bus stops. The maximum preferable distance of travel by man by walk is around 500m. Hence the existing bus stops has to checked whether their inter-bus stop distance is such that people can reach them with ease. The inter-bus stop distance cannot be too large or too small.

Accessibility of the passengers:

This refers to the accessible distance of the bus stops for the passengers, it also refers to the location of primary residential or mixed residential places from the bus stops because these type of places are the one which fetches more passengers for the bus stops.

7. STEPS IN ARC VIEW

The steps involved in Arc View (GIS) for querying and conducting analysis is listed below,

1. Scanning
2. Digitizing
3. Creating different Themes
4. Creating Attribute Tables
5. Overlaying
6. Analysis

Scanning:

The map for the area chosen for the study, here, the Saidapet – Thiruvanmiyur stretch is obtained from the concerned authority. The map is then scanned and the scanned map is copied into the computer for digitizing purpose.

Digitizing:

The scanned map is digitized with the help of the Arc View software. The complete stretch of the Saidapet – Thiruvanmiyur route is digitized carefully along with important intersections and some of the land mark features in the map.

Creating different Themes:

After digitizing the study area, different themes like ‘bus stops’ (point theme), ‘institutional’, ‘commercial’, ‘mixed residential’ land uses (all polygon theme) and ‘buffer’ (polygon theme) are created and the corresponding land uses were digitized from the land use data obtained from the CMDA and by ground inspection. The ‘bus stops’ theme is created to indicate the location of the bus stops in the study area. The ‘land use’ themes are created to represent the type of land uses in and around the bus stops. The buffer theme is created with multiple buffers around the bus stops, in this case three buffers have been created with a radius of 200m, 400m and 600m taking the bus stop as the center.

Creating Attribute Tables:

Attribute tables for each theme is created. Besides the inbuilt fields in the attribute table, for the ‘bus stops’ theme the other fields in the attribute table include the following,

- Name of the bus stop
- Passenger density in the bus stop
- Category of the bus stop (white board/yellow board stopping)
- Interval between two bus stops

Similarly for the ‘land use’ themes the fields created were rank of land use, which, is common for all types of land uses and the weight of that particular land use. For the theme study route (road) field like width of the road and for the theme buffer the field with weight of that particular buffer is created.

Overlaying:

The themes thus created are overlaid one above the other to get a complete picture of the study area. Now the view will contain the study route abutted with the different land uses, the location of all the bus stops and the buffer around each bus stop.

8. ANALYSIS

Analysis is done basically by means of querying and drawing charts.

Querying:

Querying is done to retrieve a specific data from the attribute tables. A query request is made as per the user's need and desire. The result of a query is always accompanied with a change in the visual representation of the view in way of highlighting or change in colour of the features in the theme, which suits the query and the records correspondingly will be highlighted. Queries help in deciding on a particular issue or in decision-making and is can also form part of an analysis.

Some of the queries that can be made in the study are listed below,

- Bus stops with specified passenger density
- ([Pass_densi] >= 200)
- Bus stops spaced lesser or more than a specified limit
- ([Dist_after] <= 400)
- Bus stops meant for LSS
- [Yellow_boa] = "Y"
- Bus stops with a specified passenger density and with a specified interval and meant for LSS, this is a typical complex query where in more than one criteria has to be satisfied.
- ([Pass_densi] >= 250) and ([Dist_after] >= 400) and ([Yellow_boa] = "Y")

Charts:

Charts are created with the inbuilt feature provided in the ArcView software. They are created to compare and arrive at findings which may be helpful for setting out the recommendations. The charts created in the study include the following,

- Chart for passenger density for all the bus stops located for going towards Thiruvanmiyur and Saidapet each separately.
- Chart for inter bus-stop distance for all the bus stops located for going towards Thiruvanmiyur and Saidapet each separately.

9. OBSERVATIONS FROM THE ANALYSIS:

From the analysis it was found that the following bus stops need to be relocated or removed as the case may be because of the reasons attached here under, the bus stops are,

Court – because the inter bus stop distance is only 150m and the passenger density is far low (105) when compared to other bus stops.

HRS - because the passenger density is poor (89) and inter bus stop distance is low (275m).

CLRI – because the passenger density is very low (25) and the distance from the next bus stop is low (200m) and

Anna university bus stop situated in the direction-towards saidapet which is not in use may also be removed.

10. CONCLUSION

The three bus stops which has not satisfied the criteria set for rationalisation can be removed. The analysis in ArcView can be made by other means like ranking and weighting method in overlay analysis which would be more apt and will be more representational but due to time constraint that analysis was not adopted in the study. Hence by means of querying and creating charts the analysis is done and the findings and recommendation are given.

11. FUTURE SCOPE OF THE STUDY

As mentioned in the conclusion the full use of ArcView can be realized when a ranking and weighting method is adopted as against the querying. By this, each bus stops will get a rank based on certain criteria and those bus stops below a certain rank can be regarded as the one which needs to be relocated or removed. Ranking and weighting method would be more apt when it is used for a larger study area, say for instance the entire chennai city where in the bus stops would be in hundreds and manual rationalization of bus stops would be tedious.