



Allocation Model of Rail Transportation Stations in GIS Environment

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(Received 14 April 2008; Accepted 29 November 2011)

ABSTRACT

In this paper, a GIS based model for locating urban rail stations is suggested. The Purpose of the model is maximizing the number of passengers who are attracted to the rail. The model at first generates different combinations of stations along the rail line. Following that, the model evaluates the rail trip attraction from the station-covered areas in each combination of stations. Finally, the model prioritizes the location and combinations of stations. Based on this, the optimized locations of stations are determinable. The suggested model considers local conditions, user characteristics and rail specifications.

KEYWORDS

GIS, Rail Line, Rail Trip, Combinations of Stations along the Rail Line, Rail Station

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1. INTRODUCTION

The Regional Planning Commission has received a grant from the Department of Transportation to conduct a Rail Station Location and Design Analysis along the Railroad line [1].

Funding for the study is provided through the Transportation, Community and System Preservation Program (TCSP). TCSP goals which will be achieved through this project include:

- Improving the efficiency of the transportation system.
- Reducing environmental impacts of transportation.
- Reducing the need for costly future public infrastructure investments.
- Ensuring efficient access to jobs, services, and centers of trade.
- Examining community development patterns and identifying strategies to encourage private sector development patterns and investments that support these goals [3].

2. STUDIES

Locating stations on a designated rail transit corridor is one of the most important steps in designing urban rail systems. To measure population coverage amount through stations, one of the methods is to utilize centrally united geometric shapes by reducing attraction indices (with distance increase from the station) [4].

Planners usually utilize The Presented information for urban statistical areas (population blocks) to assess population under the coverage of each station.

Each statistical area is a polygon and the users are attracted according to the attraction model through one station.

3. ASSUMING

$$C = \{c_h: h=1, \dots, H\}$$

Which C= sum of statistical areas

The Coverage of R(i) which is generated by station si is defined as this relation :

$$R(i) = \sum_{h=1}^H \sum_{k=1}^K \frac{a\rho_h}{r_k^2} Area((B_k \setminus B_{(k-1)}) \cap c_h); \quad i=1, \dots, n$$

k=index loop and K is number of loop of each station. One of the most important shortcomings of the attraction model is that it ignores trip demand from station to station.

It should be noted that if a person travels from north to south, attraction through the station from east to west would not be possible.

To solve this problem, utilizing the pattern of origin-destination trips was proposed in calculations of the numbers of attracted trips by the stations. To combine the passenger's origin-destination with the conception of stations coverage, Mesa & Ortega presented a model. In this model, areas under coverage of the station are divided through centrally united loops to smaller elements. Each of these elements is appropriate to share its surface from

the total zone area and the inverse square of distance from the station is effective in the travel exchange between stations.

In this model it is assumed that t(lm)= number of forecasted trips which are exchanged between trip generation area, Z(l) and attraction area Z(m).

Each station couple (i,j) holds a related matrix namely k*k which is shown by ODij.

Each member of this matrix ODij(k,k') shows weight summation of amounts tem for all (l,m=1, ... ,L) which shows number of attracted trips. From loop (k) of (i) station to loop (k') of (j) station.

Weights are defined considering attraction radius rk& rk' (respectively at origin & destination station). The amounts of ODij (k, k') are determined from this relation:

$$OD_{ij}(k, k') = \sum_{l,m=1, (l \neq m)}^H \left(\frac{a^2}{r_k^2 r_{k'}^2} \frac{Area((B_{ik} \setminus B_{i(k-1)}) \cap z_l)}{Area(z_l)} \times \frac{Area((B_{jk'} \setminus B_{j(k'-1)}) \cap z_m)}{Area(z_m)} t_{lm} \right)$$

Therefore, the trips under coverage of fij by a couple of different stations (si, sj) could be determined by summation of all matrix members.

$$f_{ij} = \sum_{k, k'} OD_{ij}(k, k')$$

Among shortcomings of Mesa, the Ortega model is the method of giving weights ... coverage loops which are undertaken in proportion with the square of distance. [2]

4. CONCLUSION

The main objective of this essay is to present a new model for locating urban railway transport stations. This model can resolve the problem in real dimensions utilizing geographic information systems.

Among the innovations of this essay is the appropriate combination of factors effecting stations location. Among the most important factors of the proposed model of this essay, is the elimination of a number of assumptions & substituting the real simulations which has led to more appropriate explanation of the system performance.

In this model, an attracted demand by the stations utilizing the demand diversion function (proportionate to travel time improvement utilizing the rail system) has been estimated.

Categorization of the covered areas based upon real travel time has been undertaken which are among the most important distinction factors of the proposed model with the previous models in this context.

The model after processing the inputs presents the best combinations or alignments of stations according to priority arrangements as outputs.

5. REFERENCES

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