

IMPLEMENTATION OF GEOGRAPHICAL INFORMATION SYSTEM IN MATERIAL MANAGEMENT AND SUPPLIER SELECTION IN THANE CITY – A CASE STUDY

RASHMI P. RANA

Department of Civil Engineering, TSSM'S Bhivarabai College Of Engineering and Research Pune, India,
rashmirana1490@gmail.com

DR. G. A. HINGE

Department of Civil Engineering, TSSM'S Bhivarabai College of Engineering and Research Pune, India

ABSTRACT:

Material cost contributes 50% to 60% of the total cost of the project. Thus material forms the single largest component of the total cost of the construction activities. Improper selection of suppliers leads to problems related to material price, delivery, communication, quality, availability of materials on time etc. and its adverse effect on the cost of project. Thus, there arises the need of ideal supplier for avoiding time and cost overrun. It can be possible to select the ideal supplier with the help of several supplier selection methods but these traditional methods fails to collect correct information of all the suppliers also it takes more time to collect such information manually. With the help of data base management tools the collection of required supplier data like personal details, cost of materials, quantity, quality, delivery address, location, discount, transportation facility, communication facility etc. would be less or no time consuming. Hence GIS is a powerful set of tools for collecting, storing and quantifying all data of all suppliers and easily screen all suppliers in very short time. This paper suggest that the proposed Arc GIS 10.0 based methodology may replace the manual methods to extract supplier's information from the available data base, locate location of suppliers and ideal suppliers by developing queries in very short time.

KEYWORDS: Material management; supplier selection; Arc GIS.

I. INTRODUCTION:

Today, the construction industry is an integral part of the growing Indian economy. Material management plays an important role in construction industry and in order to select most ideal material in the required time, there is a need of best material supplier. Thus the use of computer based information system may help in

reducing the redundancy as well as saving time and cost. [1]

A. MATERIALS MANAGEMENT:

Material management is simply the process by which an organisation is supplied with the goods and services that it needs to achieve its objectives of buying, storage and movement of materials.[2] The goal of material management is to insure that construction materials are available at their point of use when needed.[1] Hence efficient procurement of material represents a key role in the successful completion of the work.[3] Thus materials management is the system for planning and controlling all the efforts necessary to ensure that the correct quality and quantity of materials are properly specified in a timely manner, are obtained at a reasonable cost and most importantly are available at the point of use when required.[4] Proper management of procuring materials is critical and should be done carefully as any materials surpluses or shortages will delay the project and hence affects the overall project costs. Efficient material management results in substantial savings in project cost.

B. SUPPLIER SELECTION:

The foundation for success or failure of construction project is based on substantial supplier selection. Quality and cost of material procurement are two attributes that are directly affected by the material supplier selection process. [5] In order to maintain these attributes the supplier selection criteria should be well defined. Thus there is a lot of significance of maintaining strong relationship with suppliers to stand in competition with today's construction environment. A trade-off between tangible and intangible criteria is important in selecting the best supplier. [5]

C. CRITICAL SUCCESS FACTORS FOR SUPPLIER SELECTION:

a) Quality of materials

- b) Quantity of materials
- c) Price of materials
- d) Availability of materials
- e) Delivery service
- f) Technical capability
- g) Financial strength
- h) Geographical location
- i) Reputation
- j) Management and organisation
- k) Other factors [6].

- 6. Query and analysis
- 7. Visualization [10].

D. MAJOR STEPS FOR SUPPLIER SELECTION:

There are seven different steps on the basis of which selection of suppliers is being carried out. The seven steps are listed below.

- Step 1 - Identification of the need for a specific product
- Step 2 - Identify key sourcing requirements and criteria
- Step 3 - Determine sourcing strategy
- Step 4 - Identify potential supply sources
- Step 5 - Limit suppliers in selection pool
- Step 6 - Determine method for final selection
- Step 7 - Select suppliers and reach agreement [7].

II. GEOGRAPHICAL INFORMATION SYSTEM (GIS):

A GIS is a computer system for capturing, storing, quarrying, analysing, and displaying geographic data. GIS is relatively a new branch of such technologies which is capable of managing spatial and non-spatial data. Exploring geographical information system is needed as the database is the essential part of any information system employed for construction management. A GIS tool is used for mapping and analysing spatial data. GIS activity can be grouped into spatial data input, attribute data management, data display, data exploration, data analysis and GIS modelling. [8] A GIS is a special class of information system, which can be divided into four components involving a computer system, GIS software, human expert, and the data. [9]

A. WORKING OF GIS:

GIS stores information about the world as a collection of thematic layers that can be linked together by geography. This simple but extremely powerful and versatile concept has proven valuable for solving real world problems from modelling global atmospheric circulation, to predicting rural land use, and monitoring changes in rain forest ecosystems.

- 1. Geographic references
- 2. Input of data
- 3. Map making
- 4. Manipulation of data
- 5. File management

III. CASE STUDY:

A. STUDY REGION- THANE CITY:

Thane city is one of Maharashtra's major industrial town and is a metropolitan city. The population of city is around 1,818,872 pegged by The National Decennial Census 2011. Thane City is geographically spreads over an area of 128.23sq.km. Thane City lies in the co-ordinates 19.2183° N, 72.9781° E.

B. DATA ACQUISITION:

There are more than 100 major construction suppliers available in Thane city region. This paper has limited its research on 122 major suppliers and is restricted to only sand and cement owing to its importance and availability. Data collection included personal information of suppliers like name and address, details of materials like cost, brand, quarry source, available stock, lead time, discount, and transportation, guarantee, for safety, test certificates etc.

IV. APPLICATION OF GIS MODEL:

A. PROCEDURE FOR DATABASE GENERATION:

As GIS handles both spatial and attribute data, spatial data represents geometry of the features, while attribute data is stored in the tabular form and describes the characteristics of the different features. In this paper an attempt is made to utilize this aspect of GIS for storing, quarrying, analysing and displaying geographic data. The step-wise procedure followed for its effective use in this case study is mentioned below:

- 1. Geo-registering of Thane city map
 - Step 1: Create Thane city map file
 - Step 2: Open image file of Thane city map
 - Step 3: Add the tic marks to registered the map
 - Step 4: Calculate error
- 2. Create different Layers in Thane city map
 - a. External boundary layer of Thane city – Polygon Layer
 - b. Roads network and Railway line Layers of Thane city – Segment Layer
 - c. Supplier's location Layer in Thane city – Point Layer
- 3. Digitization of all layers
- 4. Editing map
- 5. Polygon formation
- 6. Adding labels
- 7. Table creation of supplier's location layer
- 8. Preparation of Data base of supplier's data

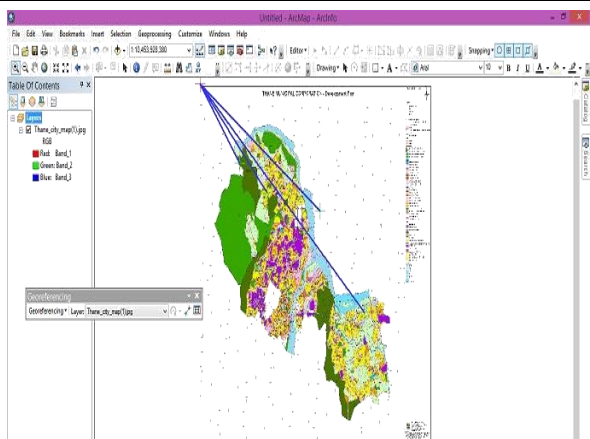


Fig. 1 Thane city opened in Arc GIS software and Geo-registered of Thane city map

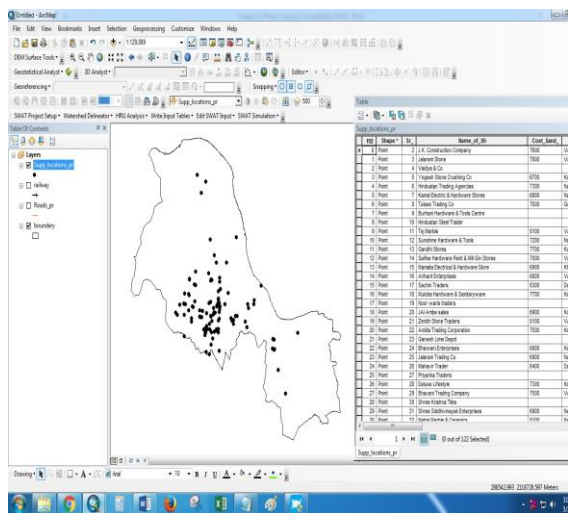


Fig. 2 Digitized map shows suppliers location and Thane city boundary layers and table creation of supplier location layer of supplier's data.

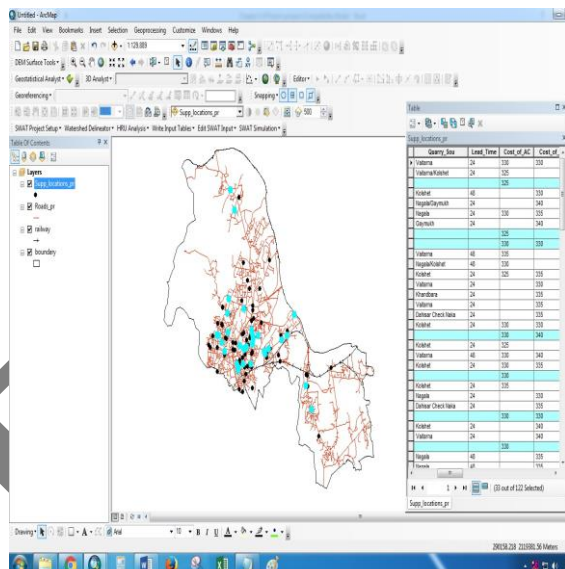
B. GENERATION OF QUERIES:

The database file of Thane city map is used in vector GIS. Vector query module basically used for running query and find out best solution. It allows you to define a spatial query against SQL spatial types in a spatial database to create a layer (query layer) that can be viewed and queried. Vector query is very important to Thane city map vector file. By running query find the appropriate solution which will provide ease for supplier selection process. With the help of this query find out minimum cost of materials, available stock, lead time etc. in very few time. Also it facilitates comparison of more suppliers and evaluation of each supplier.

QUERY NO. 1

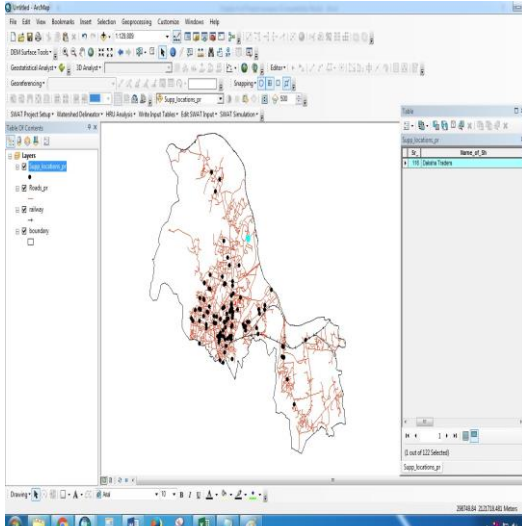
Find out lead time of cement less than 18 hrs and Condition for this query is "lead time of cement < 18"

and result of this query is 33 out of 122 suppliers having lead time less than 18 hrs. This query is very important because information of lead time play an important role in delivery of materials and supplier selection process. It is very important when there is emergency requirement of material. This query and data gives solution in very less time.



QUERYNO.3

Find out detail information of any one supplier in one click for this condition of query is "Name of shop = Daksha Traders" and result of this query shows exactly that supplier with location and all detail information.



There are several methods for evaluation and supplier selection but all methods involves collection of all suppliers data everytime. Thus it is a very time consuming process compare to use of stored data in GIS.

Vector queries gives very helpful and useful results. As per the requirement and condition it shows and categorised suppliers data in a very short time. So it helps to reduce the time of supplier selection process as well as to select best supplier.

VI.CONCLUSION:

For obtaining good quality materials the efficient selection of suppliers is very essential. Supplier selection and its evaluation is usually a main issue. Construction Company requires a tool which is interactive, reliable and affordable in order to make the appropriate decision. Thus GIS is a very effective tool to avoid these problems and is very helpful to integrate and categorised supplier's data and also provides best solution in a very short time thus reduces total project cost. There is a scope for further research in finding the nearest and best suppliers from the construction site and the best route between the supplier and construction site with the help of GIS software.

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