



# NETWORK ANALYSIS FOR URBAN EMERGENCY SERVICES IN SOLAPUR CITY, INDIA: A GEOINFORMATIC APPROACH

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## Abstract

Industrialization triggers Urbanization and urban area developed by migration of people from rural to urban and urban to urban area. The stage and rate of development of the city is largely governed on the road connectivity within city. The accessibility of any urban facility such as Banks, ATM centres, Fire stations, Ambulance, School and Colleges, Hospitals and Blood banks, Police station etc. are largely depend on road. Hence, the quality and quantity of road network handle the key role in providing emergency services to the city like hospital, fire station, ambulance service and police station etc. Geoinformatics plays vital role through providing network analysis for better emergency facility and optimal route and demarcate the service area for accessibility of emergency services in a short time span. The precise aim of this present study is to find out the optimal path and service area for better accessibility of emergency services with respect to road connectivity in Solapur city. Google earth data and Survey of India (SOI) toposheets were used to making base map. GPS survey carried out for collected the various emergency services like Hospital and fire station within city, network analysis used for find out the optimal path for rapidly accessible of emergency service area demarcated for the identification of zones of the specific emergency service with respect to time and road network. Analysis resulted

that, there is less availability of emergency services in the Solapur city and need to establishment of new hospitals, fire stations and Geoinformatic techniques has powerful source for real time data and helpful in planning for urban development.

**Key Words: GPS, Service Area, Optimal Path**

## Introduction

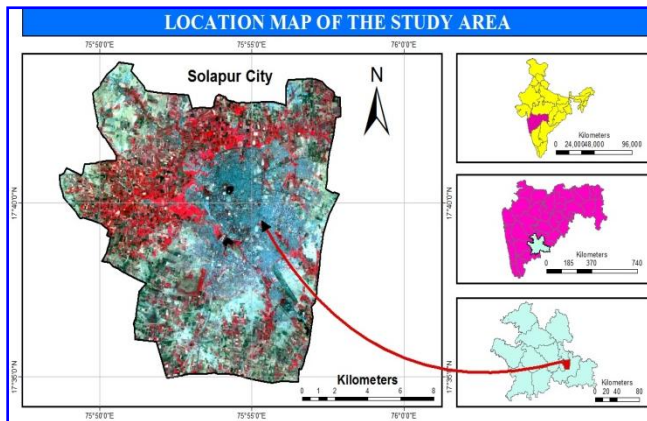
Urbanization is an index of transformation from traditional rural economy to modern industrial one. It is a progressive concentration (Davis, 1965) of population in urban unit. At the moment, India is one among the country of low level of urbanization. Number of urban agglomeration/town has grown from the year 1827 in the year 1901 to 5161 in the year 2001. During the last fifty years the population of India has grown two-and-a-half times, but urban India has grown nearly five times. In 2001, 306.9 million Indians (30.5%) were living in nearly 3700 towns and cities spread across the 4 country, compared to 62.4 million (17.3%) who lived in urban areas in 1951. The government of India has taken an important initiative to strengthen municipal governance, is the enactment of the Constitution (74th Amendment) Act (CAA), 1992. The traditional role of Municipal Corporation had been one of providing basic Utilities of civilian for their happy social life. Service includes water supply, sanitation,

roads, street-lights, health service and maintenance of public places. In addition, they performed certain regulatory functions relating construction of buildings, public areas and commercial places for public wellbeing and providing emergency services like Banks, ATM centres, Fire stations, Ambulance, School and Colleges, Hospitals and Blood banks, Police station and shopping malls, Entertainment locations establishments in a proper place in city. In addition, as each element plays its own role in the formation of urban structure, every city possesses a unique structure with its own momentum, presenting entities that are occasionally regarded as too diverse for a single topical study. Nevertheless, “geography is not about the precise analysis of particular service areas. it is more concerned with the ways in which these relationships are reflected in the functional and physical structure of the town” (Dickinson, 1959).

### Study Area

Solapur is situated on the south-eastern border of Maharashtra State adjoining Karnataka. The city is located on the East side of Maharashtra between 17° 40" N Latitude and 75° 54" E Longitude. The city covers an area of 180.33 sq km.

**Figure 1: Location Map of Solapur City**



## Database & Methodology

- **Spatial Data**

Sr. No.	Used Data	Spatial Reference	Data Source
1.	Toposheet 47 o/14	1:50,000	Survey of India
2.	Cadastral Map	1:10,000	Solapur Municipal Corporation

**Table: 1. Spatial Data**

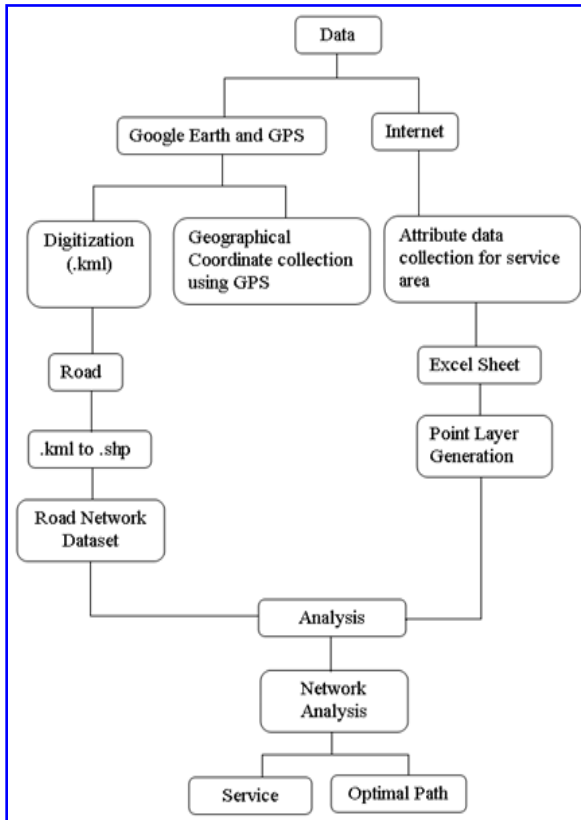
- **Non-Spatial Data**

**Table: 2. Non-Spatial Data**

Sr. No.	Data Used	Data source
1	Prabhag Name of city	Solapur Municipal Corporation
2	Attribute Data: Service Area	www.indiacom.com

In the present research methodology, both spatial and non-spatial data integrated in GIS environment. First road network map prepared on Google Earth and GPS survey carried out for collection of utility services in the city. Both Google map and GPS survey data convert into shape file using Global Mapper 12 software and bring these file into ArcGIS 9.3 desktop application. Final analysis carried out using Network Analysis tool in ArcGIS 9.3 and calculate Optimal path and service area of various utility services in the city with respect to time and speed of vehicle. Figure 3. highlight the general research methodology.

Figure 2: Research Methodology Chart



With the use of remote sensing & GIS technology we can calculate accurate distance & time from incident to facility. Here calculate distance (meter) & time (minute) from incident( Bus Stop) to facility(Hospital). Here we consider the average speed of vehicle have 30Km./hr . In Solapur city Shivaji Chowk Bus Stop is main Bus Stop from this incident Dr. Chidgupkar Hospital is very nearest. The distance between this two place is 747.401694 meter & 1.494803 minute time necessary for cover this distance. Then, Sidheshwar Cancer Hospital is far way from facility (Hospital) The distance between this two place is 4778.255535meter & 9.556511minute time necessary for cover this distance. Table No: 3 calculate the distance (meter) & time (minute) from incident( Bus Stop) to facility(Hospital) in Solapur city.

**Service Area for Hospitals:**

Here calculate the service area of hospitals with using remote sensing & GIS technology. Service area divided in to four categories (0-500, 500-1000, 1000-2000 & 2000-3000 meter ) & calculate total area & time distance. Nearly, 18995 sq km. area cover in 0-500 meter service area zone , 5658 sq km. area cover in 0-500 meter service area zone . 4140 sq km. area cover in 500-1000 meter service area zone & 57426 sq km. area cover in 1000-2000 meter service area zone.

**Result and Discussion:  
Optimal Path for Hospital Services:**

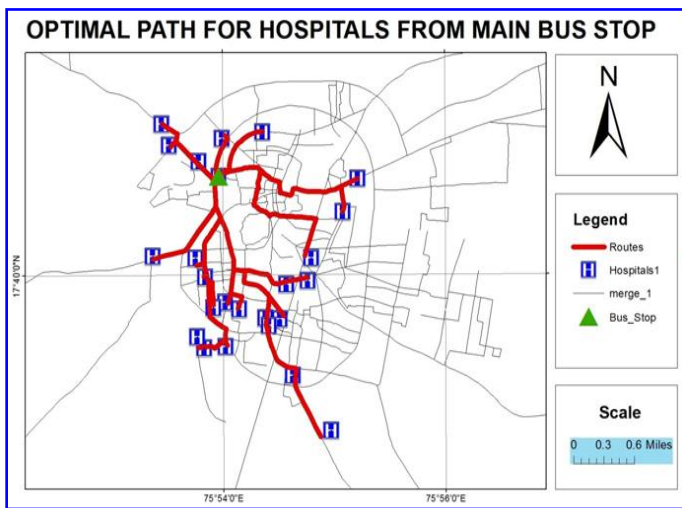


Figure 3: Optimal path for ambulance Service

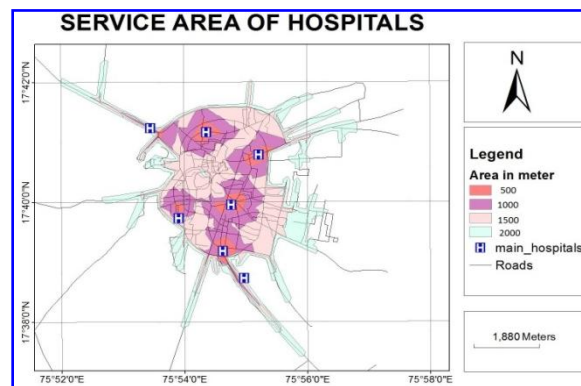
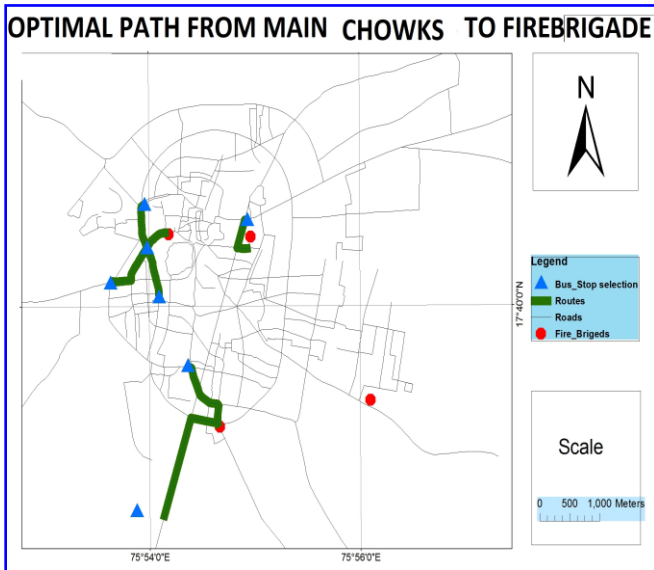


Figure 4: Service Area of Hospital

**Optimal path for Fire Brigade:**

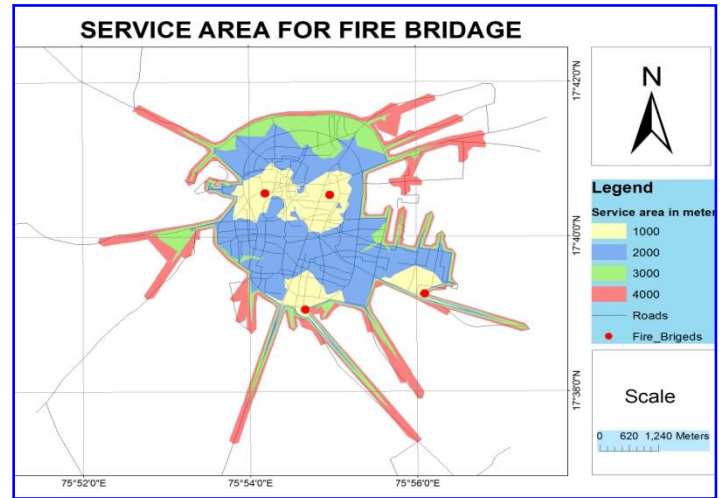


**Figure 5: Optimal path of Fire Brigade**

Here draw optimal path from fire brigade to main chowk . The distance between Saraswati chowk Bus Stop to first fire brigade is very optimal or short compare to other that is 445.296254 meter distance & want 0.890593 minute time for cover this distance. The distance between Ashok Nagar Bus Stop is much away from second fire brigade compare to other that is 2060.44582 meter distance & want 4.120892 minute time for cover this distance.

**Service Area for Fire Brigade:**

In Solapur four area found. Here we calculate the service area of fire brigade with breakage 1000, 2000, 3000 & 4000 meter. As well as calculate the time in meter for cover this particular area. For 1000 meter area travelling wants two minute time. In Solapur city want 12 to 14 minute’s time for provide fire brigade service to outer side of city. Then 6 to 8 minute’s time want for middle area of city.



**Figure 6: Service Area of Fire Brigade**

**Conclusion & Suggestion:**

In Solapur city several emergency services like blood banks, hospitals and fire brigades etc. mainly found in the very few in number and concentrated at city core area which took more time for providing emergency services.

Dr. Chidgupkar Hospital is very nearest from CBD. The distance between this two place is 747.401694 meter & 1.494803 minute time necessary for cover this distance. Then, Sidheshwar Cancer Hospital is far way from facility (Hospital) The distance between this two place is 4778.255535meter & 9.556511minute time necessary for cover this distance. Most hospitals lie within 1000-2000 meter i.e. 57426 sq m.

In Suggestion, there is needed more hospitals, fire stations and blood bank at the peripheral region of the Solapur city for providing better emergency services to the civilians.

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