Road network analysis in Neyveli Township, Cuddalore District by using Quantum GIS

K. Ilayaraja
Department of Civil Engineering
Bharath University, Selaiyur, Chennai -73
Email: ilayaraja1981@yahoo.com

ABSTRACT

The entire road network is captured by using the open layers plugin. The road network was digitized by using Quantum GIS and analysis is carried out by using Road graph plugin analysis. This study is carried out with an idea to connect the available roads networks in Neyveli Township to identify the shortest path. The shortest path between any two points within the road network is determined using the tool shortest path in Quantum GIS. This database can be used many solutions to develop new service area closest facility and traffic control.

Keywords: Quantum GIS, Road network, Shortest path, Neyveli, Cuddalore District

1. Introduction

According to Ullman (1954) transportation is defined as a measure of relations between areas and therefore is an essential part of geography. GIS can be a useful tool in the planning of road networks in new developments. Gopala Raju et al. (2012) have studied the road network in Visakhapatnam city using geographical information systems. Shortest path algorithm such as Dijkstra is the most common algorithm used in finding shortest path which has a lower computational complexity (Zhan & Noon 1998). Sekine (2003) determined the shortest path distance from each residential point to the nearest clinic which is measured on the actual road network using ArcView. Now-a-days there is a rapid development of information technology which can be used to support the mobility of people, vehicles and goods. According to Dueker and Tu Ton (2000), Organisations which have ownership and maintenance responsibilities for transposition infrastructure use the transport system in their business also the police and the delivery services, post office, tourism etc., often rely on data integrators to provide transportation data in the form of maps and network for location, path analysis and routing. In addition to shortest path, path queries processing over transportation has also been studied by Yun-Wu Huang et al (2000). Route planning for transportation road networks has been studied intensively by Yu-Li Chou et al (1998) and Sungwon Jung & Sakti Pramanik (2002). GIS consists of data, software, hardware, personnel and arrangements for collecting, storing, analyzing and disseminating informations about areas of the Earth (Dueker and Kjerne, 1989). Network analysis is one the function in GIS to identify the road direction either shortest or fastest path. Therefore this study is mainly focused on the shortest path where the criteria taken under consideration are the length and traffic speed of the road.

2. Study area

Neyveli is a mining and power generation township in Cuddalore district in the Indian state of Tamil Nadu. The study area is located at 11.30° N - 79.29° E (Figure 1). Neyveli is a township in Cuddalore district just 8kms west of Vadalur. The Neyveli Township was developed after mining of lignite started under the Neyveli Lignite Corporation (NLC) in 1956. The study area covers 53 square kilometres provide around 18,000 houses for the employees. It is well connected by road along the Chennai-Thanjavur NH 45C National Highway. The basic industries on which Neyveli thrives are the lignite mines (I, II, IA) and thermal power stations (I, II & I-Extn.). The largest open-cast mines in India, with very large machinery, the lignite mines is an engineering marvel. The entire road network of the study area is about 259 kms. The possible road junction in the network is identified such as Water tank Junction (WT), Store Road (ST), Church (CH), General Hospital (GH), Muthanidikuppam Junction (MK), College (CO0) Main Bazar (MB), Kamaraj junction (KJ), Library (LIB), Skew bridge (SC), BSNL, Nehru (JN), Central Bus Stand (CBS), Guest house (GS), Eight road (ER), Thomuza (TH), Field office (FO), Puthukuppam (PK), Ashok pillar (AP), Court (CT), Murugan Koil (MKL), Acrh gate (AG) and Police station (PS) (Figure 2).

3. Materials and Methods

The entire road network is captured by using the open layers plugin. The possible road networks were digitized by using Quantum GIS and analysis is carried out by using Road graph plugin and shortest path is calculated by shortest path analysis. The roads were classified into three different classes such as National Highways, Major roads and Streets. The ID for each class are given and stored in the attribute table. The road

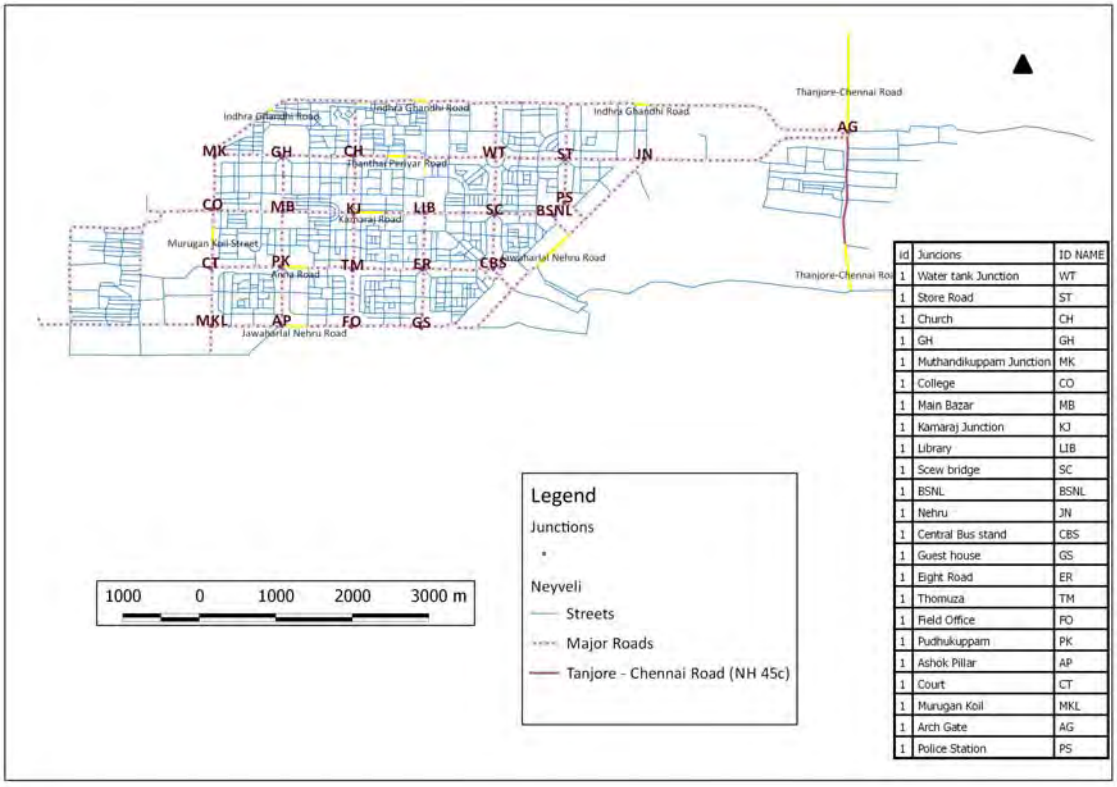
network was assigned with the speed impedance such as 80, 60 and 45 Km/h for NH, Major roads and Streets. The lengths of the road are calculated from the attribute table. The Road graph is a plugin in Quantum GIS, which calculates the shortest path between two points on any line layer and plots this path over the road network. Prior to using the plugin has to be configured, therefore the analysis was carried out by giving an approximate speed limit as 50 km/h for all the possible scenarios. The work flow of methodology is shown in the figure 3.

4. Results and Discussions

The total length road network in the study area is about 259 kms, with a count of 1740 entity. The length of the road ranges with a minimum of 0.016355 and maximum of 3.671322 Kms. The roads were classified into three different classes such as National Highways, Major roads and Streets and the ID are given as 3, 1 and 0 respectively. The actual lengths of the road were classified and the traffic speed for each road is known. Therefore the analysis was carried out by giving an approximate speed limit as 50 km/h. Therefore, shortest path is computed within the available road network of the study area for various scenarios such as one-to-one point and for an accident place to Hospital which is shown in the figure 4, 5 and 6 respectively. The total distance from on-to-one place is about 9.62634 km and the time taken to reach the place is computed as 0.175024 hours (Figure 7) which is equal to 10.50144 minutes and for the next scenario the shortest path is 10.0808 km the time taken to reach is about 0.183287 hours which is equal to 10.99722 minutes (Figure 7). In the next scenario a simple example is considered were the accident point is stated as the start location and whiles the healing place is the General hospital is taken as the second point. The total distance from accident place to the general hospital (GH) is given about 3.81169 km and the time taken to reach the place is computed as 0.0693035 hours which is equal to 4.15821 minutes (Figure 7). This study can also be used for better information by recognizing the route between the two known address, by linking the entire data base of address.

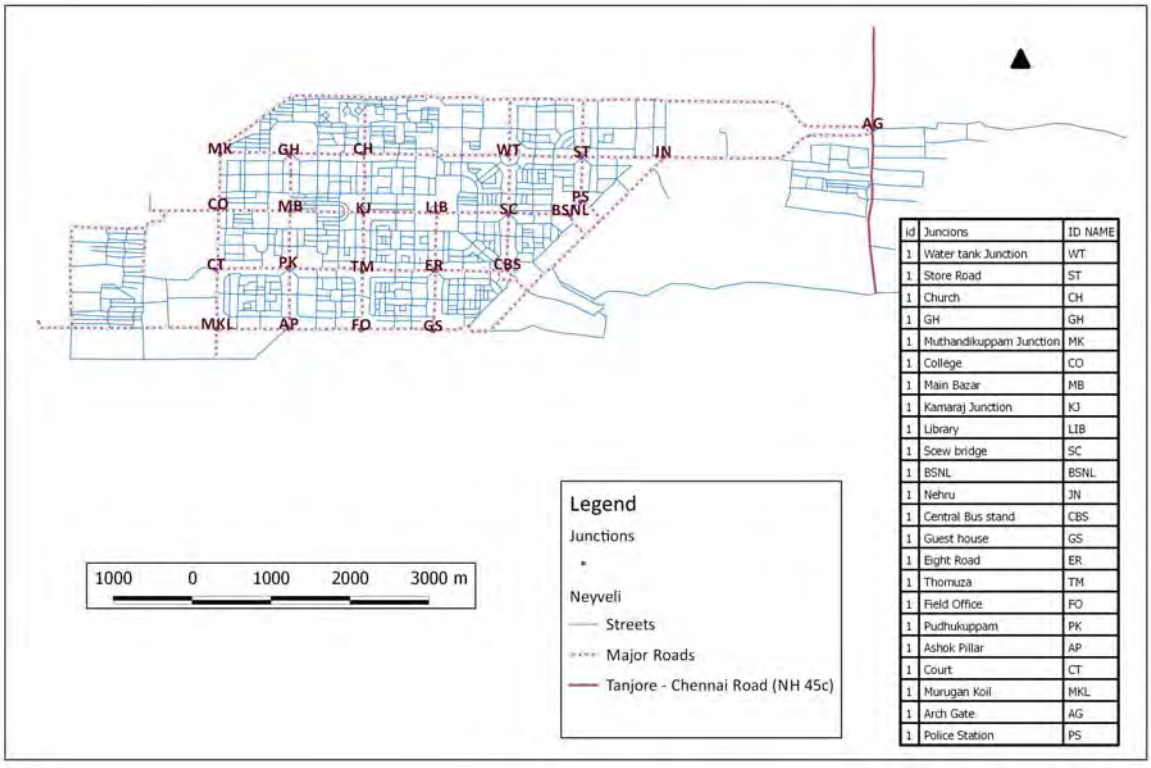
5. Conclusion

In this study the data base has been created by using Quantum GIS. The total length road network in the study area is about 259 kms, with a count of 1740 entity. The length of the road ranges with a minimum of 0.016355 and maximum of 3.671322 Kms. Quantum GIS is powerful tool in providing the details from the available data sources to support the decision making. The shortest routes for three diffent senariors are presented. This data base can be used for transport management by various organisations. Also this data base can be linked with real time traffic data were the time impedance will be varied but the length of the road will be the same.



id	Juncions	ID NAME
1	Water tank Junction	WT
1	Store Road	ST
1	Church	CH
1	GH	GH
1	Muthandikuppam Junction	MK
1	College	CO
1	Main Bazar	MB
1	Kamaraj Junction	KJ
1	Library	LIB
1	Scew bridge	SC
1	BSNL	BSNL
1	Nehru	JN
1	Central Bus stand	CBS
1	Guest house	GS
1	Eight Road	ER
1	Thomuza	TM
1	Field Office	FO
1	Pudhukuppam	PK
1	Ashok Pillar	AP
1	Court	CT
1	Murugan Koil	MKL
1	Arch Gate	AG
1	Police Station	PS

Figure 1. Base of the study area with selected road names



id	Juncions	ID NAME
1	Water tank Junction	WT
1	Store Road	ST
1	Church	CH
1	GH	GH
1	Muthandikuppam Junction	MK
1	College	CO
1	Main Bazar	MB
1	Kamaraj Junction	KJ
1	Library	LIB
1	Scew bridge	SC
1	BSNL	BSNL
1	Nehru	JN
1	Central Bus stand	CBS
1	Guest house	GS
1	Eight Road	ER
1	Thomuza	TM
1	Field Office	FO
1	Pudhukuppam	PK
1	Ashok Pillar	AP
1	Court	CT
1	Murugan Koil	MKL
1	Arch Gate	AG
1	Police Station	PS

Figure 2. Junctions in the road network

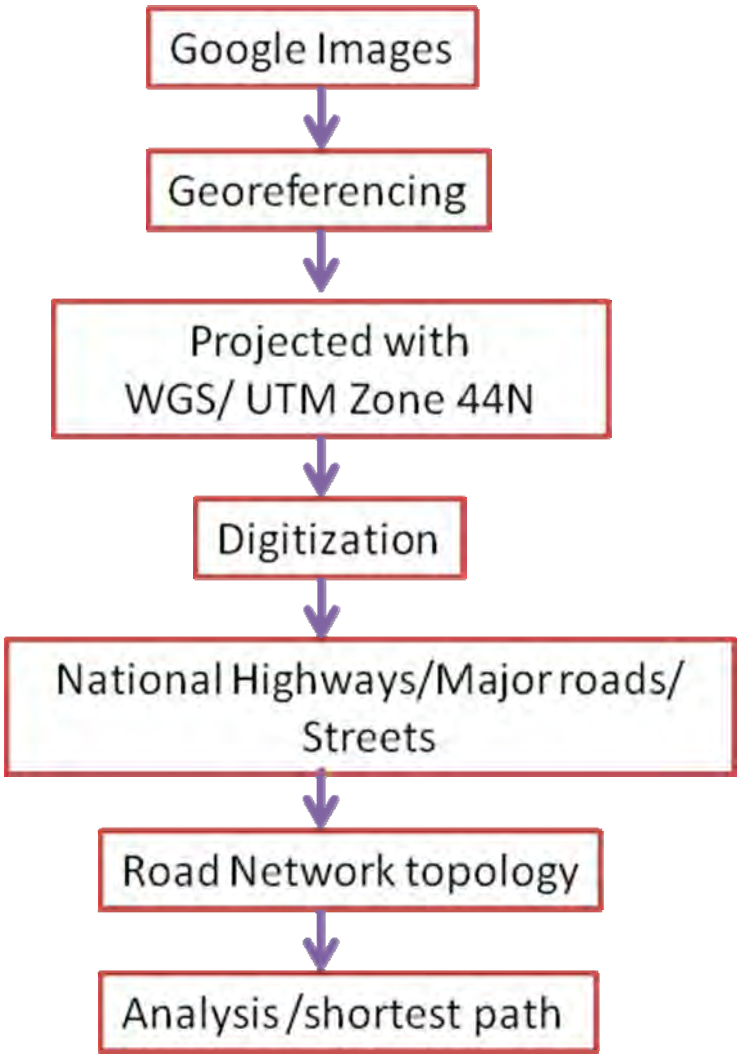
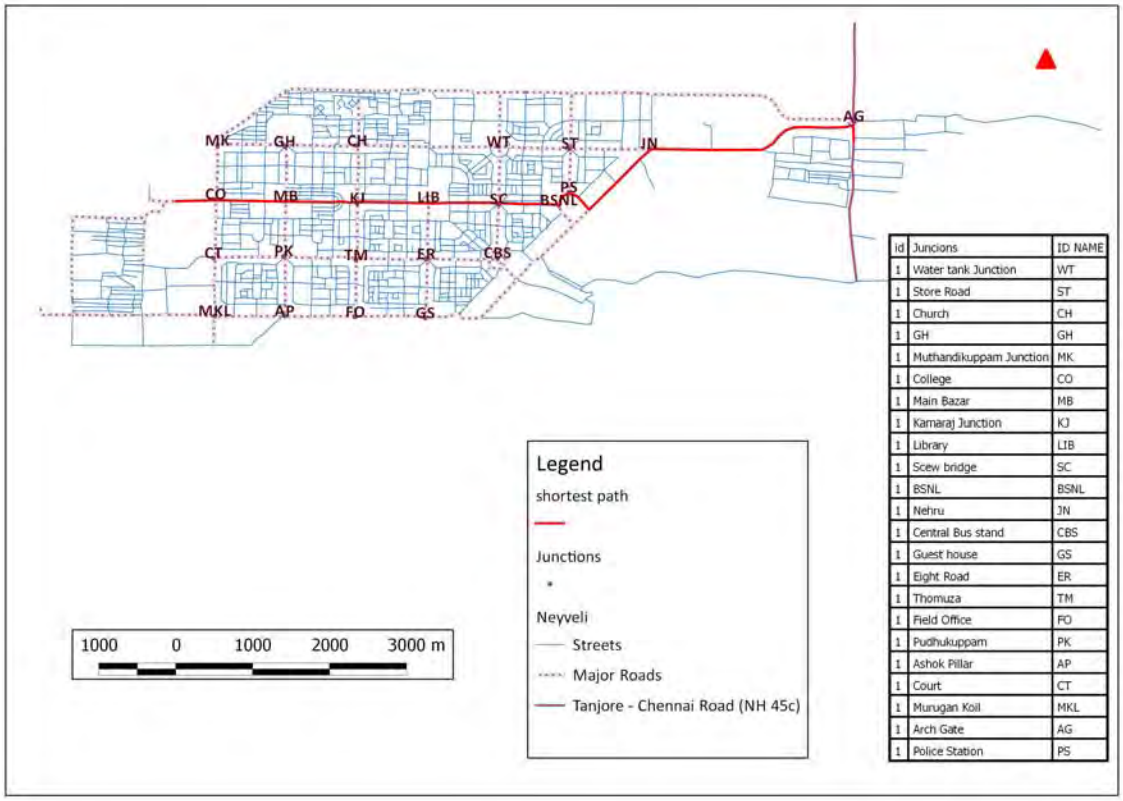
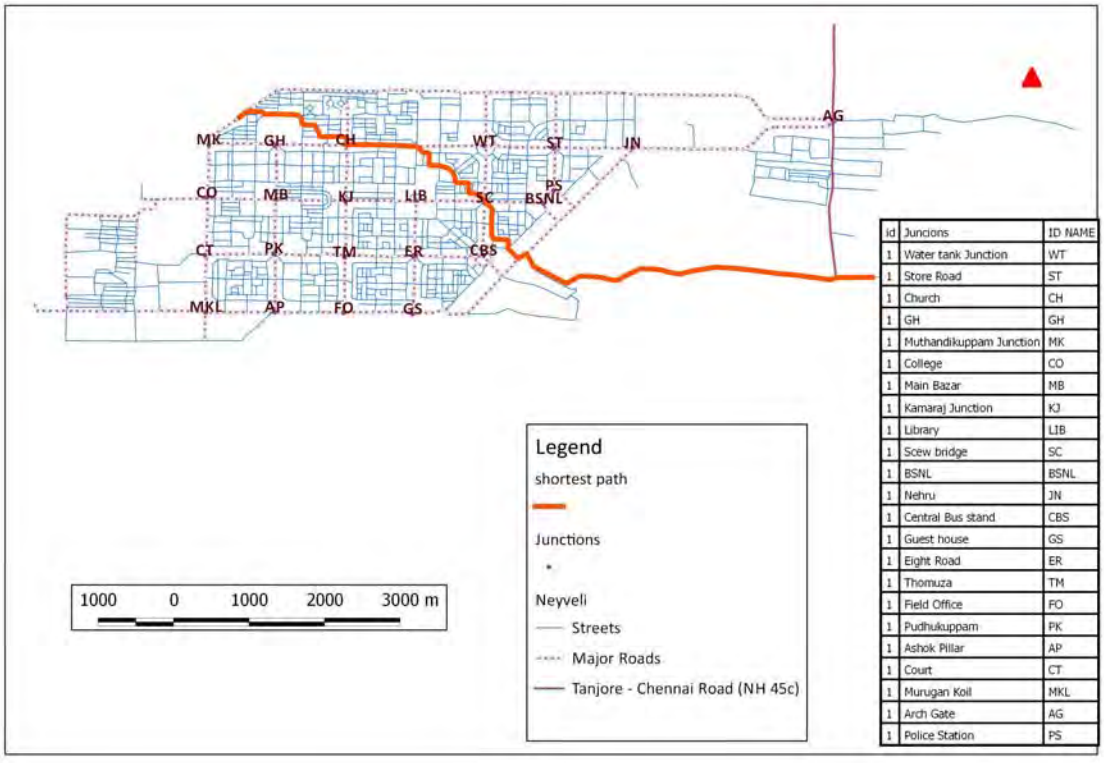


Figure 3. Flowchart of methodology



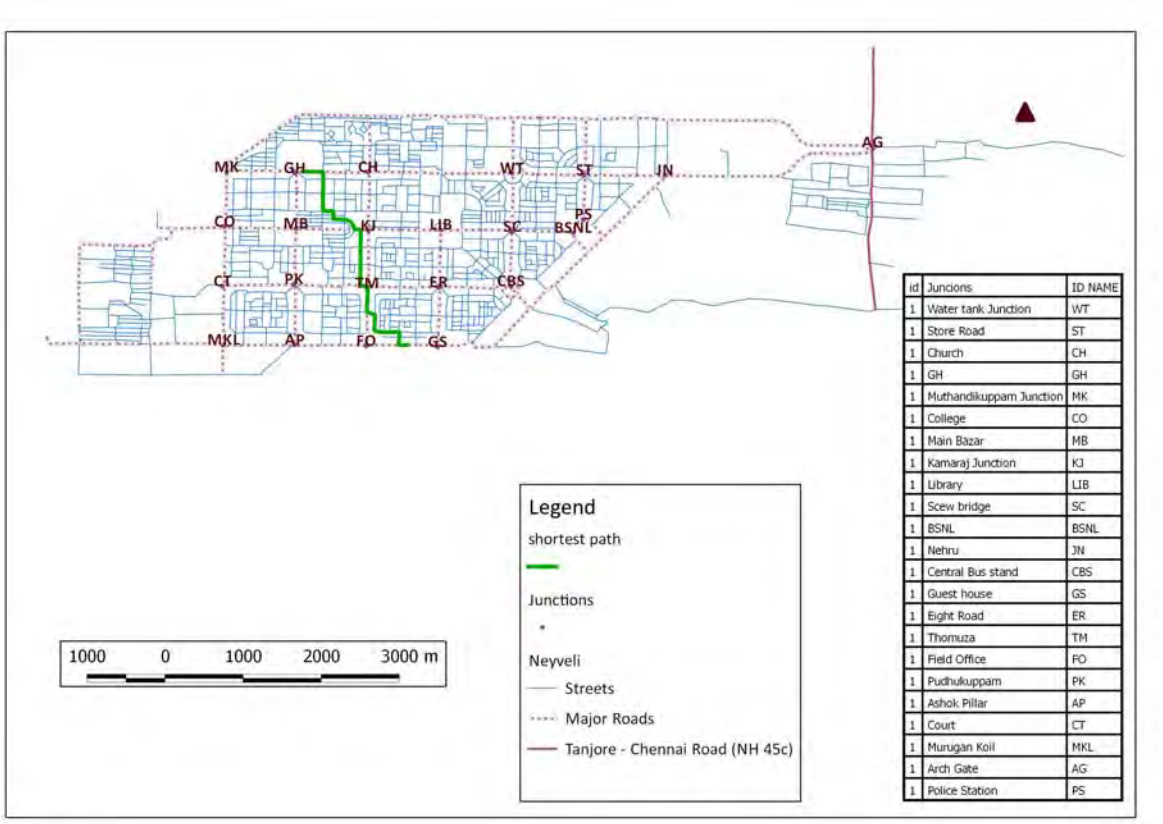
id	Juncions	ID NAME
1	Water tank Junction	WT
1	Store Road	ST
1	Church	CH
1	GH	GH
1	Muthandikuppam Junction	MK
1	College	CO
1	Main Bazar	MB
1	Kamaraj Junction	KJ
1	Library	LIB
1	Scew bridge	SC
1	BSNL	BSNL
1	Nehru	JN
1	Central Bus stand	CBS
1	Guest house	GS
1	Eight Road	ER
1	Thomuza	TM
1	Field Office	FO
1	Pudhukuppam	PK
1	Ashok Pillar	AP
1	Court	CT
1	Murugan Koil	MKL
1	Arch Gate	AG
1	Police Station	PS

Figure 4. Shortest place between seletecd two places in the road network



id	Juncions	ID NAME
1	Water tank Junction	WT
1	Store Road	ST
1	Church	CH
1	GH	GH
1	Muthandikuppam Junction	MK
1	College	CO
1	Main Bazar	MB
1	Kamaraj Junction	KJ
1	Library	LIB
1	Scew bridge	SC
1	BSNL	BSNL
1	Nehru	JN
1	Central Bus stand	CBS
1	Guest house	GS
1	Eight Road	ER
1	Thomuza	TM
1	Field Office	FO
1	Pudhukuppam	PK
1	Ashok Pillar	AP
1	Court	CT
1	Murugan Koil	MKL
1	Arch Gate	AG
1	Police Station	PS

Figure 5. Shortest place between selected two places in the road network



id	Junctions	ID NAME
1	Water tank Junction	WT
1	Store Road	ST
1	Church	CH
1	GH	GH
1	Muthandikuppam Junction	MK
1	College	CO
1	Main Bazar	MB
1	Kamaraj Junction	KJ
1	Library	LIB
1	Scew bridge	SC
1	BSNL	BSNL
1	Nehru	JN
1	Central Bus stand	CBS
1	Guest house	GS
1	Eight Road	ER
1	Thomuza	TM
1	Field Office	FO
1	Pudhukuppam	PK
1	Ashok Pillar	AP
1	Court	CT
1	Murugan Koil	MKL
1	Arch Gate	AG
1	Police Station	PS

Figure 6. Shortest path beteen accident point and hospital in the road network

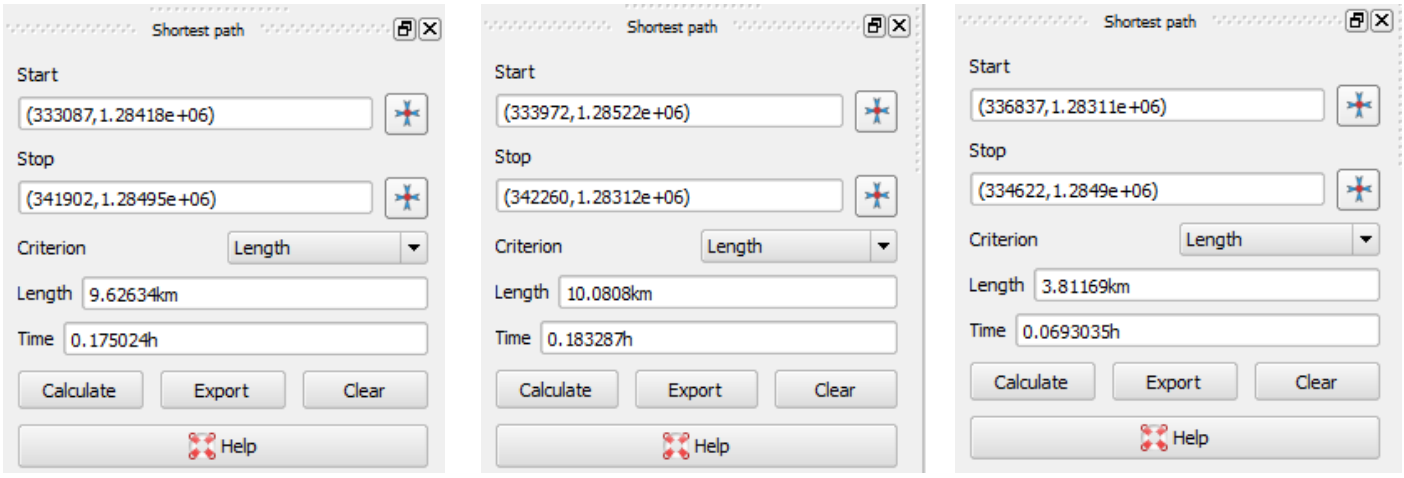


Figure 7. Length and time for various scenarios in the road network

ReferenceS

[1] Dueker K. J., Tu Ton (2000) Geographical Information Systems for Transport, In (Henscher D. A., Button K. J) *Handbook of Transport Modelling*, Pergamon; Amsterdampp. 253-268.

[2] Dueker and Kjerne (1989) Multipurpose cadastr: terms and definitions. Bethesda, MD, *American Congress of Surveying and Mapping*.

[3] Goplala Raju S.S.S.V, Durga Rani K and Balaji K.V.G.D (2012) Analysis of road network in Visakhapatnam city using geographical information susyems. Indian Journal of Innovations Dev., V(1), No. 5: 395-399.

[4] Sungwon Jung and Sakti Pramanik (2002) An efficient path computation model for hierarchically structured topographical road maps. IEEE Transactions on Knowledge and Data Engineering, 14(5):1029–1046

[5] Yun-Wu Huang, Ning Jing and Elke A. Rundensteiner (2000) Optimizing path query performance: graph clustering strategies. *Transportation Research Part C* (8): 381- 408.

[6] Yu-Li Chou, H. Edwin Romeijn, and Robert L. Smith (1998) Approximating shortest paths in large-scale networks with an application to intelligent transportation systems. INFORMS *Journal on Computing*, 10(2):163–179,

[7] Zhan, F. B., & Noon, C. E. (1998) Shortest Path Algorithms: An Evaluation using Real Road Networks. *Transportation Science* 32(1): 65-73.