# SHORTEST PATH ANALYSIS AND SERVICE AREA ALLOCATION OF AMBULANCE SERVICE IN THIRUVANANTHAPURAM CORPORATION – A GIS APPROACH

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#### INTRODUCTION

Emergency Medical services (EMS) is a network service coordinated to provide aid and medical assistance from primary response to definitive care, involving personnel trained in rescue, stabilization, transportation and advance treatment of traumatic or medical emergencies.

#### No single Emergency Management System in India

Proper Planning of Ambulances not done efficiently - route to be followed, placement of ambulances and area to be covered

 Kerala occupy a unique position in health sector in India and provide medical facilities at par with Western world, but Emergency services are not fully developed

## **AIMS AND OBJECTIVE**

- Generate a detailed vector database for the study area.
- Understand the current operating system of 108 ambulance service in the study area.
- Find the shortest path for the ambulance to reach the site of accident and back to hospital
- Generate the closest ambulance facility
- **×** Demarcate the service area of ambulance
- Evaluate the results with the current operation of 108 Ambulances

#### **STUDY AREA**

**×** Thiruvananthapuram Corporation

x Graticules - 8°21'53" to 8 °36'19" N and 76°51'21" - 77°01'40" E

Increase in Geographical extent,
Population and Accidents





Incident Number	Type of Incident
1	Accident
2	Assault
3	BP
4	Burning
5	Cancer
6	cardiac problem
7	Diabetic
8	Fever
9	Others
10	Poisoning
11	Pregnancy
12	Respiratory problem
13	Stroke
14	Unconscious



### **METHODOLOGY**

**×** Secondary Data Collection

**× Primary Data Collection** 

**× GIS Database Creation** 

× Network Analysis



## ANALYSIS

- Three network based analyses were performed - new route, new closest facility and new service area.
- Analyses were performed based on the travel parameters; length of roads, time to travel on each road segments, turn details and points of traffic congestion.
- Analyses based on the classic Dijkstra's algorithm

## ROUTE

- Quickest and shortest route based on the travel constraints
- The route analysis layer consists of different components such as.
  - Stop feature layer (ambulance, accident, hospital)
  - Barrier feature layer (congested areas where ambulance can't travel)
  - Route feature layer (generated route from ambulance-accident- hospital)



## **CLOSEST FACILITY**

- Closest facility solver measures the cost of travelling between incidents and facilities and determines which are nearest to one other within stipulated time
- × Closest facility analysis layer consist of
  - Facilities feature layer(ambulances)
  - Incidents feature (accident spot)
  - Barrier feature layer (congested areas where ambulance can't travel)
  - Route feature layer (generated route from ambulance-accident spot)



![](_page_14_Figure_0.jpeg)

#### **SERVICE AREA**

- Service Area Solvers return a subset of connected edge features such that they are within the specified network distance or cost cutoff
- Service area for ambulances within the corporation were calculated based on the time interval of 3, 6 and 12 minutes

![](_page_16_Figure_0.jpeg)

![](_page_17_Figure_0.jpeg)

### **KEY FINDINGS**

- Reliable and scientific data base on roads for the study area. Data highly beneficial for the user agency like PWD, Police and Health Department.
- Shortest route analysis with the travel parameters provides the optimized route for the ambulances to reach an accident site and reach back to hospital. If in any situation like demonstration, road maintenance etc happens, optional routes can be suggested.

- Service area showed clustering of ambulances in certain portions and other pockets ill served. The shortfall in this placement is rectified by appropriately realigning the ambulance locations.
- Closest facility analysis reveals inadequate number of Ambulance in the northern part of study area.

#### CONCLUSION

The current system followed by the ambulance services in the region is satisfactory the incorporation of the travel parameters and analysis based on them will enhance the current operation of 108 ambulances.

![](_page_21_Picture_0.jpeg)