

# GPS based police station distribution in Allahabad city

## Abstract

The Paper examines the spatial distribution of police station in Allahabad City, Uttar Pradesh. Global Positioning System (GPS) was used to measure the coordinates (Latitude and Longitude) of the police station in the Allahabad city, while the population data of each police station were covered from interview and population census (2011). Arc (GIS) software 10.3 ver. was used to draw the map of the distribution. It is important to whether the Police station are informally distributed to help the civilians to locate or reach the police station without much difficulties and also there are times when misperception areas in which Police Station to go and file an FIR. In order to all whether the Police Station are informally distributed or not nearest neighborhood analysis was utilized which has shown that the distribution of Police Station with respect to population in Allahabad city is clustered than random settlement. This study recommends a uniform distribution of Police Station in Allahabad City.

**Keywords:** GPS mapping, DGPS, GIS

Volume 8 Issue 4 - 2020

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**Received:** July 02, 2020 | **Published:** July 27, 2020

## Introduction

Global Position System (GPS), originally Navistar GPS, is a space based radio navigation system owned by United State Government. It is a global navigation satellite system that provides geo-location and time information to a GPS receiver anywhere on or near the earth where there is an unobstructed line or sight to four or more GPS satellite.

- Satellite in Orbit – 31
- Total Satellite – 33
- Orbital Height – 20,180 Km
- Accuracy – 50 cm

Differential Global Positioning System (DGPS) is an enhancement to Global Positioning System that provides improved location accuracy, from the 15-meter nominal GPS accuracy to about 10 cm in case of the best implementations.

## Need and justification

Geographic Information System (GIS)<sup>1</sup> can be used as a tool by police personnel to plan effectively for emergency response, determine mitigation priorities, analyze historical events, and predict future events. In addition it can help crime officers determine potential crime sites by examining complex seemingly unrelated criteria and displaying them all in a graphical, layered, spatial, interface or map. Applications of GIS to crime mapping and management have been successful in many developed countries.

Spatial analysis can reveal descriptive associations between events and places providing a preliminary look at potential casual associations between problems and places. The locations and geographic distribution of these events and survey outcomes can be mapped and their geographic relationships qualified by querying the GIS database (ibid) therefore the present study entitled “GPS Based Police Station Distribution in Allahabad City” has been carried out with the following objectives:

## Objectives of the study

- To measure the GPS co-ordinates of Police Station of Allahabad.
- To examine the spatial distribution of Police Station in Allahabad Region.
- To observe the distribution pattern of Police Station with respect to population.

## Methodology

### Materials selected for the present study

The Study was conducted at the department of Forensic Science, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad the essential materials required for the work are as follows -

- Tremble R1 GNSS Receiver
- Computer System

### Method selected for the present study

Main purpose of this chapter to describe the research design followed in conducting the study the methodology followed during the course of the study discussed under-

- Selection of study
- Collection of data
- Measurement of GPS co-ordinate
- Data analysis
- Statistical analysis

### Selection for the present study

The area of Allahabad City Latitude and Longitude Coordinates are: 25.473034, 81.878357, were selected for the study.

**Sample of the study**

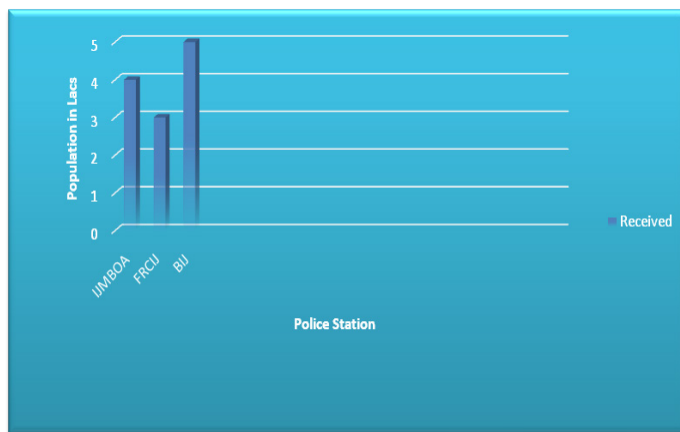
GPS coordinate of 15 Police Station was recorded using Trimble Terrafles GPS device. The in charge of Police Station were interview for general information about that Police Station. These data were same as recorded for the purpose of further analysis.

**Results and discussion**

**Spatial analysis of police station at Allahabad (Table 1) (Figures 1 & 2).**

**Table 1** Spatial distribution of police station and population of Allahabad

Thana	Outpost	Population
Shiv Kuti Police Station	4	150000
Colonel Ganj Police Station	7	1500000
George Town Police Station	3	300000
Daraganj Police Station	3	300000
Ked Ganj Police Station	4	200000
Mutthaganj Police Station	3	300000
Atarsuiya Police Station	4	500000
Kotwali Police Station	6	1200000
Shahganj Police Station	4	70000
Khuldabad Police Station	3	300000
Mahila Police Station	1	59,54,391
Civil lines Police Station	5	900000
Cant. Thana Police Station	4	500000
Dhoomanganj Police Station	5	250000
Kareli Police Station	2	200000



**Figure 1** Spatial distribution of police station and population of Allahabad.

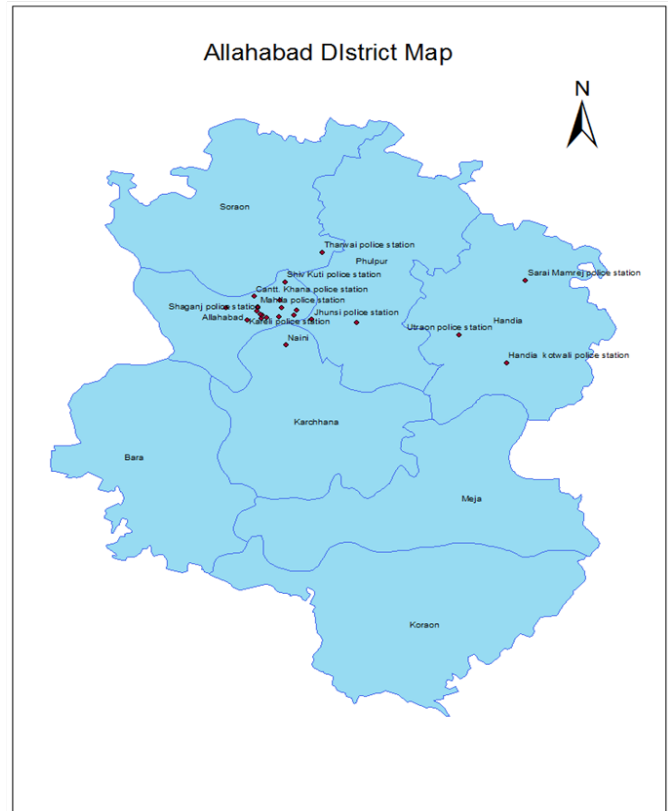
**Nearest neighbor analysis (Table2)<sup>2</sup>**

$$R_n = \frac{\bar{D}}{0.5 \sqrt{\frac{a}{n}}}$$

$\bar{D}$  (Obs) = D/n = 21.88/15= 1.46

$$R_n = \frac{1.46}{0.5 \frac{\sqrt{76832.646}}{15}}$$

$R_n = 0.04$



**Figure 2** Spatial distribution of police stations on map of Allahabad.

Since the NNA value is 0.04 which is less than 1 Thus it can be interpreted that the distribution of Police Stations with respect to population in Allahabad City is clustered than random settlement.<sup>3-6</sup>

**Summary and conclusion**

**Summary**

Police are the law enforcing agents who main function is to provide security and to maintain law and order in the societies, state and union security is one of the basics for human survival.<sup>7</sup> The study area covers only the Allahabad city in Allahabad district of Uttar Pradesh, considering in the main city. It was found out that the maximum Police Station was located in Allahabad city covering 15 police station. The Global Positioning System (GPS) was used to get the locations of all the police Station after which the GPS co-ordinates were exported to Arc GIS software to draw the map of the distribution. It is vital to know whether the police stations are uniformly distributed based on the population. This will help the civilians, victims to locate or reach the concerned Police Station without much difficulty or to reach within few kilometer distances to file an FIR or report. Not only that, it will also narrow the search. A simple statistics tool called Nearest Neighborhood Analysis was applied to see whether the Police Stations are uniformly, random or clustered.<sup>8,9</sup>

**Table 2** Calculation table for nearest neighbour analysis

Sl. No	Name of the settlement	Nearest neighbors settlement	Dist. in Km	Dist. in m
1	Shiv Kuti Police Station	Colonel Ganj Police Station	3.20 km	3212 m
2	Colonel Ganj Police Station	George Town Police Station	1.34 km	1340 m
3	George Town Police Station	Colonel Ganj Police Station	1.34 km	1340 m
4	Daraganj Police Station	Kyd Ganj Police Station	2.25 km	2251 m
5	Kyd Ganj Police Station	Mutthiganj Police Station	1.85 km	1850 m
6	Mutthiganj Police Station	Atarsuiya Police Station	0.83 km	830 m
7	Atarsuiya Police Station	Kotwali Police Station	0.69 km	690 m
8	Kotwali Police Station	Shahganj Police Station	0.42 km	420 m
9	Shahganj Police Station	Kotwali Police Station	0.42 km	420 m
10	Khuldabad Police Station	Shahganj Police Station	0.60 km	600 m
11	Mahila Police Station	Civil lines Police Station	0.09 km	90 m
12	Civil lines Police Station	Mahila Police Station	0.09 km	90 m
13	Cant Police Station	Civil lines Police Station	1.96 km	1960 m
14	Dhoomanganj Police Station	Kareli Police Station	3.74 km	3740 m
15	Kareli Police Station	Atarsuiya Police Station	2.14 km	2140 m

## Conclusion

- To measure the GPS co-ordinates of Police Station of Allahabad.
- To examine the spatial distribution of Police Station in Allahabad Region.

To observe the distribution pattern of Police Station with respect to population.

1. The GPS coordinates of 15 police station of Allahabad city were recorded using Trimble R1 GNSS device and their latitude longitude and other information obtained through personal interview of the Police station representative were reported to make a database

2. The spatial distribution of Police Station in Allahabad city were analyzed by positioning the GPS coordinates on Map of Allahabad and observations were made through Arc GIS software which represents that the distribution of outpost and police station in Allahabad is not random its clustered and need a uniform distribution

3. The Nearest Neighbor Analysis were conducted using the data observed and Arc GIS software. The calculated value is 0.04 which is less than 1 which concludes that the distribution of Police Stations with respect to population in Allahabad City is clustered than random settlement.

## Acknowledgments

None.

## Conflicts of interest

The author declares there are no conflicts of interest.

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