

Mapping Archaeological Remains of 14th Century Fort of Jahanpanah Using Geospatial Analysis



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1 Introduction

Delhi has been the centre of political history for more than a thousand years. The present Delhi is an amalgamation of seven historical cities: Qila Rai Pithora (QPR) (extension of Lal Kot), Siri, Tughlaqabad, Jahanpanah, Firozabad, Dinpanah (Purana Qila), Shahjahanabad [1]. All the seven cities were fortified settlements; remains of many of them still exist. Few of the forts have lost their contours owing to the growth and rapid urbanization of Delhi after India gained independence. The fortifications like Tughlaqabad, Firozabad and Purana Qila have passed the test of time and stand resolutely under the protected eyes of ASI (Archaeological Survey of India) [2]. Whereas only parts of QPR, Siri, and Shahjahanabad are protected but large portions still exist as unprotected remains and encroached spaces and the contours of Jahanpanah's fort are largely obscured.

The present study is focused on the fourth historical city, Jahanpanah. It was built in 1327 AD by Muhammad Bin Tughlaq of the Tughlaq Dynasty (1320–1413 AD), the successor of Ghiyasuddin Tughlaq who built Tughlaqabad. Muhammad Bin Tughlaq followed the Tughlaq dynasty architecture with the construction of Daulatabad Fort in Daulatabad, Maharashtra and Jahanpanah in Delhi. After the reign of Ghiyasuddin Tughlaq, Muhammad Tughlaq first shifted his capital to Daulatabad but later came back to Delhi and enclosed QPR and Siri Fort with two fortification walls [3] (see Figs. 1 and 2). This enclosure came to be known as Jahanpanah. Siri Fort is towards the north-east of Jahanpanah while QPR is at the south-west. Along the southern part of the fortification, an irrigation structure known as Satpula (a weir creating a reservoir directing water from the south into the fort boundary) was constructed at

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the same time in order to regulate water for agriculture [4]. The Satpula Bridge is still intact, but the same cannot be said for the entire fortification wall of Jahanpanah [5]. The remains of the wall lay in isolated patches in the urban sprawl of South Delhi covering the areas of IIT (Indian Institute of Technology), Khirki Village, Panchsheel Park, Malviya Nagar, and Adchini [6]. However, these references are not enough to discern the exact contours of the fortification wall and hence there is no clear evidence for the exact locations of the Jahanpanah walls. Jahanpanah remains had only one inscription in the ASI protected monuments list, the bastion, where a part of the Jahanpanah wall meets QPR's [7] (see Fig. 2).

This paper tries to identify the exact location of the walls of Jahanpanah and map the accessible remains using geospatial data and analysis. Remote Sensing (RS) and Geographical Information System (GIS) has been increasingly used now in the field of archaeology and for mapping heritage sites [8]. For this study, old maps of Delhi and Corona Satellite images of 1965 were used to analyse and identify



Fig. 1 Map, The seven cities (1867)

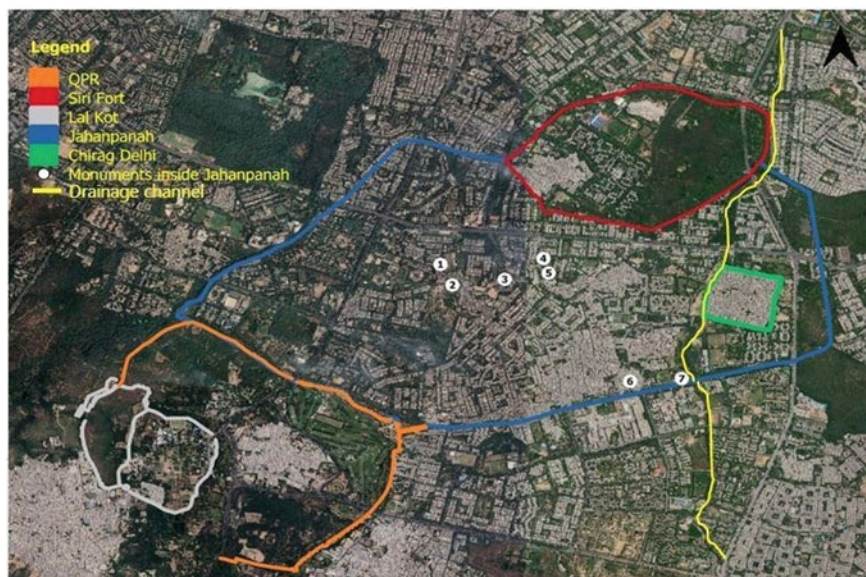


Fig. 2 Overlay of georeferenced fort walls of south Delhi; see Table 1 for numbered locations

the exact location of where the fortifications would have been, and then through analysis of multi-date satellite images of recent years specific locations (unbuilt patch like green areas, parks) which potentially still may have some remains were selected. Subsequently, field visits to the selected location can be carried out for making ground observations and geotagging the feature found along the erstwhile fortification walls.

2 Methodology

The first step was to find reliable spatial information (location and shape) of the Jahanpanah fort. This was achieved through finding old maps from archival sources and digital libraries. The maps of the colonial period are preferred due to their accuracy in scale compared to earlier maps. A map of The Seven Cities (1867) [9] was found which marks the fortifications of the seven historical settlements of Delhi (Fig. 1). In addition Corona Satellite image of 1965 was accessed in order to identify remains of the Jahanpanah wall as this showed the view of the landscape before rapid urbanization occurred in Delhi [10]. Corona Satellites were used by the US Spy Intelligence (1960–1972), under the name Discoverer Program for the public. In 1995, these images were declassified for global change research. Map of Seven Cities of Delhi and the Corona Satellite image were georeferenced with the present Google Earth image (5th June 2021) of Delhi. Georeferencing Corona images is relatively

Table 1 Monuments inside Jahanpanah

S. no (corresponding to Fig. 2)	Monument	Period
1	Bijay mandal	Early 14th c
2	Begumpur mosque	Mid. 14th c
3	Serai shahi mahal	Early 16th c. (not clear)
4	Kharbuze ka gumbad	Before 1397
5	Lal gumbad	1397
6	Khirki mosque	Late 14th c
7	Satpula bridge	1343

easier than old maps as features are identifiable with current Google Earth Imagery. The shapes of road intersections are readily discernible as compared to maps before the nineteenth century.

A total of 32 GCP points (Ground Control Points) were taken to georeference The Seven Cities (1867) in Thin Plate Spline resampling with a mean error of 0.0024. Thin Plate Spline transformation was preferred over different Polynomial transformations as it gives localised warping than complete image warping as in Polynomial methods. The distortions in the latter gave a mean error of more than 40, which doesn't give an ideal accuracy for the features to be overlaid in the current Google map. After georeferencing, these maps were overlaid on the current Google Earth image in order to get the exact location of the Jahanpanah fort wall (Fig. 2). Monuments which lay inside the Jahanpanah fort have also been marked, where Bijay Mandal shows the possible citadel area of Jahanpanah during Mohammad Bin Tughlaq's reign [11] (Table 1). Field work has to be carried out on the possible remains of the wall as seen on different timelines on Google Earth.

Map features: The map, The Seven Cities (1867) was chosen as it contains the layout of all the seven cities which makes it easier to study Jahanpanah as it has multiple features that can be correlated. This map has fewer details as compared to other contemporary maps, which show other historical cities of Delhi in greater detail. However, this map had more details on the contours of the fortification of Jahanpanah. Old Delhi (Lal Kot and QPR area), Siri, Tughlaqabad and Jahanpanah are prominently marked whereas the City of Sher Shah and Ferozabad are coincided by dashed outlines. Directional orientation of the map is marked indicating a North-South alignment with scale. The map demarcates the landscapes of Delhi showcasing Aravalli ridges on the north-west and west of Lal Kot and QPR and the River Yamuna on the east. Two medieval routes are marked from Shahjahanabad: one from Ajmeri Gate to Mehrauli via Jahanpanah and QPR; another from Delhi Gate to Mathura by the route passing through the City of Sher Shah and detours to Tughlakabad. Significant monuments, mosques, temples, tombs and places are labelled, many of which fall inside the boundaries of the seven walled cities, thereby adding to the heritage value of these cities. Drainage network of the city is seen on the map where one of the channels is going through Satpula Bridge and further to the north-east. It

clearly marks the railway lines that were laid out in the colonial period. Although the map doesn't feature any legends, the labels and symbols used are self-explanatory.

2.1 Analyses of Geospatial Data

Overlaying the georeferenced 1867 map of The Seven Cities on Google Earth showed exact locations of the possible remains of the fort wall. The wall on the eastern side goes through vegetative land via Jahanpanah City Forest and meets Siri Fort crossing the Chirag Delhi drainage channel which goes till Satpula Bridge. As evident around the southern fortwall, the Press Enclave Marg road has emerged with time retaining the shape of the past wall [12]. It also remains consistent and accurate where the wall of QPR meets Jahanpanah as recorded on ASI Bhuvan [2]. The western portion of the fort wall goes adjacent with the moat along the northern boundary of QRP.

The findings made through overlaying georeferenced Corona Satellite images are worth noting. On close analysis, a circular shape of bastion can be observed where the eastern wall meets the southern wall of Jahanpanah. There are many semicircular shapes indicating bastions on the southern wall which can be observed in the Corona image (Fig. 3). There is a clear difference in the remains of the fort wall in the 1965 image and the present Google Earth image of Delhi, testifying the fact that urbanization with little regard to heritage sites have engulfed many portions of the fort remains.

2.2 Geospatial Studies of Archaeological Sites

The impact of such a geospatial database on archaeological sites and remains shows a clear picture of the past and present land use. Use of GIS studies adds to the historical data as the extent of the study can be analysed further, even where textual data suggests lesser information. The present example of Jahanpanah where its remains have further deteriorated can be seen both in Corona satellite images and current Google Earth images. However, such geospatial studies of fort extents and monuments of different regions can add to the heritage repository and open up new avenues for authorities to use this data in a way which can be added to the city development keeping ASI's prescribed protection boundaries intact. Just like in the case of Jahanpanah, there are several sites which have gone missing due to construction activities, largely due to a lack of spatial data on the context of the site. One similar case study is that of Chikkajala Fort in Karnataka, where unprotected sites of the fort were demolished for the construction of NH-7, clearly seen in the Google Earth imagery from 2004–2018 [13].

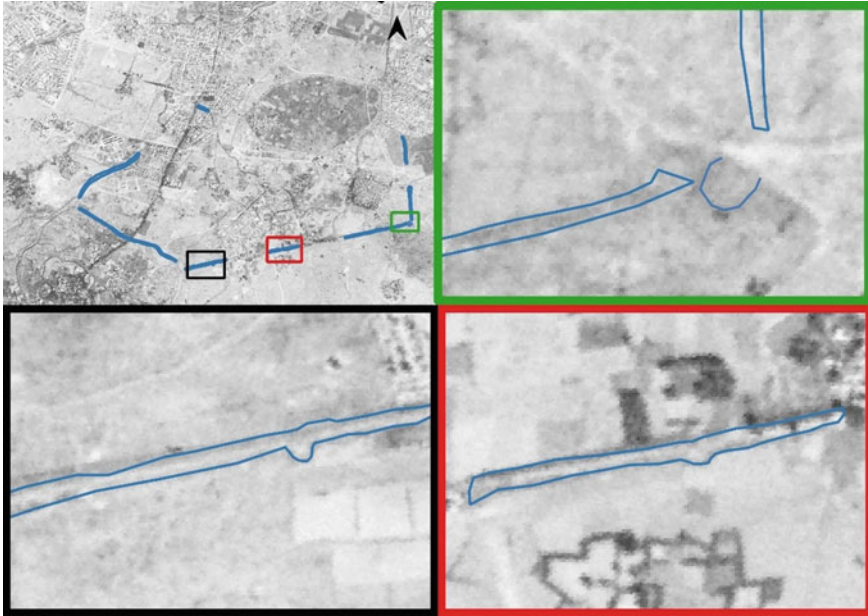


Fig. 3 Remains of Jahanpanah wall identified in corona satellite image (1965)

3 Conclusion

The geospatial analysis of the Jahanpanah wall throws light on new avenues for discovery. Use of old maps (of Colonial period) in today's spatial context offers new insight to the historical information. There are maps available which show drainage channels flowing south to north at Satpula Bridge, highlighting the emphasis on hydraulic structures for irrigation during Tughlaq and later periods [14]. Such channels have been in use in later dynasties as well, which can be further analysed using geospatial tools. This paper marks the fort line of Jahanpanah which is testified in the Corona image. It offers exact locations of Jahanpanah fort remains, which can be accessed for ground truthing on the field. The remains and mounds which can be found using this study will further add to the scholarship on the seven historical cities of Delhi.

Acknowledgements The research reported in this paper was conducted as part of a project funded by the Indian Space Research Organization, Department of Space, Government of India, under the RESPOND Scheme. The authors thank ISRO for the same.

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