Internship Report at Columbia University, NYC

Water Urbanism in Varanasi

Sunny Bansal,
PhD Student, IIT Kharagpur

My Experience

The academic internship at Graduate School of Architecture, Planning and Preservation, Columbia University was a different experience for me. It was a four-month internship involving an urban design studio from January till April 2018, with the final presentations to be made at Columbia University, New York City, US. It was an intensive Urban Design, Urban and Regional Planning, and Infrastructure Engineering Collaborative Workshop on Project Varanasi.

The internship started in January 2018, when selected students from IIT Kharagpur and Columbia University visited Varanasi, Uttar Pradesh for the first stage of the internship. The first stage comprised of detailed field visits, primary reconnaissance surveys, and secondary data collection in Varanasi. It also involved meetings and discussions with a number of stakeholders and decision makers from Varanasi Municipal Corporation, Varanasi Development Authority, etc. and experts from institutes like Jnana-Pravah – Centre for Cultural Studies and Research, Design Innovation Centre, IIT (BHU) and (BHU).

The second phase was to work on for the studio for 14 weeks online with the students of Columbia University. It involved rigorous discussions over web-conferencing, preparation of drawings and reports, and an interim-review of work. For the last stage, the final presentations were to be made at Columbia University. Progress of work was discussed after reaching New York and accordingly the end-term presentation was prepared. The final presentation took place at the Indian Consulate in New York on 3rd May, 2018 and many academicians and professionals related to the work were invited for the end-term review. The final review presentation involved a short introductory video clip, design proposal, and posters.

The overarching theme was about Water Urbanism in Varanasi. How can Varanasi be a new model for growth and prosperity for Indian cities that embraces the ecological, the spiritual, culture, health and wellness? How can water be at the center of a new vision for the city's urban pattern? It has been further expanded to explore how the inter-connected network of inland water-bodies in Varanasi had ensured better water infrastructure as compared to the prevailing closed system of channelized flow in rivers; how community-based water management has been a pivot element for citizens' participation, thus, ensuring water quality in those ponds.

The prime intention to participate in the research activities in the semester-long Urban Design studio was the unique exposure it offered at global level as two of the best universities came together with a common objective focusing on "water urbanism". The internship provided me with an incredible opportunity of interacting and working with the scholars and faculty members from both the universities and helped me in understanding the different perspectives of how to approach for research and studio work.

Moreover, the objective of the Studio is in coherence with my interests and research area. To understand the urbanization trends in smaller towns and cities and peri-urban areas with the role of social and physical infrastructure in it and further to design the policy frameworks with the "inclusiveness" of the historical, ecological, and creative components of the region is the need of the hour and it focused on the same with the case study of Varanasi, which is also my thesis case-study.

Work Details

The Nomadic Landscape: Sandbanks of Varanasi

The sandbank area of Varanasi is a temporal landscape formed by the deposition of sand through the meandering of River Ganga. This is a nomadic and evolving landscape, which does not fall under any of the administrative boundaries (neither Varanasi Master Plan nor Ramnagar Master Plan). Few activities are found here, which are either commercial or agricultural based, but are scattered and unorganized. Considering the constant flow of tourists to this holy city, sandbank development could potentially lessen the crowding and congestion of the busy Ghats.

Figure.1 The Sand banks

When we are proposing a better system, we are not only focusing at the physical space and specific facilities but at a cycle of activities originating at local level, including local activities, materials and human resources, preserving the cultural history and ecology of this landscape. The ecological aspect is of significant importance because of the temporality and dynamicity of the sandbar as shown in Figure.

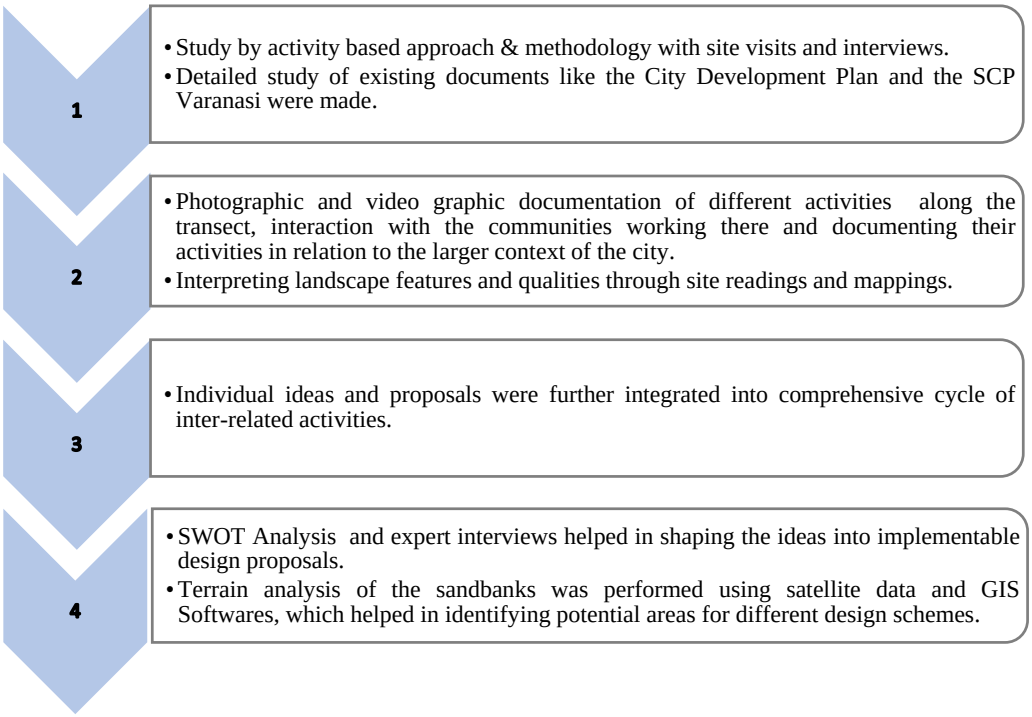
The sandbanks get inundated during monsoons and are only available for 7 to 8 months in a year on an average. The erosion on the west bank along with silt deposits from upstream flow have gradually increased over time due to prohibition of sand mining and deforestation originating upriver respectively. As the expanse of the sandbar increases, width of the river reduces and risk of flooding increases. Hence there is a need to manage this dynamic sandbank with sustainable designs taking into account the flooding cycle as well as the process of erosion and deposition.

Figure.2 Sandbank Temporality (i) Dry (ii) Submerged

The objectives of the study are

- To understand if the sandbank can act as a model for socio-ecological urbanism grounded in change and time?
- To propose a physical space for commercial transactions and cultural exchange on the sandbanks opening up new possibilities, which is culturally relevant, socially and economically inclusive, and an implementable one.

Methodology



Timeline of the field studio

Day 1 – The Sand banks (opposite to the Munshi Ghat Area)

The movement from Ghats to the sandbanks entails the transition from feelings of congestion to openness as we cross the river. Upon reaching the other side, the sense of relief erases the memory of confusion that the streets had left into view. The Sandbanks provide a panoramic view of the Majestic Ghat façade, which enable visitors to appreciate the magnificence of this holy landscape.

Recreational activities like Camel and Horse rides are attracting more tourists to this area. A few commercial shops to support the small-scale activities, which takes place in the sandbanks, have brought some life to this nomadic landscape. People were charged over the Maximum Retail Price considering the transportation costs involved, highlighting the requirement of infrastructure and facilities to support the commercial activities here on the sandbanks. Families and teens could be seen bathing and enjoying the serenity and calmness of river Ganga away from the chaos and congestion on the Ghats. These activities happen year round except in the monsoon when the sandbanks are submerged.

Figure.3 Activities

The soil is mostly sandy or a sandy loam and not an ideal medium for vegetation growth. Furthermore, it is not appropriate for building, as it does not have much support. Fertile silt deposits were found along the outer edge of the riverbanks. The soil becomes coarser and hard as we move inwards. The fresh alluvial deposits have been utilized for cultivation of Mustards and the heavy dosage of fertilizers have made these soil turn hard. The surface is inundated during monsoon and thus are replenished with fresh soil deposits. This cycle continues which helps in balancing the alluvial deposits along the riverbanks but invariably polluting the river downstream with harmful chemicals present in the fertilizers.

Figure.4 Changing Landscape

Day 2 & 3– Villages

The green belt area and nearby villages are rich with a wide variety of flora forming the outer edge of the sandbanks. Babul trees dominate the green belt, which stands on a higher plateau acting as a natural boundary to River Ganga. This species of trees are the cheapest source of wood for cremations and the tribal people from the inner parts of Ramnagar are the main customers.

There are no major establishments in the area except for two or three Ashrams. Major share of the land is utilized for wheat and vegetables cultivation with sparse settlements. Unpaved and dusty roads shows a very different picture of Varanasi owing to the belief in inauspiciousness of the Ramnagar side. There are two bridges which mark the end of the crescent shaped sandbanks. Nomadic settlements were found around the two key infrastructures, whose activities are based on Bamboo weaving near Malviya Bridge and temporary farming based near the Ramnagar bridge. The seasonal farming of watermelon, bitter gourd, and other green leafy vegetables were found here.

Figure.5 Farmlands

Day 4 – Ramnagar

The Ramnagar Bridge, which was recently opened to the public, have increased the traffic in the Fort Road, but has not brought much increase in commercialization of the space. The Ramnagar Fort, attracts local and foreign tourists and there are a few supporting commercial activities around it. Other than that, Ramnagar area have mainly rural households, most of whose living is based in agriculture and animal husbandry.

Drains could be found flowing into Ganga carrying harmful chemicals from the farmlands and other debris from the settlements around it and thus polluting the holy river. The uninhabited area under the Ramnagar Bridge is used as a dumping site clearly indicating Solid Waste Management inefficiencies. All of these contribute in making this area highly polluted.

Day 5 & 6 – Boat Ride

Boat ride along the river gave a spectacular view of the Ghats standing tall along the west banks of River Ganga. The boatmen shared their views on sandbanks and how it changes over different times of the year. On the way downstream it was found that some of the Ghats have been sinking in to the river. An interesting story unveiled once we started exploring the possible reasons behind the collapse. Prohibition on sand mining was found as one major reason. This was due to the presence of Tortoise Sanctuary in this stretch which was started in 1989 as part of Ganga Action Plan- phase I. The Sanctuary has its own importance to clean the water especially in the Manikarnika Ghat area where the tortoises eat the remains of the cremated bodies thrown into the holy river.

Figure.6 Collapsing Ghats (near Manikarnika)

Authorities claim that sanctuary is home to different species like Aspederites Gangetic (self-shell turtles), Geoclamis, Hamiltonai, Chitra Indica and Lasimous which are carnivorous tortoises and hard shelled herbivorous tortoise- Pechra. Tortoise and all other aquatic species are protected and fishing or any attempt to temper with the habitat of the animals found in the Sanctuary, has been declared a cognizable offence in this stretch of the River Ganges, under 1972 Act. Motor boats and sand mining in the protected zone of the Sanctuary is prohibited. But the locals and the boatmen community say that in reality, turtles are never seen in the Ganges, but in the name of prevention it is continuing.

It is studied from previous researches that sand deposition varies year-to-year that may depends on the discharge and flow velocity change due to climate change. Such changes distort the natural quasi equilibrium of the river; in the process of restoring the equilibrium, the river will adjust to the new conditions by changing its slope, roughness, bed material size, cross sectional shape, or meandering pattern. More sand is deposited each year reducing the river cross section by which the flow velocity increases and carries away the soil underneath along with it. The prohibition of sand mining in the area because of the tortoise sanctuary have worsened this problem. The Ghat collapse happen because of this weakened base, which stresses the need for some quick actions.

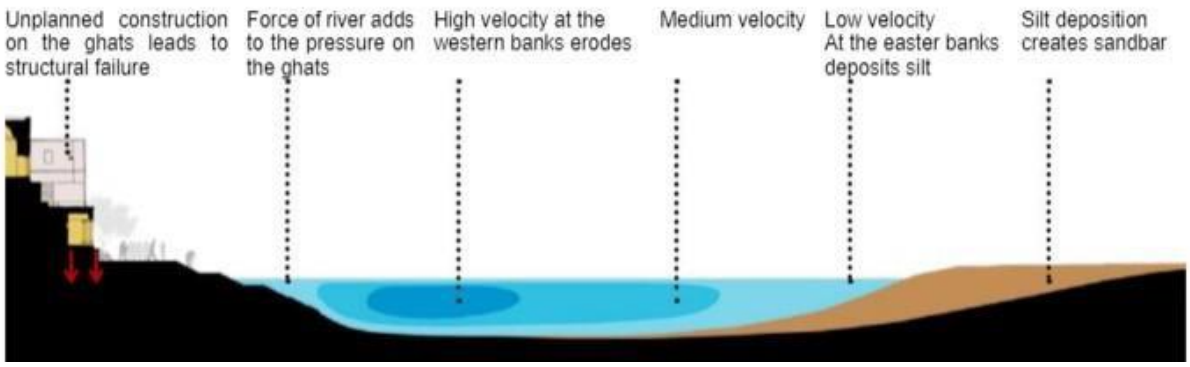


Figure.7 Cross sectional view

SWOT Analysis

With an understanding of the rich culture of Varanasi and its people, we have reached out to a variety of people to discuss the outcomes of our SWOT and their vision to identify possible interventions. They stressed on the importance of practically implementable solutions, the benefits of which should have a multiplier effect on the well-being of society, and which would be tangible in the short to medium term.

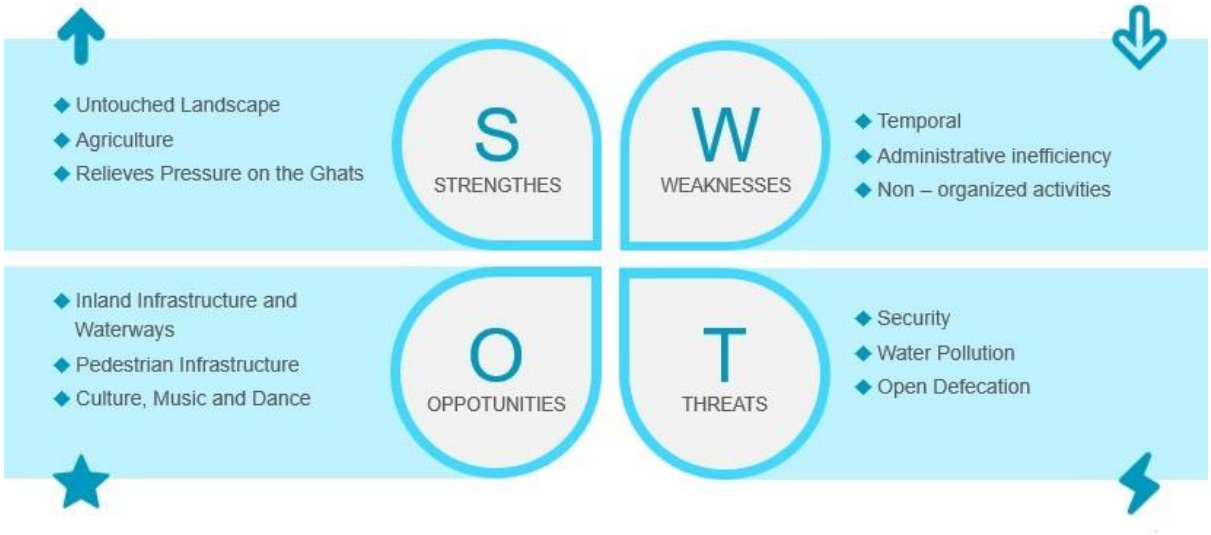


Figure.8 SWOT Analysis

The informal settlements close to the edges of the sandbanks have very limited sewerage system. Due to which most of them resort to open defecation making northern and southern edges of the sandbanks a pollution hotspot in the holy city. Besides the wastewater from the settlements and farmlands adds to the pollution woe. The vast Sandbank stretch can be planted with grasses for bio-filtration to occur which can help in natural cleansing of the river.

The streets in the old city area are so narrow that effective emergency response during fire and earthquake, are difficult to be taken. This problem is aggravated during major bathing festival. Since it is nearly impossible to create a quick response route through the narrow lanes, the best alternative is to develop a waterway for water ambulances. The sandbanks can serve as an open evacuation area as part of the emergency infrastructure being developed. Self-adjusting Jetties and inland waterway terminals can be developed on the outer edges of the sandbanks for water transport modes like Amphibuses and Cargo Vessels.

The recently proposed Inland Waterway Infrastructure for Varanasi (IWAI) poses a threat or a challenge has to be carefully studied. Unlike many of the world's major watercourses, the Ganga is a seasonal river that swells with the monsoon rains and recedes in the dry winters. While small boats can indeed ply along this seasonal river, large cargo barges need a minimum depth to sail in. The EIA Clearance despite the existence of Tortoise Sanctuary and other legal hurdles associated with a heritage city like Varanasi was clearly because of the importance of this project and the positive impacts it can have on the people and infrastructure along the river. Sand dredging will increase the width of the river flow and lessen the pressure on the west bank. Besides the less intrusive dredging techniques like water injection method can help in stabilizing the natural riverbed, which can address the issue of collapsing Ghats to a large extent.

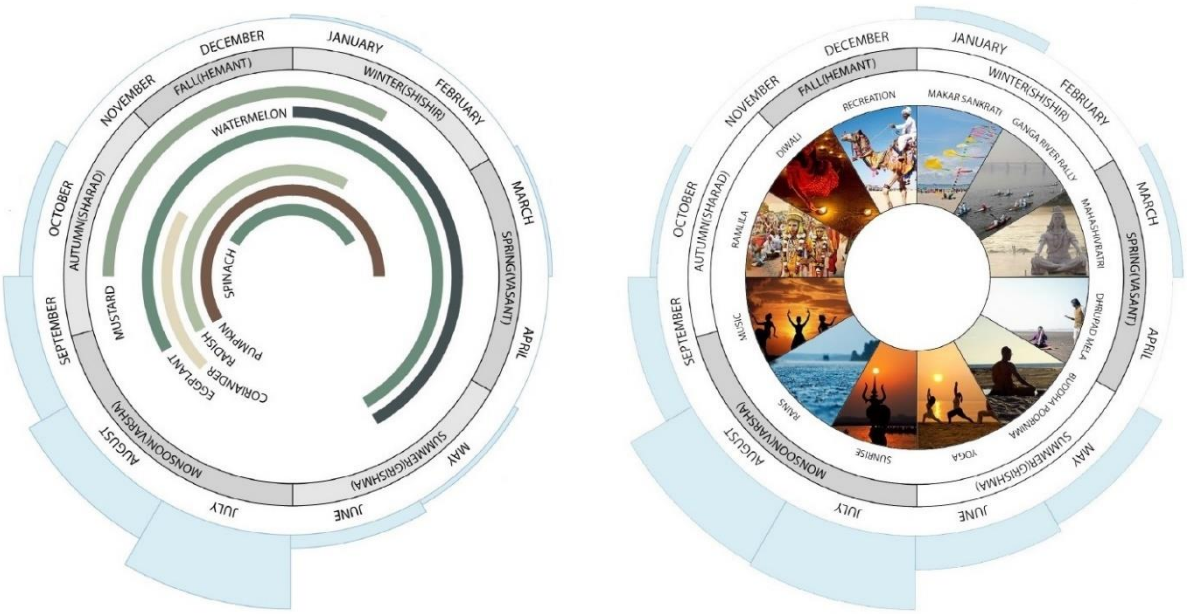


Figure.9 Flywheel of activities

A cycle of activities was proposed by the team based on the findings in the landscape.

- The commercial, recreational and cultural cycle, which can be organized on the sandbanks in relation with the Festivals and activities happening on the Varanasi side.
- Agricultural activities with sowing and harvesting timeline considering suitability of the crops and availability of alluvial deposits.

Both these proposals are subject to change and can be considered as a flywheel (figure) rotating with time and place. Design intervention should take into account the flooding periods as well as the process of erosion and deposition. The months with heavy rainfall with higher flooding chances are shown with blue sectors (not to scale) indicating the non-availability of the sandbanks.

The proposal depicts how this shifting fluvial landscape can be developed into a public space that can be used intensively in the dry season for recreational activities thus alleviating the stress on the Ghats. Besides seasonal farming can be organized on the southern part of the east bank where the flood plain soils can support vegetables and fruits cultivations.

Conclusion from the field visit

Strategic focus of the Sandbank and its surroundings was derived from the SWOT and terrain analysis, ensuring to capitalize on the strength and the opportunities of this land and mitigating its threats and

weakness. SWOT analysis, which is derived from the observations, citizen consultations and expert opinions indicates its strength and opportunities as an agricultural space and a tourist spot relieving the pressure on the Ghats. On the other hand, temporality and lack of several urban facilities emerges as the weakness and threats of this land. In this background, the strategic focus of Sandbanks should be in:

- Developing the basic facilities to promote the agricultural activities, which owns a major share of the land use.
- Organizing and networking of the activities and people in an around the sandbanks with promoting non- motorized modes and pedestrian infrastructure for tourists.
- Creating Infrastructure for multimodal transportation and emergency routes along waterways where sandbanks can play a supporting role.

Sandbanks being a temporal landscape unavailable during monsoons and Ramnagar being considered as the inauspicious part of Varanasi, there is a need for government initiative, guidelines and public participation for the systematic development and preservation of this area.

Final Outcome

Varanasi in Flux: *Accommodating the flux by integrating maidan spaces*

Varanasi is a land of festivals and has various traditions related with these festivals. The festivals occur round the year with significant rituals as per the seasons or the seasonal changes. Also, the holy city is a major religious hub for various religious beliefs of India and abroad. Geographically, the city holds a prominent location at the Indo-Gangetic Plains. All these and few others factors bring in a flux of people, birds, flora, and water to the city throughout the year in repeated cycles. The central theme or issue identified for the design studio was to accommodate this flux of people, birds, flora and water in Varanasi. This was proposed by integrating 'maidan' spaces into Ghats, parks, and kunds in self-sustaining way. Major observations from the final presentation are listed below:

- The understating of the concept of 'maidan' is an exemplary effort. The maidans or esplanades have always played a big role in integration of various activities like public gathering, recreation, fairs and other events organisation. To revive the same practice in a city like Varanasi is a bright and feasible solution.
- The inclusion of the flux of water is an interesting perception as water is both, the actor and the catalyst, in the realm of water urbanism.
- The integration of maidan spaces is exemplified with three different case-studies of a trajectory including a park (Benia Park), a kund (Pishach Mochan Kund), Ghats and sandbanks (Ramnagar) side. How these spaces will be transformed for different peaks to accommodate flux is strategically planned and designed.
- The design proposal involved a lot of sensitivity as the cycles of flux were not identified and portrayed as calendar cycles but as seasonal and cultural cycles of Varanasi. This showed the insights and depth of the thoughts behind the design interventions.
- Striking a balance between the soft infrastructure systems proposed for the riverfront and sandbanks with the hard infrastructure construction underway for the National Waterway 1 through the same stretch can reduce a lot of environmental impacts and aid the city's vision for smart and green infrastructure.

Final Presentation Pictures

Figure 10: Prof. Geeta Mehta, Columbia University at Indian Consulate, NYC

Figure 11: The Consul General of India in New York – Mr. Sandeep Chakravorty

Figure 12: Prof. Kate Orff, Columbia University and Prof. Joy Sen, IIT Kharagpur at Indian Consulate, NYC

Figure 13: Mr. Sunny Bansal, IIT Kharagpur at Indian Consulate, NYC

Figure 14: Mr. Deepanjan Saha, IIT Kharagpur at Indian Consulate, NYC

Figure 15: The Consul General of India in New York – Mr. Sandeep Chakravorty, Mr. Ranbir (Ron Gupta) IIT KGP Alumnus, Prof. Joy Sen and Ms. Vidhu Pandey, IIT Kharagpur