



by Lailun Nahar Ekram

Slum Networking of Indore City

Indore, India



Architect
Himanshu Parikh

Client
Indore Development Authority

Design
1987-1995

Completed
1989 and ongoing

I. Introduction

The Indore Slum Networking project is a wholistic approach to a community-based sanitation and environmental improvement programme. The infrastructure is upgraded using the network of slum settlements as a starting point and the project encompasses the entire city of 3'218 km². Out of the total Indore population of 1'400'000 (1995), 28% live in slums. The expected slum population in urban Indore, a textile manufacturing and industrial engineering centre, is expected to increase to 30% by year 2000. There are a total of 183 slums within the networking system.

Essential to the project is the networking of the sewers and the drainage system, which acts as a main sewerage artery along the city's river. The introduction of this artery has had an impact on other features of slum life including housing, infrastructure, and social and environmental conditions. The pivotal point in the project is the *jheel*, or lake/riverfront area, the central city location of the Krishnapura slum area where the rivers Khan and Saraswati meet. The rivers were once full of sewage and garbage, but the project has transformed the area into a waterfront which has revitalised culture, heritage, and human lives. Slum networking is an integrated upgrading scheme wherein the city building process is used to transform the slums into settlements while mainstreaming the poor into the urban population.

II. Contextual Information

a. *Historical background*

Indore, the capital of Madhya Pradesh and its largest city, was originally known as Indrepur or Indreshwar.

Known as the "Magnificence of Malwa," Indore presents a complementary mix of history and pragmatic urban futurism. It is situated on the western part of the Malwa (historically known as Deccan) plateau on the banks of two small rivers, the Khan and the Saraswati. These rivers meet at the centre of the city, where the small, 18th-century temple of Sangamnath, the historical *chatri*, or Hindu temples and palaces, and the Sarafa area are located. The spectacular part of this project, the Krishnapura slum, is located in this area. Here 2 km of riverfront development and slum networking have taken place. Out of a total of 90 km, 55 km of the river are within the city.

b. *Local architectural character*

The Indore slums are characterised by overcrowded *kutchas*, or temporary, dilapidated structures, lacking hygiene, services, utilities, and infrastructure. More than half of the 183 slums in Indore city are in the textile-mill area. The rest are either in the old, inner city or are on the city's periphery. In Indore, nearly 30% of the slum houses were formerly unfit for human habitation. In 1971, there was a housing shortage of 20'000 dwelling units. Despite a population increase from 1971–81, only 25'000 new units were built, resulting in an overall shortage of 51'000 units. Indore, unlike other slums, is not crowded, but was impregnable from the exterior with pockets of open community space inside. A survey of 160 slum settlements in Indore reported that the average gross land area per family was 121 m², of which only 33 m² were developed.

c. *Climatic conditions*

Indore has three distinct seasons. The region has a moderate climate ranging from 25–40°C in the hot, dry, summer (March to June), during which no rain falls. The monsoon season (July to October) is wet and humid. The annual rainfall is 750 mm. During monsoon season, the rivers Khan and Saraswati are sometimes flooded, while at other times of the year they serve as narrow sewage discharge channels. Winter (November to February) is a temperate, pleasant, dry season with temperatures ranging from 10°C – 30°C.

d. *Site context*

Because of its central location in India's fertile Malwa Plateau and its access to transportation networks, Indore is an important marketing and distribution centre for cotton, nuts, wheat, and other cash crops. The city is well connected to the rest of the country; it is situated on the Bombay-Agra trunk road and is a major junction of the western railway system. There are regular flights between Indore and other state capitals.

The city's growth as a market and business centre has created avenues of employment and resulted in a migration to the city. Those who come settle into slums: unplanned housing clusters used as homes for the migrant population. The city is surrounded by a semi-urban population of mixed occupations and a secondary ring of rural agricultural land. Slum concentration is distributed throughout the city. Population is heavy in the centre of the city and lighter on the periphery. A forecast of slum growth is anticipated, owing to urban migration in the coming years.

e. *Site topography*

Indore lies at an average altitude of 550 m above sea level. The general elevation of the town (where the slums are located) varies from 536 to 563 m. All slums are on slopes along the banks of the rivers.

III. Programme

a. *Conditions of programme formulation*

The Indore city sewer built in 1936 served only 5% of the population and only 10% of the city. All city sewage and solid waste were discharged into the Khan and Saraswati rivers, resulting in poor health and unhygienic conditions. Ironically, all of the slums were located along the rivers like similar informal settlements in the region. The inevitable problem of growing slums in India was enormous and for a long time considered too large to deal with.

The designer was convinced that India has adequate technical and physical resources to mainstream the slums into the urban fabric. The conditions that gave rise to the project's formulation were:

- A challenge and a strong will to succeed;
- The determination of appropriate priorities;
- Adequate and integrated institutional support;
- An appropriate delivery mechanism.

The programme resulted in:

- A cleaner city;
- The mainstreaming of urban settlement growth;
- The regulation of sewage and waste management;

- A landscaped garden with fountains for aeration created by the flow of treated water through the river;
- The revitalisation of the historical heritage in the city centre.

b. Objectives

Slum Networking featured five objectives which, when achieved, resulted in a liveable city where poverty was alleviated from within. (1) A wholistic approach to environmental issues in order to upgrade an entire city; (2) A significant reduction in the cost of utilities and housing; (3) The mobilisation of material resources for the development of settlements; (4) The increase in community responsibility and control; and (5) the improvement of the overall quality of life in terms of education, health, and income generation.

c. Functional requirements

Until 1991 Indore did not have underground sewers. The natural watercourse coincided with the slum settlements. The designer took advantage of these factors and based his solution on the “introduction of an efficient infrastructure path for services like sewerage, storm, drainage, and water supply of the slum utilising the natural river course”. The network created by the infrastructure resulted in housing upgradation through the following physical improvements: roads and footpaths, storm drainage, sanitation and sewerage, a water supply, earthworks and landscaping, street lighting management, and the removal of solid waste. The designer carried out extensive base-line surveys to determine physical and socio-economic conditions in the slums. The physical survey plotted the natural gradients and elevation of the ground in order to use the natural waterway for sewerage, drainage, water supply, and roads. The second critical survey identified slum families so that only those presently in need could be rehabilitated, thus preventing an excessive influx into the existing slum. A community hall was built for social, economic, cultural, and educational improvement.

IV. Description

a. Project data

Tenure is vital in any slum rehabilitation. A state government ordinance in Indore gave the slum dwellers (most of whom were squatting on government land), *pattas*, or long-term leases which made the unauthorised colonies legal. The largest household is 32 m², the average being 23 m². The average number of households varies within each of the 183 slum settlements.

b. Evolution of design concepts

In a broad sense, the concept is to design a clean, environment-friendly, infrastructurally-efficient city with no slums (but settlements) and a beautiful waterfront along the city centre. The concept also calls for a revitalisation of the city’s history and cultural heritage. All slums were rehabilitated in place except two, which were below the river water level. The dwellers of two slums were given a choice of locations for resettlement.

The design solution was proposed at two levels. At an urban level, a main sewerage artery pipeline funded by ODA and IDA was constructed along the riverbank. At the slum level, all sewerage lines of the slum household were connected to the main sewerage artery at the homeowner’s expense.

Response to physical constraints

Prior to the network project the slums did not have roads or sewerage systems. Garbage and waste

water flowed into open drains and into the river. Houses were irregularly planned.

The designer gave priority in his solution to:

- the design of lowering road levels within the slum that could alternately function as wide drains for excess rainwater;
- the design of the placement of a gully trap in each household for the removal of waste water, solid waste, and sewerage;
- the design of a manhole for every 6–8 houses connected to the inspection pit manhole located in the by-lanes;
- the maintenance of a slope along the road towards the river located behind the slums so that rainfall would flow into the river;
- placing housing blocks between secondary roads which run towards the river and primary roads running parallel to river;
- connecting all slum sewerage lines to the main sewerage artery along the river.

Houses

The plot size of each house ranged from 23–32 m². Houses and plots were oriented towards the streets. All slums consist of row-houses aligned along a secondary road running towards the river. Each house has an *otta*, or veranda space (0.9 metre deep) in front. This space has a variety of uses: garden, children's play area, outdoor activity, neighbourly conversation space, etc. Each house has its own toilet and connection to a water supply.

Response to user requirements

The basic principle of spatial organisation derives from an efficient system of utilities. For example, the gradient needed for water and sewage drainage guided the layout of the roads. Since almost all slums were rehabilitated in place, efforts were made by the designer not to disturb them while clearing a path for roads towards the river.

Although the houses face the road side by side, the boundaries of each house are quite visible. The front façade is important to each family. The project places an emphasis on identity through different colours, designed cornices, decorative railings, grilled windows, and pre-cast concrete ventilator windows. The inhabitants often enjoy plants, either growing from the ground (if space is available) or in a pot. The *otta* and the façade gives each house a sense of pride, identity, and creativity.

The plots are rectangular and narrow. The depth of the plots typically provides space for a room including a kitchen, a toilet, and a wash room. These are all the spaces required for a house. One corner serves as a kitchen and another corner has a bed. The most organised space in the room is the prayer space. The walls are a part of the way the room functions. Neatly organised on the wall rack are all the utensils for the kitchen. Clothes hang nicely from hangers on the wall.

Houses are very clean and are well maintained, although only a single light hangs from a bare socket (without a lampshade) and an old ceiling-fan which has lost its colour spins slowly. The designer realised that for the sake of the environment and maintenance, every house must have its own washroom and toilet. Each family is responsible for its own cleanliness. The washroom in some slums is located in the front of the plot because the main water supply (provided by IDA) only runs along the road. The toilet is located so that the gully trap eventually joins the street sewer line and then the manhole (which acts as an inspection pit) before it is connected to the main riverside artery.

Formal aspects

Massing in the slum is linear along the roadside. The houses are of low heights and are mostly one storey. When an extension is required (e.g. if a son is married off), another floor or two are sometimes added. Religious centres such as *mandir* and mosques are located in the slum according to the ethnic population.

Street fronts have colourfully marked property lines. Roof lines display a variety of decorative railings and cornices. Though the linear façade forms a line along the road, it is varied according to the offset of the *otta*, or veranda. These have different uses in different houses and form an interesting fabric, which is a mix of different motifs. The design brings out diversity within a totality. After the upgrade the houses are not slums any more, but are regular urban houses like those found in other parts of Indore. The slums have therefore become regular housing that could be found in any South Asian region characterised by Indian style and form.

Landscaping

A major target of the networking project was to revitalise the city with the rivers playing a major role. In the city centre, where the Khan and Saraswati, the river has been made perennial with treated sewage water and rainwater draining into it as provided by designed gradient towards the river. Water fountains (for aeration), river cruising in rowboats and other recreational activities adorn the treated, but clear, clean sewer and waste water. The achievement is miraculous, beautiful, and emotional.

This is the city centre called the Krishnapur Lake/river front area. On one side is old Indore, a *chaitri* area and an historical site. *Chaitris* are Hindu temples where the cremated ashes of the kings were buried. The heritage of this historical site was neglected and was a site for drug addicts and was infested by crime. With the network project, history has been revitalised, and become an attraction, especially to tourists. The slums having been shifted, a beautiful 2-km riverfront has been landscaped on one side with curved, paved walkways, seasonal plants and creepers shading trees, and sculptured art work. There are two bridges as well as a footbridge in this lake area. What is achieved is a transformation of a drainage gully to an oasis for flora and fauna (birds like to visit the area) and for a city population to take refuge from their busy, hard life. The landscaped level is lower than the street level, which enhances the quality, and the recreational scale and behavioural quality of the space within the busy city centre. The other side of the river has been designed into a two-level shopping arcade, the upper level being an open-air mall with kiosk-type shops built along the back wall of the municipal market that faces away from the river.

c. Structure, Materials, Technology

The state government enacted laws to give land for in-place slum settlement. The structure of the planning for housing found the best roads, paths, community halls, and utility space, were the result of community participation and their preferences. Settlement form was a result of a house-to-house physical survey beginning from the door and going to the fence. A most efficient land-use plan was structured, based on co-ordination between the designer, H. Parikh, the project director of the IDA, and the community.

The local sub-soil composition is of expansive, black, cotton soil which is expansive and silty clay. Houses needed hand-augured, double-rimmed, 3 metre-deep, pile foundations. The piles were self-driven by the homeowner or local labourers who were trained and skilled in constructing the houses and in brick-masonry work. The foundations and the load-bearing brick walls allow for two- to three-storey houses. Roofs are mostly corrugated iron sheets and the last item to be added because they are the most expensive component of the building.

All houses in the slum have individual latrines (Indian pan) with water-flushing-type system connected to a 20 by 20 cm gully trap for solid waste disposal and waste water drainage. The wash rooms of all houses are connected to a piped water supply.

To develop local indigenous technology and social engineering, the Indian government's Ministry of Urban Affairs has developed two urban training centres at Lucknow and Hyderabad.

d. Origin of technology, materials, labour force, professionals

The networking of 183 slums in Indore was based on a wholistic integrated design system which used local, indigenous, appropriate technology developed by Indian (H. Parikh.) professionals. The technology was cost-effective and of above average quality.

A task, seemingly impossible, was achieved through local technology involving:

- Satellite surveying to find the natural gradient of the drainage-flow in relation to the existing river and their integration;
- A Computer-Aided Design module developing a software by the designer to best solve the house-plotting and the road alignment towards the river sewerage pipe line;
- A system-design kit developed for the house foundation, toilet and water system, solid waste management;
- Water treated and re-used to create a riverfront which was challenging and previously unimaginable.

Local material such as brick for walls, cement concrete plaster on walls, local stone floors, were the basic building materials. Labour force was 100% local, mostly homeowners. However nearly 100 small local contractors were involved in the construction of roads, pavements main sewerage and water lines.

Visionary local civil engineer, Himanshu Parikh, and the project director, C.M. Daganker, have a life-long experience in social engineering and have transformed challenges into reality.

Nearly 100 NGOs are involved in social programmes involving health, education, income generation, and social welfare.

V. Construction Schedule and Costs

a. History of project

The Indore project was launched in March 1989 by the IDA with financial assistance from the Overseas Development Administration (ODA) of the British Government. Actual implementation of the project is still ongoing.

Slum networking however is continuous and not a one-time event, a process and not an end in itself. The physical works are phased over a four-year period with social and community programmes running parallel. Initially, a part of the project was funded by World Bank.

b. Total costs and main sources of financing

Total cost for the project time frame was India INR 600 million (USD 1 = c. INR 38.5) i.e. USD 15'600'000 from the ODA funding which was provided the main sewerage artery along the river and internal road and pavement.

The Madhya Pradesh State Government provided INR 20.0 million i.e. USD 520'000 for the main sewerage out fall for the city.

IDA provided funds for the shops in the *jheel* area, riverside earthworks for slopes and landscaping.

c. Comparative costs

Piped sewerage is found to be cost-effective, because slums are close together and do not require long lengths of additional pipes to connect to the main sewerage. By linking sewerage lines in the slums a main network for all of Indore city has been developed.

Conventional sewer lines run along the main roads. By placing underground sewerage lines along rivers the natural gradient has dramatically reduced cost and managed both sewerage and waste water in order to achieve better flow.

A comparative analysis of piped and open storm drains proved piped sewerage to be cheaper.)

d. Qualitative analysis of costs

Slum dwellers have contributed by paying for their own household water and sewerage connection. The earthwork and landscaping components were done by the slum community offering their own labour at no expense.

Some slums have raised funds and built up enough resources to invest and finance improvement within the slum.

The average investment in their own dwelling/houses and utilities by families is INR 10,000 (USD 260), matching an original project investment of INR 4,200 (USD 106.50) in the physical and sewerage line, i.e. the environmental upgrading.

The investment by ODA and IDA created a stimulus among the slum dwellers to invest more than double the amount of their own funds for an improved habitat.

e. Maintenance costs

IDA has invested in riverfront development. The cost of riverfront improvements were met by the private sector purchasing recreational and commercial facilities, like sponsoring fountains etc., and purchasing shops in the shopping arcade designed along the river front.

Indore Municipal Corporation bore the revenue and maintenance cost of all infrastructure work through a larger tax network generated by the increase in income level of the slum dwellers, as well as in waterfront commercial activities.

The costs of running and maintaining the city-level sewerage treatment plant and the slum network under the National River Action Plan are expected to be met with the sale of treated water, manure, and the sale of shops designed on the *jheel*, or lake area.

Social sectors such as health, education, income-generation are being maintained through NGOs.

Slum dwellers are also financially contributing by paying cost of the household connection to the main sewerage line.

VI. Technical Assessment

a. Functional assessment

The primary achievement was the development of an integrated community-based system for 183 slums that included:

- improving sanitation and the environment;
- upgrading of the city's drainage system by using the network of slum settlements as a starting point;
- linkage between the old city sewerage (only 5%) with the new piped sanitation system with proper solid waste management;
- channelling the clean, treated water into the nearly drying Khan and Saraswati rivers;
- providing improved road network and footpath within slum and linkage with city road system;
- providing a clear, piped water supply for drinking and household use; and
- installing street lighting and landscaping along the revitalised riverfront in Krishnapura area of the city centre.

These achievements in infrastructures resulted in improved houses and environment within the slums.

Nearly all of the 183 slums are located along the riverbanks. Legalisation of settlements with in-place rehabilitation has strengthened the networking scheme and effectively been utilised to set a trend in the city development/revitalisation process.

Housing is organised and clean. People and children are healthy, the community is becoming aware of education and culture, and is motivated to raise its socio-economic output.

b. Climatic performance

As is typical in all slums, dwelling face the street, although the widths on the street are short and plot depth is long. The plots - 23 to 33 m² - are well lit and ventilated. Windows, doors with articulated, designed frames, sunshades and cornices stand as symbols of income status. Plantations are popular and moderate the climate. Since slum dwellers are not vehicle owners, the streets are narrow, pedestrian, and therefore quieter, pollution-free and accident-free.

c. Choice of materials, level of technology

The criteria for choice of material were efficiency, low cost, local availability and local workmanship:

Stone-paved roads were designed at below grade (-8 cm) to act as drains within slums;

Landscaping, with stone-paved surfaces on footpaths, was designed along the waterfront;

Riverbank protection is provided by stone pitch, earth binding plants, floral groundcovers and creeper plants;

Engineering elements were miniaturised, i.e. gully traps (20 by 20 cm) instead of manholes; and

One manhole was placed for every 8-10 houses reduces cost and maintenance problems.

d. Ageing and maintenance

Indore is old Indian city. Historically the city area was limited to the *chaitri* area with the Khan and Saraswati Rivers as boundaries.

The city later expanded to the other side of the river. Bridges connected the two sides of the rivers. Indore, just like any other typical traditional city of India, was left to grow by itself with its residents and an ever increasing migrant slum population.

The network project has revitalised the entire city and injected new life and activity. Therefore, the city has been rejuvenated and has become youthful instead of ageing.

Maintenance is a community affair. The vitality that the project has infused in the community, with 100 NGOs working there, has fostered a dedication and commitment to maintenance. Funds for such maintenance is community-generated or provided by NGOs.

e. Design features

In the housing within the slums, the massing, volume, articulation of spaces, and community activities are similar to any other lower and middle-class housing in Indore city.

Indore is a quiet city of low-rise buildings, with three or four buildings that reach the maximum ten-storey height. The upgraded slums have merged with the neighbouring land-use. It is becoming difficult to de-mark the boundary of the slum, which is in effect one of the most important objectives of the project: mainstreaming the urban poor with the regular population.

The different income levels of slum dwellers is obvious. Those who have increased their incomes spend more on beautification of the façade of their houses with brightly coloured door and windows. It is an inspiration for others to follow.

The spirit and trend has been created in individual housing improvement to copy building elements from affluent or historical housing sectors, e.g. copying a cornice, a railing etc. Vertical extension are rampant and land/rental valuations have appreciated due to the upgrading.

The continuous process of improvement of housing, infrastructure and the environment, if maintained, will make Indore, an attractive city of rich history, pleasant to live in. The Krishnapara lake/riverfront park is a typical Indian garden with local flowers and trees. The shopping arcade on the opposite bank has traditional architectural elements of balustrades, arches, and domes in the malls.

VII. Users

28% of the Indore slum population are the users of the network project. The users of the slum network project are the families of 183 slums having a total of 75'089 dwelling units covering 900'000 people. The range of numbers of dwelling units varies, the highest being Chandan Nagar slum (3'047) units and lowest Lalbag (Triveni) having 40 units. However, indirectly the entire city population is the user because:

- (1) city sewerage is brought under the main sewerage artery;
- (2) Krishnapura lake/riverfront is enjoyed by the entire city; and
- (3) the environment of the entire city is positively affected.

VIII. Persons involved

Project personnel

Consultant:	Himanshu Parikh, civil engineer providing consulting services including concept, design, detail, and supervision. He is the architect, designer, and planner.
Client:	C.M. Dagaonker, Project Director for Indore Development Authority (IDA) a public sector officer fully committed to urban development. He is the project formulator and the visionary along with his staff.
Survey:	the most critical pre-condition to planning was carried out by Chetan Engineers Associates, consultant to H. Parikh.
Engineer:	Vijay Maratha, a civil engineer turned landscape designer. A full-time employee, who has presently become more interested in plants and landscape than in his civil engineering works.
Craftsman and Painter:	All details of seats, paintings and sculpture of garden elements, seats, tree trunks are attributed to him.
ODA:	Overseas Development Agency of the UK provided funds for the sewerage main artery. They support the planning policy, funding, monitoring, and evaluation of the project. ODA also carried out an impact-assessment study on the project.
Contractors:	Nearly 100 contractors worked in the project.
NGOs:	Engineer Prasanth Tiwari, an ex-IDA employee has had completed his contractual job with IDA, and is presently involved in the project in NGO training.

Lailun Nahar Ekram
May 1998