The
Toilet portfolio
2021
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Agra- Kuchhpura
Rourkela- Leprosy colony
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CONTENTS

The toilet portfolio
Introduction.............................................1

Decentralised networks.........................6
Simplified sewer system
Cluster septic tanks
DEWAT
Feacal sludge management system

Household toilets.........................17
Core house toilet
Toilet for kuccha house
First floor toilet for temporary house
Toilet for unsewered areas: SaniLoo
Pre-fabricated septic tank
Retrofitted septic tank

Community toilets.................37
Barrier-free community toilets
Child-friendly toilets
Night toilets
Pink toilets
Introduction

A decent toilet is a toilet that is inside the house and built in a way that will keep its contents separate from the water sources. As simple as it may sound, access to a personal toilet remains a challenge, especially for urban poor communities. Two billion people globally, still lack basic sanitation services with more than 700 million relying on rudimentary holes or pits, as per the Joint Monitoring Program of the World Health Organisation and UNICEF (June 2019). In India nearly 600 million people defecate openly, the largest number worldwide. The disease burden from open defecation costs the Indian economy about Rs 2.44 trillion (USD $53.8 billion)- a per capita impact of Rs 2,180.

The urban poor are most affected by the lack of good sanitation- impacting their health and ability to be productive. Women and young girls living in dense urban slum settlements risk sexual harassment and safety, when defecating outside their homes.

Community toilets are the default option when cities invest in provisioning of sanitation services to slums. Community toilets provided to slums are poorly maintained, crowded, without adequate water supply, unavailable at night, and are therefore unpreferred to many. A study on understanding the behavioural science behind choices on where to defecate, showed that unpredictability of toilet availability when in need (due to other
users ahead in the queue) and disgust were key reasons that pushed people to defecate in the open. As economic conditions of families in slums improve, they seek individual toilets over which they have full control.

However, building a toilet is not simple either. It needs access to conveyance mechanisms such as sewer lines that connect to treatment systems like faecal sludge treatment plants, or on-site solutions such as properly engineered septic tanks that will not contaminate the groundwater through leaching. Toilets also need a safe space in the house and lumpsum money for construction, that the poor cannot always afford. Slum settlements, because these are on occupied lands, or maybe in untenable areas such as along drains or in low-lying, or on flood prone areas or at city’s edges where they may not have access to the city’s sewer systems. Or these settlements may have very narrow and winding lanes that have emerged organically, but are hard to engineer and bring in sewer lines.

Local bodies are reluctant to extend sewer lines inside slum settlements as these are deemed to be illegal, discouraging personal toilets. They also believe that slums do not have the space required to build home toilets.

Standard sanitation systems have not been able to address the challenges of creating an ecosystem that enables poor to build their own toilets. There was thus an urgent need to innovate, de-engineer and decentralize, creating a wide-range of sanitation options for different settings.

In the belief that home toilets are a pathway out of poverty by putting people into a positive cycle of good health and improved incomes, CURE has developed several models for different contexts. These have been based on our deep understanding of the challenges involved in building toilets. Our efforts have been spread across the sanitation value chain – from the architecture and design of toilets to the curation of sewerage and on-site and off-site treatment systems such as septic tanks and Feecal Sludge Treatment Plants. CURE has also addressed issues of grey and black water treatment to improve living environments of slums. These sanitation systems have been co-created with the help of the urban poor communities in the pilot areas. In working with the communities, CURE has helped set up financial mechanisms – toilet savings groups, revolving funds that offer credit to the families, and operation and maintenance committees (O&M) to manage the systems post construction. CURE has also used an ecological approach to provisioning of sanitation that has included wastewater treatment to treat sludge that flows into city drains from non-networked toilets.
While we strongly believe that household toilets are critical for building equality and inclusion, we also recognize that community toilets may be there for a while, till local governments overcome their reluctance to connect. Therefore, we also worked extensively on improvement of community toilets and retrofitted these to make these functional, linked to sewer systems, and made women, child and disability friendly.

Through this toilet portfolio, CURE is sharing its sanitation insight and solutions for replication in other cities and contexts. Some of the solutions have been put on the ground, while others have remained in the design stages due to resource constraints. We do believe that these are implementable and hope that readers of the portfolio would find their own resources to put these on the ground.

The portfolio has been sectioned into three,
• Decentralized Network Systems
• Household Toilets
• Community Toilets

Each model has a brief snapshot of the concept, approach, resources required, construction and cost estimates where available, have also been provided.

CURE is pleased to share its knowledge and learnings in this Toilet Portfolio. We are also pleased to mentor organizations who may wish to implement these designs in their areas– help make the contextual modifications to fit these to other contexts and geographies. At CURE we look forward to receiving your feedback and experiences of scaling these innovations. These can be uploaded at CURE’s following social media links to create a catalogue for the sanitation community.
Sanitation solutions

Decentralised networks
- Cluster septic tanks
- DEWATS
- Feecal
- Simplified sewer system

Household solutions
- Septic tanks
- Prefabricated septic tanks
- Retrofitted septic tanks

Community solutions
- Toilet structure
- Saniloo
- Cluster toilets
- Incremental toilets on the ground floor
- Toilets on the first floor
- Retofitting community toilets
- Night toilets
- Child-friendly toilet
- Barrier-free toilets
- Pink toilets
Decentralised networks

Household toilets need sewerage system that can convey toilet sludge to treatment facilities. In cities, Decentralized Sewerage Systems can enable poor households to have private, safe and dignified toilets. Simplified sewers networked to existing trunk sewer lines or connected to cluster septic tanks have proved to be cost-effective and efficient in delivering good sanitation in densely populated and unplanned low-income settlements. These also prevent people from connecting their toilets directly to open drains. Decentralized Wastewater Treatment Systems (DEWATS) and Faecal Sludge Treatment Plants are effective in treating and safe disposal of sludge in areas where sewer systems may be unavailable. Unsafely disposed and untreated faecal matter has an adverse effect on the health of residents; reducing their ability to earn better, transform their lives with an intergenerational impact on household poverty. In this section, we will showcase four models of decentralized sewerage collection and treatment systems piloted/planned by CURE.
Households should be encouraged to build pour flush toilets or use water saving cisterns to avoid back flows in the narrow pipes.

1.1 Simplified sewer system

Most slums in the city lie at the edge of, but are unconnected to, city trunk sewers. They are served mostly by community toilets. Some families build personal toilets, but due to lack of space, money or technical knowhow, may construct unsafe septic tanks or directly discharge into open drains. Simplified sewers are small diameter pipes that are laid at a fairly flat gradient and are networked or connected to the city’s trunk infrastructure. Simplified sewers are suitable for unplanned and highly dense areas because of their flexibility and cost-effectiveness. These allow many families in a street to have access to safe and hygienic disposal mechanism, enabling them to invest in household toilets. Simplified sewer systems, when co-created with community, can have mechanisms for community collective management.

CURE built a simplified sewer system, networked to the city’s trunk sewer line in Safeda Basti, Delhi in collaboration with the residents. This has since been replicated in 6 settlements by communities with their own resources.

Community participation

The first step is to help the community, especially women, articulate need for personal toilets. Following this, organize the community into a Bastee Sanitation Group for continued engagement on the design, implementation and management of the system. Share a conceptual sketch and preliminary costs to help people understand and agree to the idea and their contribution – in cash and kind, in building the sewer line. The costs to households must be affordable and decided collectively. The mechanism of collection must be flexible and payable in easy instalments as per earning patterns. To ensure transparency the collected money should be banked in a group account. It helps to have all households in the street agree to connect to the system as this lowers costs per family and ensures the system can be engineered to connect all households and be operationalized. The poorest households can be supported to save up in smaller sums and access subsidies to build the toilets. A Community Revolving Fund can also provide loans to such families at zero interest rates. In the case of Safeda Bastee, the community contributed 15 per cent of the total cost of construction. This created a strong sense of ownership and nudged home toilet building. In other settlements, communities spent between fifty and up to hundred percent of the cost of the system. The Bastee Sanitation Group should be involved in identifying local contractors; labour, masons, plumbers, etc.; overseeing the construction, meeting city officials for permissions and long-term maintenance of the system.
A Total Station Survey must be carried out to mark slopes from the main outfall point to allow for a gravity flow. A simplified sewer system has a few manholes at appropriate distances along the street, connected to a cluster of household toilet chambers—allowing for easy cleaning of the system in case of blockages. Manholes must be provided at street corners and pipe bends for smooth disposal of sewage. In the end, the simplified sewer must connect to the main trunk line, usually located outside the settlement.

The technical design must be prepared with the help of engineers. As slum streets are usually narrow, the same pipe may be combined to accommodate sewerage and drainage. Grey water from kitchens and bathing areas must be connected to the sewer line. This will allow the sewer to achieve self-cleaning velocity. Households should be encouraged to build pour flush toilets or use water saving cisterns to avoid back flows in the narrow pipes.

City Integration

Necessary permissions need to be procured from the relevant authority for connecting the simplified sewer with the trunk line. Capacity building and training of the community to maintain the system is required. A set of rules and protocols need to be developed and explained to all. This will avoid damages to the system from inappropriate use of the toilet such as dumping solid waste, plastics, etc. into the toilet and cleaning or adding new connections.
Poor people live in neighbourhoods that lack access to trunk infrastructure. In smaller cities, almost the whole city is without an underground sewer system. Households toilets are built with on-site sanitation or septic tanks, which are usually poorly designed and constructed and leach into the ground, besides emitting dangerous gases. Some may discharge into informal drains without outlets, causing unsanitary conditions. A Cluster Septic Tank (CST) is a shared septic tank built away from homes and linked to the household toilets through a simple sewer line. It is a cost-effective, decentralized, de-engineered solution for small houses in city’s unserved and unplanned areas.

CURE built a Cluster Septic Tank (CST) and sewer line system in collaboration with the people of Savda Ghevra, a resettlement colony in Delhi and in response to their concern over recurring costs of cleaning septic tanks and structural damage to their houses. The CST enabled about 200 households to build their own toilets. The CST with the simplified sewer system for 5 streets, in 2010, was built at a cost of Rs. 12462 per household. It reduced the B.O.D.(Biological Oxygen Demand) by nearly 83% and C.O.D.(Chemical Oxygen Demand) by 86%.
Community participation

The community process includes; need articulation, formation of a bastee or O&M (operation and management) committee for community contribution in the design, fund collection, construction and maintenance. In the case of Savda Ghevra, the community only contributed for the maintenance (Rs.30 per month which is now increased to Rs.50 per month) and paid to connect to the system. An O&M plan needs to be developed and explained to the community to ensure continued/annual maintenance.

Technical design

The CST is a large tank with baffle walls to treat the sludge. It is connected to a simplified sewer system that enables household toilets. The septic tank outflow may discharge into the closest closed drain (after treatment) or the city trunk line or a soak pit. The outflow can also be connected to a reedbed system for further treatment of the outflows. The size of the CST will depend on the number of households it will connect and the available open space to build the structure. A detailed survey is needed to establish levels and slopes for building the sewerage network that can maintain the gravity flow from households to the CST.
City integration

Permission to use the vacant land for construction needs to be obtained from the land owning agency. In the case of Savda, the Delhi Shelter Improvement Board also reinstated the roads after the sewer lines were built. CURE landscaped the park around the CST and created play areas for children.

and ensure self-cleaning velocity. Because a CST is much larger, structural stability is an important consideration. Walls need to be well bonded to prevent leakages or possibility of collapse from soil pressure on the sidewalls. Vents are to be provided for gases that build up in the system, to escape. Leakages at the bottom can be prevented by rounding the edges and corners and adequate water proofing.

Where possible the CST should be accessed for de-sludging. In the case of Savda Ghevra, the CST was built in the central park of one of the blocks. While this made de-sludging a challenge, this was the only available space for the system. De-sludging was managed through private operators from the O&M fund.

Paved streets after completion
Relaying street

Manhole construction

Household connection

Relaying street

Play area for kids
Peri urban areas are often beyond service networks and rely on on-site sanitation systems that do not connect to safe disposal systems. Settlements on the edge of storm water or other city drains directly discharge their wastewater into these, carrying the sewage to rivers and fresh water bodies. Decentralised wastewater treatment systems or DEWATS offer an off-the-grid solution for safe disposal of toilet waste thereby enabling households to invest in home toilets. The treated water can be repurposed for irrigation and improve the quality of wastewater being discharged into rivers or water bodies. A DEWAT is an approach to treat wastewater using natural systems and natural material, improving wastewater quality to acceptable levels for reuse.

CURE has built two DEWATS in the peri urban areas of Agra and Shamli in Uttar Pradesh. The Agra DEWATS was designed to treat 50 kilo litres of waste water, bringing down the Bio Oxygen Demand (BOD) from 320 to 30 using a bio-remedial system. Over 400 households in the settlement of Kuchpura in

DEWAT Kuchpura, Agra
Agra benefitted from the DEWAT, investing in toilets and housing upgrades between 2010 and 2017, when it was transferred to the city. Shamli DEWAT is built to treat 1500 kilo litres of waste water. The treated water is intended for a Butterfly park.

Community participation
Communities in the neighbourhood of wastewater drains must recognize the value of DEWATS in transforming their living environment, health and productivity. In Kuchpura, Agra, household health costs dropped by nearly Rs700 per month after the DEWATS became functional. Involving the community in the planning, construction and management of DEWATS, helps in creating understanding and ownership. The DEWATS in Agra was managed by the community youth, who operated heritage walks for tourists in the area and shared part of the to maintain the DEWATS.

Technical design
The DEWATS includes three chambers connected to each other for primary, secondary and tertiary treatment. The primary treatment consists of sedimentation using a baffled septic tank. The secondary treatment is an anaerobic process with baffled reactors and natural filters such as charcoal. The tertiary treatment using plant roots through reed beds to add oxygen back into the water while filtering it further. While in Agra and Shamli, the DEWATS has been built on the drain, where land is available, this can also be constructed at a location which is parallel to the city drain. The treatment components and filters in the DEWATS can be customized for wastewater from homes, industries, hospitals, hotels etc.

City integration
The local body or city government is a key stakeholder in the project. Besides providing approvals and access to the drain or land for construction, they should adopt decentralized systems for delivering sanitation to unserved areas. DEWATS are cheaper than conventional piped networks and Sewage Treatment Plants (STP). Cities must therefore make DEWATS integral to their city’s sanitation infrastructure and provide for their long-term operation and maintenance costs in their annual budgets.
CURE designed an FSTP for the resettlement colony of Savda Ghevra, New Delhi, in partnership with the Delhi Urban Shelter Improvement Board (DISIB). It was designed for 10,000 households, with plans to extend the system to the proposed PMAY housing for the poor in the area. The design was shared with the Delhi Jal Board for construction on available land.

1.4 Faecal sludge treatment plant

Several parts of large cities, small towns or planned resettlement colonies do not have sewers. They are also urbanizing rapidly contributing to the unsanitary conditions in these areas. Families living in these areas aspire and prefer to have individual toilets with proper disposal system. In the absence of sewer networks, people build soak pits or poorly designed septic tanks that contaminate ground water. Smaller ones need frequent emptying and rely on private suction trucks (honey suckers) for cleaning. These operators are known to dump the septage into open nallahs or storm water drains or water bodies adversely affecting the city’s environment, adding to costs of health and water treatment for the city and the city region. A Faecal Sludge treatment plant (FSTP) is a localized and de-engineered solution to safely extract, transport and treat sludge from septic tanks, pit latrines or any other onsite sanitation facility in a faecal sludge treatment facility using bio remedial methods. An FSTP does not rely on a sewer network, can be built within or in close proximity to the area to be served and its by-products can be used as fertilizer in farming and horticulture. Because it is decentralized and therefore smaller in capacity, it is cheaper to build and can be operated and managed by the community itself.
**Community participation**

An FSTP will lead to an increase in the number of household toilets. For the FSTP to be economically viable it must operate on the optimum faecal sludge load it has been designed for. It is therefore essential that cities promote home toilets and create access to subsidies and technical knowhow. Families will need to be mobilised for regular de-sludging by designated honey suckers at agreed costs. This will ensure the system works at optimum capacity. Families may also contribute a small monthly charge for the regular O&M of the FSTP.

**Technical design**

An FSTP comprises of a receiving tank, a bio-gas settler, a stabilization tank, a sludge drying tank and an anaerobic baffle reactor and filter. The sludge passes through these various chambers that treat the sludge to produce compost, water and biogas. The compost is dried first in sludge drying beds and stored in a faecal sludge composting yard from where it can be distributed for horticulture. The water is collected in a chlorine contact cum treated water collection tank and further treated using an activated carbon filter to make it fit for agriculture purposes.

**City Integration**

An FSTP needs access to land that the city must make available for the Plant. Although cheaper than an STP, it requires high capital expenditure, the cost of which must be borne by the local government. The maintenance costs can be met through household contribution. Households will also need to pay for honeysucker costs, which should be made affordable.
Household toilets

Household toilets are the preferred sanitation choices. Women in particular find these safer, dignified and healthier. Household toilets are known to improve productivity, enhance incomes, alleviate poverty and reduce vulnerability. Building household toilets in slum or low-income settlements is however a challenge due to lack of space, temporary housing, access to sewer lines, appropriate technology and lump sum capital. CURE has piloted several toilet designs that address these challenges. Appropriate technical solutions have been implemented that respond to the particular needs and context of families and their housing conditions, location, affordability and access to infrastructure. This section includes toilets that can be built in kuccha (temporary) structures, rented houses, with or without access to trunk infrastructure. All toilets can be built incrementally, in small spaces, in high density slum areas or sparsely populated and peri-urban areas.
2.1 Core house toilet

Slum houses are usually small, one room structures. Families build incrementally adding rooms as per need, converting temporary shacks into multi storeyed permanent structures. Incremental building impacts the structural stability of a house unless foundations can withstand the additional load. Households that upgrade from a kuccha to a pucca structure, usually add walls, that may not be able to take the weight of the upper floor. Besides weakening the existing structure, it also reduces light and ventilation, making the indoor air quality unhealthy. A core house is a structure with foundations, columns, beams, that can safely permit incremental upgrading without risk. In particular add a toilet on the upper floor. The walls can be later infilled with brick or other material depending on the resources available to the family. The core house offers a well-engineered frame at low cost with possibility of quick housing upgrades including adding a toilet to the home.

CURE built one core house in Savda Ghevra, a resettlement colony in Delhi, to demonstrate the concept of structurally safe houses with toilets on the first floor. The plot sizes at the resettlement site were small; 12.5 and 18 sq. meters. Initially people could only build a basic one-room structure without a toilet, due to lack of money. Slowly people began to upgrade their houses to include an upper floor, and in some cases added a toilet with an unlined pit underneath the house. This led to dampness and made the house structure even more unsafe. Additionally, the pit was leaching into the ground and contaminating the ground water that people were using.
Community participation

Innovative technologies need to be showcased so people can see, judge its usefulness and adopt. Appropriate financing mechanisms need to be set up for large borrowings, that are not indebting. To demonstrate the model, CURE identified an interested entrepreneur from among its livelihood groups, who was willing to invest in a core house and set up a Water Treatment Kiosk on the first floor. A zero-interest loan was extended to him from the Livelihood Revolving Fund that supplemented his finances, which he could repay in smaller sums. Technical design and handholding through the construction process to ensure quality was integral to the process.

Technical design

The core house is a column and beam structure with a roof and a staircase. The toilet is designed on the first floor, approximately 3ftx4ftx8ft in size. The toilet is connected through a chamber and manhole to the simplified sewer system (refer figure ‘a’). The walls of the house and toilet are infilled with brick, although any other temporary infill material can be used which can be upgraded over time. The toilet roof can be permanent or temporary depending upon household needs and capacity. It can be upgraded later in future household expansion or to add a water tank or solar panel. In the case of Savda Ghevra, the family paid to connect to the simplified sewer system and cluster septic tank. Alternatively, families can connect their toilets to city’s sewer system (where available) or build a properly engineered septic tank.

The cost of a two-storeyed core structure with shared columns and a toilet was approximately Rs 32,000. (2015, Savda Ghevra, Delhi). A single-storey structure costs lesser, about Rs 30,000. Where neighbours are willing to share columns and walls, in case of two adjoining plots, costs can reduce further for each family. The cost does not include wall infills, fittings, floorings and other fixtures. The technical design was developed with the help of architect Julia King, a PhD student interning with CURE.

Diagram 1: Incremental housing with toilet
City integration

As the house was self-owned, no permissions were needed. The resettlement colony had been established by the Delhi Urban Shelter Improvement Board (DUSIB) and allottees had received a ten year licence to live on the land. The demonstration had a strong ripple effect in the community. Nearly 15 families adopting it immediately, demanding that the contractors follow the technical design of the core house. Over the years, this has become the standard construction practice in the area.
2.2 Toilet for *kuccha* house

Many slum areas have a mix of *kuccha* (temporary), semi *pucca* (semi-permanent) and *pucca* (permanent) houses. While many of the permanent houses do build toilets on the upper floor, those who live in *kuccha* houses cannot do so. They are usually among the poorest households and lack finances or resources. Besides, *kuccha* dwellings have poor structural stability for building toilets. A flexi-toilet is an intermediate solution suited for high density slums that have piped water supply and a sewerage connection.

A *kuccha* house toilet in a *kuccha* house can be built on the ground floor at the front. It uses an incremental and flexible method of construction that adapts easily to the precariousness of the house and households by being low-cost and compact. While the toilet itself is located within the footprint of the house, it is built along the street to avoid any extra piping and plumbing within the house. The toilet was designed in consultation with families living in different housing typologies in Savda Ghevra.
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**Community participation**

Poorest households need to believe that they can have personal toilets without having a *pucca* house but having a toilet pan and a connection to the sewer line. Families can be supported to access interest free loans from a Toilet Revolving Fund and with upskilling and better livelihood options to enable repayment of the loan in small sums. Awareness needs to be created among the community to avoid opening toilets directly onto the drains – a common practice in slum communities.

**Diagram 2: Components of toilet**

**Diagram 3: Plan of a toilet for kuccha house**
Many slum areas have a mix of kuccha (temporary), semi-pucca (semi-permanent) and pucca (permanent) houses. While many of the permanent houses do build toilets on the upper floor, those who live in kuccha houses cannot do so. They are usually among the poorest households and lack finances or resources. Besides, kuccha dwellings have poor structural stability for building toilets. A flexi-toilet is an intermediate solution suited for high density slums that have piped water supply and a sewerage connection.

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Diagram 4: Elevation of a toilet for kuccha house

Technical design
The kuccha house toilet design is unbundled into two parts; the pan and the enclosure. The two are independent of the other and can be constructed separately as per need and affordability, dismantled and reassembled elsewhere if the family relocates, thereby securing their investment. The toilet has a waste pipe that connects to the sewer line, and a lid over the pan that can be closed and the area used for bathing. The toilet is most suitable for homes with access to a sewer line.

The toilet pan with a metal frame uses easily available, low cost material. The metal frame of the enclosure can be infilled with PVC panels or any other infill material. The seat pan and lid is made from stainless steel for easy maintenance. An in-built drain connects the toilet pan to the sewer line. The bathing panel is provided with grating at the edges for bath water to collect and flow into the roadside drain. The enclosure is designed as a temporary structure which can be screwed to the ground and easily reassembled at a different location if required.

City integration
Since sewer lines are provided by the city, permission can be obtained from the local authority to connect the toilet, at an official fee.

This model has not been implemented on the ground. It is based on CURE’s intensive interactions with the resettled households in Savda Ghevra Resettlement Colony, Delhi.

Diagram 4: Elevation of a toilet for kuccha house
2.3 First floor toilet for temporary houses

Very small sized, low-income houses may often be built up to the first or second floor, but are constructed from temporary material such as ply board, tin sheets, stone or brick tiles. Adding a toilet on the upper floors therefore becomes an unsafe option. The first floor toilet for such conditions, is designed to decrease the dependence on the existing house structure for its stability. It takes up minimum area on the ground, leaving space on the ground for family living. These can be developed for individual households or as a shared option for a cluster of families in a common open space. Access to the first floor toilet is through bamboo ladders in place of a staircases to economize on space.

Diagram 5: Toilet sketch for a (kuccha) temporary house

Diagram 6: Reinforcement for a first floor toilet at a temporary house
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Community participation

The first floor toilet is an expensive option, but addresses a need among the poorest to have a personal toilet. It is therefore suggested that the toilet and its cost be shared among a cluster of families. This requires the families to come together, form a group and agree on the cost sharing for construction and maintenance. It is important that all families in the cluster get equal access to the toilet and no one family monopolizes the toilet and that a clear maintenance protocol and cost sharing arrangement is laid out. A model developed for a cluster of 5 houses based on site conditions at T-Point settlement in South Delhi was estimated at Rs. 30,000 in 2018. The maintenance cost was calculated at Rs.1 per day or Rs.30 per month per household.

Diagram 7: Project One visual, a project to build a shared toilet structure for a group of renters.
[T-Camp briefing document, December 2018]

Diagram 8: Project Two visual, a project to upgrade a house with extreme space constraints.
[T-Camp briefing document, December 2018]
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The first floor toilet is an expensive option, but addresses a need among the poorest to have a personal toilet. It is therefore suggested that the toilet and its cost be shared among a cluster of families. This requires the families to come together, form a group and agree on the cost sharing for construction and maintenance. It is important that all families in the cluster get equal access to the toilet and no one family monopolizes the toilet and that a clear maintenance protocol and cost sharing arrangement is laid out. A model developed for a cluster of 5 houses based on site conditions at T-Point settlement in South Delhi was estimated at Rs. 30,000 in 2018. The maintenance cost was calculated at Rs.1 per day or Rs.30 per month per household.

Technical design

The toilet approximately 3ftx3ftx8ft in size, is constructed on a free standing steel column with a soil pipe. The soil pipe connects to the existing sewer line or a septic tank. The toilet height is consistent with the ceiling height of the existing houses. A truss is used as a vertical member (Figure 2) that takes minimal support from the existing houses. The toilet is fabricated from locally available material which require minimum maintenance. There are provisions for add-ons - water tank and /or a solar panel, which can make the toilet more sustainable.

City integration

If connected to city sewer lines, permission can be obtained from the local authority to connect the toilet, at an official fee. This model has not yet been implemented on the ground, however it is based on CURE’s intensive interactions with the families living in T-Point Colony, Delhi.
2.4 Toilet for unsewered areas: SaniLoo

SaniLoo is an on-site treatment solution for households in areas that are highly dense, unsewered, or without enough space to build a septic tank that can be de-sludged easily and have to be emptied by manual labour using unsafe and unhygienic processes. This enables people to have a personal toilet. Care should be taken not to install this close to a ground water source or high water tables. The model has been piloted successfully by one slum household in Ayurvedic Camp, Delhi at a cost of Rs. 13,000 excluding the cost of the super-structure.

Community participation

Poor households willing to construct their own toilet can be motivated to build a SaniLoo as it is low-cost and uses local material, can be installed in small spaces, is odourless and requires very low maintenance. With minimum technical guidance the toilet can be constructed by people themselves.

Diagram 9: Side view diagram of SaniLoo
Technical design
Saniloo is a single chamber tank using minimum space (1.1 – 1.4 sq. m surface area). It has two sections that are designed to separate the solid and liquid waste. It has a digester above and a liquid filtration section below. The digester tank is lined with brick walls on all sides except the bottom which is lined with covered with organic digester material to allow percolation of the liquid. The digester on top is separated from the filter by a cement concrete perforated slab (jali) overlaid with a chicken wire mesh and a layer of broken discarded bricks, pieces of CD waste or stone chips of about 20 mm size and sprinkled with a dry mixture of soil, saw dust
and cow dung (starter inoculum). The bottom of the lower chamber is evenly covered with a layer of sand and broken, discarded brick bats or stone chips 20 mm. in size. A vent pipe attached to the system supports the aerobic digestion of the waste and avoids generating foul smell, which may impact its efficiency.

Faecal waste in the system is treated by micro-organisms using aerobic decomposition. The upper section retains only the solid waste and passes the liquid to the lower section through the perforated digester-lined layer. The liquid separates naturally and passes down into the lower section for filtration and percolation into the ground. The process reduces the volume of solid as hardly any sludge is formed. This small digester can therefore operate for an extended period – nearly 10 years, without de-sludging, recovering the capital cost.

The system may be designed with a pour flush toilet and a squat pan with a 20 mm. water seal. The cost can be further reduced if the cement concrete slab is made of “pervious cement concrete”. The efficiency can be improved by adding a perforated basket with dry grass or wood shavings and Tiger earthworms that compost the faecal matter. Care must be taken to avoid dumping solid or non-organic material into the system or using cleaning acid as these may kill the micro-organisms.
City Integration

This is a simple, yet complete on-site household toilet system and no approvals are required. The decision is that of the household.
2.5 Pre-fabricated septic tank

Peri urban areas or city’s edges are usually without sewer lines. Poor households in these areas invest in on-site sanitation systems with a septic tank. Pre-fabricated septic tank is a good option for such sparsely built areas where households have access to open space or a courtyard within the plot. Pre-fabricated septic tanks require less space as compared to a standard septic tank. It can be built offsite and installed on site with minimal disruption to the household and maintenance needs. The pre-fabricated septic tanks were built in 118 households in four slum settlements of Agra.

Diagram 11: Sectional view of a pre-fabricated septic tank located in the courtyard/open space of a plot/property.
Community participation

People prefer private toilets with their own septic tanks to avoid conflict at the time of cleaning and maintenance. While building a private toilet can be done individually, technical and financial support may still be needed, for which people can form collectives. A Toilet Revolving Fund managed by the community can be set up with capital investment from the project. People can borrow up-front money to purchase the pre-fabricated unit, and payback in instalments. Local masons in the community can be trained to provide manufacturing, installation, construction and cleaning services.

While building a private toilet can be done individually, technical and financial support may still be needed, for which people can form collectives.
**Technical design**

The pre-fabricated unit comprises two circular tanks made of ferro-cement of varying heights that are placed underground on a concrete bedding in an open space within/outside the house. The sewage enters the larger first tank and the wall between the two tanks act like a baffle filter that separates the liquid and solid components. The sewage decomposes under anaerobic conditions in the larger tank. The solid matter settles to the bottom while the liquid enters the second tank. Both tanks are fitted with a manhole cover for a suction machine to remove the sludge once the tank gets filled up. Digester inoculums can be added to septic tanks that have consistent and heavy usage. The outfall can be drained out into a leach field or can be further treated using a DEWAT system (see section 1.3 for a description on DEWATS). The septic tank should ideally be built away from ground water sources such as bore wells, handpumps etc.

The tanks can be pre-fabricated in three units of 4ftX3.5ft dia each and then transported to the site. Two tanks can be stacked one on top of the other to create the larger tank. This ensures that only one size of formwork is required and transportation is easier. Pre-fabricated septic tanks with ferro cement are cheaper than the standard septic tanks as the costs of labour for masonry walls is almost negligible. The costs can be further reduced if metal sheets instead of manhole covers are used. In 2009 a toilet with the two tanks, piping and the toilet pan costed Rs 5,500 for a household. The super structure was added incrementally by the family at their own cost.

Locally manufactured pre-fabricated tanks can be installed in about four days. In Agra, the fabrication and installation was done locally with the support of a small-scale entrepreneur who was trained to upgrade and manufacture the tanks.
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City Integration

At a community level, the outfall from the septic tanks must be conveyed through proper drainage linked to a treatment system. The municipality should be consulted on how best this can be provided.
2.6 Retrofitted septic tank

A Retrofitted Septic Tank replaces unlined pits of latrines which are a threat to the ground water. A Retrofitted Septic Tank is an improved pit design equipped with a filtration system. It was built in JJ Colony, Sector 8, Noida. While CURE demonstrated one toilet in the community, the design was modified and adopted by others using their resources.

Community participation

As this requires households to replace an existing system, awareness is needed on the harmful environmental and health impacts of badly built pits that contaminate ground water which is drawn for drinking purpose. Replacement also requires additional expenditure which families may be reluctant to bear and therefore families would need help to access financial subsidies from government programmes.
The Retrofitted Septic Tank consists of two chambers as in a regular septic tank except that the second chamber is left unlined at the base. Both chambers are made out of brick walls that are plastered on the inside to prevent seepage. The first chamber or sedimentation tank, has a concrete base which slopes towards the inlet to collect the solid waste. After the solid matter settles, water on the top flows into the filtration tank that is fitted with a filtration system with two layers of gravel and one layer of sand to allow percolation of the filtered liquid waste. This reduces the contamination of ground water sources. The chambers are closed with manhole covers. A tall vent pipe in the first chamber is provided to allow the foul smell to escape.

In 2016, the retrofitted tank with the toilet costed Rs 15,000, although the cost can vary based on material used. The system can be fabricated from locally available material. It requires minimum maintenance. The use of inoculum in the first chamber can speed up the process of decomposition and reduce the volume of solid matter, minimizing the frequency of cleanout.

City Integration
Since the water is percolating into the ground, the filter material needs topping up or replacement. It is important for the households to check ground water quality at regular intervals to ensure that the system is working properly.
Community toilets

Community toilets are provided by the government in slum communities or in places where individual toilets cannot be built for technical, land or legal issues. Globally, community and public toilets have been prone to high degree of vandalism and are constantly plagued with problems of poor maintenance. An efficient, well-located and well managed community toilet helps improve access to good sanitation and toilet use practice.

A community toilet must address the needs of diverse users, especially children, the elderly, women and people with special needs. Many community toilets lack essential features that can make these facilities user-friendly and efficient. Improving access through barrier-free, child and women friendly features should be an integral part of community toilet design. CURE has retrofitted several community toilets with features that make these more accessible to different groups thereby increasing its usage and reducing open defecation.
3.1 Barrier-free community toilets

A barrier-free community toilet provides safe, easy and unobstructed access for people with disabilities. Inclusive and barrier-free design features can be added to both existing or new community toilets. In a Leprosy colony at Rourkela, a community toilet was retrofitted to address the special needs of people affected by leprosy. The design has been replicated by the Rourkela Municipal Corporation in similar settlements.

 Barrier free toilet

Community participation

The design for the barrier-free toilets are co-created with affected people. The process is initiated through an awareness campaign to focus on issues of hygiene, sanitation and entitlements. Participatory needs assessment helps to understand the precise nature of people’s challenges in accessing and using the existing community toilets. Technical designs are developed, discussed and finalized with the community to create ownership and improve usage. A community group may be mobilized for toilet management.
**Technical design**

There are specific guidelines for barrier-free designs prescribed by the city government. These included larger size units, side bars, handles for support and ramps for wheelchairs. In addition, CURE re-designed wash basins with lowered heights and mirrors, push taps that can be easily operated by people with loco motor challenges. Ramp slopes were adjusted for wheel chair movement and railings provided for support. Slippery tiles were replaced with anti-skid tiles, both inside and along the access.

Door vents covered with wire mesh were created for toilet and bathing cubicles for better circulation of air. This helped keep the toilets dry and odour free especially during peak hours. Menstrual waste disposal areas were created in the women’s section. Additionally a solar lighting and a rainwater harvesting system was installed to ensure adequate light and water in the toilets. These features also help reduce costs of maintenance and help keep the toilet clean.

**City integration**

The design and execution of barrier free features in a community toilet require coordina-
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**City integration**

The design and execution of barrier free features in a community toilet require coordination with the local authority and engineers. The city is responsible to provide the basic toilet and permit additions that are unique for special needs. Approval from the city government is needed to make modifications to the structures. The city must agree to maintaining the toilet. Rourkela Municipal Corporation entered into a contract with the women’s group of the colony and provided money for daily maintenance work.
3.2 Child-friendly toilets

Children often find community toilets difficult to use as they are designed for adults. Toilets seats, walls and door heights and latches suitable for adults can be intimidating and uncomfortable for by children. Children reported being bullied while using community toilets, especially during rush hours. Simple design features such as reducing wash basin heights, smaller cubicle doors, walls and toilet seats can help make community toilets child friendly and healthy. CURE has built child-friendly toilets in three community toilets.

Community participation

Children and parents should be engaged in assessing needs and designing child-friendly options. They can be involved in making child toilets bright, attractive, informative and less scary through wall paintings, wall art, floor games, etc. To ensure effective use of child toilets, campaigns for parents, especially mothers who are required to accompany very young children to toilets, may be organized. These should aim at creating awareness, good toilet and hand hygiene behaviour and to ensure toilets are left clean after use.
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**Technical design**

Dedicated child-friendly toilets should be provided close to the entrance of community toilets in both the male and female sections, so that children can easily find their way to them. Low height wash basins, smaller pans, low partition walls between 1 and 1.5 metres, side bars should be provided. In addition, footsteps can be painted on the toilet pan footrests to guide the children. Roof slabs are optional where the toilet is in the open space of the community toilet. It is recommended that there should be one toilet for every ten children under five years of age.

![Diagram 17: Child friendly toilet section design](image)

**City integration**

The addition of child friendly design features in community toilets will require both permission of the local authority, and construction oversight by the city engineers to ensure integration with the existing infrastructure.
3.3 Night toilets

A Night toilet is a smaller stand-alone facility or identified section of the community toilet that can be kept open in the night to prevent open defecation and ensure safe sanitation, especially for women and children. Night toilets may have added expenses of lights and maintenance staff – to prevent late night vandalism, therefore a nominal user cost could be charged, as per affordability. CURE facilitated a Night Toilet in Hasanpur settlement, North Delhi, by upgrading and operationalising an erstwhile defunct toilet for night use.
Community participation
Communities should be engaged in articulating the need for a night toilet, identification of section of the toilet that can be repurposed and the design components. In case a new facility is to be built, the communities should select the site be part of the construction. Communities can contribute to the cost of construction, if needed, and set up a small community fund to pay for maintenance and electrification at night.

Technical design
The night toilet should preferably be located centrally, accessible to all, especially women and children. The access route and its immediate surroundings should be well-lit at night, with clearly marked signage. In case a section of an existing toilet is being used, then one cubicle from the men and women’s sections closest to the entrance should be identified for night use. The rest of the community toilet can be kept closed and secured.

City Integration
Since community toilets are managed by the local government, permissions will be required for the construction/upgrading toilet for night usage, safety and maintenance.
3.3 Pink toilets

Most community toilets have a uniform design that is applied to male and female sections. While male section of the toilets are usually equipped with urinals there are no special provisions for women to address critical issues of hygiene and menstrual health.

Addressing issues of hygiene, improving access, security and privacy contribute to making community toilets more responsive to the needs of women. Additionally, the toilets could be equipped with breastfeeding room, changing room, have disable friendly toilet seats and incinerators to dispose the sanitary napkins to prevent pollution.

Toilets designed with such features meant for women are known as Pink toilets. The toilets are painted pink on the outside to make them easily distinguishable. CURE has retrofitted 3 existing women’s toilets in Delhi and 4 and installed sanitary pad vending machines by way of addressing this basic need.

Community participation

Building awareness on sanitation and hygiene practices and addressing women’s needs with respect to safety and security are good starting points for a pink toilet. A women’s enterprise can also be built around hygienically produced sanitary napkins. IEC material and training on toilet management including the use of incinerators by staff and users is also an important component of the Pink toilet.

Addressing issues of hygiene, improving access, security and privacy contribute to making community toilets more responsive to the needs of women.
**Technical design**

Pink toilets must be restructured to include spaces such as washing and baby bathing areas, breast feeding chairs, diaper changing platforms, etc. Women are also usually accompanied by children and so a small play area can be included. Door hooks to hang clothes and mirrors are a useful accessories in women’s toilets. Vending machines in the women’s section can create access to sanitary pads at a nominal cost with safe disposal facilities. Where it is not possible to put a vending machine, sanitary pads can also be provided on request with a separate space for their safe and hygienic storage. Painting them pink is for ease of access when located in public areas or along road sides.

**City integration**

Retrofitting an existing community toilet into a pink toilet or building a new one will require necessary permissions from the local body. Private sector partnerships for provision of sanitary napkins and other features of the toilet.
Access to appropriate, timely and affordable financial models continues to be one of the major hurdles in the provision of safe sanitation infrastructure for the urban poor. Government schemes such as the Swachh Bharat Mission under its IHHL scheme has been able to achieve a target of 105% by providing financial support for construction of 62,48,875 toilets in its first phase. It has also achieved a similar target for community and public toilets. Despite this massive effort by the Government many families are still left out of the loop of safe sanitation.

CURE, through its extensive work with urban poor communities has applied and tested financial models for sanitation depending upon the specific need or type of sanitation solution, affordability and level of community engagement, for urban poor communities.

**Toilet revolving fund:** A fund capitalized out of project grants or donations from which people borrow at zero interest and return in flexible-agreed terms as per earning capacity/ regularity. The money is revolved to more people. This model is most appropriate for the construction of Home toilets with onsite sanitation systems such as septic tanks or for areas where a sewerage system exists.
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**Community O&M fund:** A monthly fee for all members who have connected to a common system such as a simplified sewer system and a cluster septic tank. This money is banked and then used for maintenance of the system on an annual basis or when the need arises. Families that connect to the system at a later stage are charged an additional connection charge. The fund is managed by a community-based organization.

**Need based Community funding:** Communities only contribute when there is a need to upgrade, retrofit or repair a common sanitation facility or system. People get together and pool money based on a rough estimate for repairs or upgrades. This kind of funding is useful in the case of upgrading or repairing community toilets or cluster septic tanks so that regular maintenance costs are not affected.

**Contribution for infrastructure:** Communities contribute only a part of the total cost of construction while the rest of the finances and provided by the government or through project funding. Communities also have the flexibility to contribute in the form of labour.
The Toilet portfolio

Standard sanitation systems have not been able to address the challenges of creating an ecosystem that enables poor to build their own toilets. There was thus an urgent need to innovate, de-engineer and decentralize, creating a wide-range of sanitation options for different settings. In the belief that home toilets are a pathway out of poverty by putting people into a positive cycle of good health and improved incomes, CURE has developed several models for different contexts. These have been based on our deep understanding of the challenges involved in building toilets. Through this toilet portfolio, CURE is sharing its sanitation insight and solutions for replication in other cities and contexts.